Azman Kasim · Wan Siti Atikah Wan Omar
Nor Hidayatun Abdul Razak
Nor Lailatul Wahidah Musa
Roslilee Ab. Halim · Siti Rosiah Mohamed *Editors*

Proceedings of the International Conference on Science, Technology and Social Sciences (ICSTSS) 2012

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Preface

The International Conference on Science, Technology and Social Sciences 2012 (ICSTSS 2012) is a bi-annual conference on science, technology and social sciences organized by the Universiti Teknologi MARA (UiTM) Pahang. ICSTSS 2012 covered recent advancements and trends in the various disciplines in Science, Technology and Social Sciences to facilitate knowledge sharing and networking amongst researchers on the new challenges pertaining to these fields. It also provided a platform to disseminate research findings as a catalyst to bring out positive innovations in the development of the region. More than 100 papers were presented by participants from various universities and institutes of higher education during the conference. Of these, 90 papers have been selected to be included in this book ranging from the sciences (pure and applied) to technology (computers and engineering), as well as social sciences (business, education and linguistics). The papers in this book have undergone a careful selection process to ensure that they meet the objectives of the conference. They serve as a significant point of reference to academicians and students who want to pursue further research in their respective fields

Pahang, Malaysia

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In the name of Allah, the Most Gracious and Most Merciful. Praise be upon Him for giving us the courage, strength and patience to complete the *Proceedings of the International Conference on Science, Technology and Social Sciences (ICSTSS) 2012,* UiTM Pahang.

First and foremost, the Editors would like to extend their heartfelt thanks to the members of the editorial board for their enthusiasm, hard work, endless support, team-work, etc. throughout the process of editing, reviewing, typesetting, right up to the publication of the book.

Special thanks also go to our ICSTSS 2012 chairman, Associate Prof. Dr. Azhan Hashim, for his encouragement and moral support and also to Associate Prof. Dr. Hjh. Rugayah Hashim for her technical support and proper guidance from the first stages of the publication process.

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Part I
Social Sciences

Chapter 1
Using Reader's Theatre to Promote Reading the Judicial Decisions (Court Case) Among Foundation Law Students

Norbaiyah Abd Kadir, Farah Haneem Ahmad Jamal, Juhaida Ismail, and Roose N. Subki

Introduction

Learning a new concept is not that easy for some students especially when they have no basic knowledge on it. The subject law, for example, is not an easy subject for some law students because there are many legal concepts that they need to learn and understand. The Foundation Law students of UiTM Kuantan campus are students who have just completed their Sijil Pelajaran Malaysia (SPM) examination. They have scored excellent result in this national examination and are given a place to do Foundation Law program. These students do not have any basic knowledge in law, and therefore, some of them find law subjects difficult to comprehend. In the first semester of their Foundation Law program, they will be asked to read and analyze the judicial decisions (court case) and some of them find the court case "dry" and they could not understand the content of the case. When asking the students to read the court case, normally they will be asked to read it on their own first and then it will be discussed in the class. Sometimes their law lecturer would make a review on the case in the class and discuss together with them. It is found that students are not really enthusiastic during the discussion and only a few would participate. We feel that the Reader's Theatre activity to be adopted when reading this court case could help promote these Foundation Law students to read and understand the court case better. Most of the current researches on Reader's Theatre focused more on primary students in schools who had problems in reading [1]. It is suggested by some researchers in this area that more research on Reader's Theatre should be done and tested not only on this group of students but also on older students and adult learners. Therefore, we are trying to test whether the Reader's Theatre could help promote

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the students of Foundation Law of UiTM Kuantan to read and understand the judicial decisions (court case) better.

What Is Reader's Theatre? Reader's Theatre could be described as a presentation of a story. Students are asked to read aloud play scripts. According to the book entitled *Literacy for the 21st Century: A Balanced Approach*, students choose roles and rehearse reading scripts in Reader's Theatre. During rehearsals, students would practice reading character's lines in the script and interpret the story without using much action; instead, they use their voices, gestures, and facial expressions. Finally, students give a performance of the script in front of their classmates. To summarize this, below are the steps in the Reader's Theatre:

1. *Select a script*. Here, students or teachers select a particular script from any literary text, read and discuss it.
2. *Rehearse the production*. Teachers could help the students to interpret the characters they are reading.
3. *Stage the production*. What is good about Reader's Theatre it could be performed either on a stage or in a corner or in front of the classroom [2].

In our case, the judicial decisions (court case) are used as the reading scripts. (This will be discussed later in the procedure that we have done in our action research with the Foundation Law students.)

The Significance of Reader's Theatre in Promoting Reading

When using Reader's Theatre as a means to promote reading, it is proven that students when reading aloud could improve their fluency and later it is agreed that Reader's Theatre could develop students' interest in reading [3, 4]. In our case where the court case may be difficult to be read and comprehended alone, adopting Reader's Theatre could help in improving the students' fluency, and when they are fluent, it would be easier for them to read any text accurately and quickly. In addition, they could recognize the words automatically. Then they could focus more on the meaning of the text rather than concentrating on decoding the words in the text [5] and thus could make it easier for them to understand the text better. This could help promote them to read the court case text given to them.

It is undeniable that fluency is very crucial and has a critical role in a student's reading process because it is just like a bridge between word recognition and comprehension [6]. Even though fluency will not guarantee comprehension, comprehension will be difficult without fluency. Therefore, with the help of Reader's Theatre, students will be fluent and this will help them to comprehend a text better. This in turn would promote reading because they will not be intimidated by the difficulty of the text. It is found that when students constantly stop reading when they stumbled on difficult or unknown vocabulary, the meaning will be distorted and this makes the reading process long and tedious [7]. With the help of Reader's Theatre, students could develop more interest and could minimize these problems because

when they become proficient readers, they could use the higher-order thinking skills such as analyzing, interpreting, drawing conclusions, and inferring meaning from the texts [3]. This could make reading a meaningful and shorter process.

Reader's Theatre does not demand a lot of preparations. There are no props, costumes, or actions involved. They need only the scripts of a play and they need to practice reading the scripts dramatically with proper intonation. They do not have to memorize the scripts and this is the beauty of the Reader's Theatre. The emphasis is on the dramatic reading of the scripts, using expressive reading, setting the appropriate tone, and maintaining the audience's interest on the performance [3]. This could also be done with the judicial decisions (court case) because the text can be developed into a play-like script and a group of students can read and perform it in front of their friends and this could help promote reading the court case. Together with the lecturer, they could make reading the court case more meaningful. Even the most reluctant or poor readers could participate in this activity and they could understand the text better. Reader's Theatre is also said to improve students' motivation and attitudes toward reading and this is what we hope for our Foundation Law students when they are asked to read the court case. It is further stated that participation in Reader's Theatre could increase students' motivation in other unrelated school tasks/works [8].

Action Research and Findings

Twenty-five students of group D Foundation Law students were selected as our respondents and were asked to read the judicial decisions (court case) entitled PP v. Kok Wah Kuan before they watch and listen to the Reader's Theatre performance. For this activity the court case text is read like a play-like script. Four students were chosen to participate in the Reader's Theatre performance. This is to reinforce the reading of the text so that they could understand better the court case. To justify the findings of our action research, we distributed questionnaires to all of them after the Reader's Theatre activity. Below are the findings that we have gathered from this action research:

Data Analysis (Cross Tabulation Analysis)

The tables below show the data analysis to justify the findings of the action research based on the questionnaires (Tables 1.1, 1.2, 1.3, 1.4, 1.5, 1.6).

Our data analysis is based on the SPSS cross tabulation analysis. In Table 1.4, when asked the question whether they like the Reader's Theatre activity, 92 % of the students answered positively that they like it. They like it because this is the first time this semester that they are asked to get involved in such activity in a law class because normally activity like this will be done in a language class setting. We

Table 1.1 *(Q1)*: Do you think that the judicial decision (court case) is dry?

| | | | Gender | | |
			Male	Female	Total
Dry case	Yes	Count	2	6	8
		% within Gender	33.3 %	31.6 %	32.0 %
	No	Count	4	13	17
		% within Gender	66.7 %	68.4 %	68.0 %
Total		Count	6	19	25
		% within Gender	100.0 %	100.0 %	100.0 %

Dry case * Gender Crosstabulation
Findings: *32 %* of the respondents stated that the judicial decision (court case) are dry

Table 1.2 *(Q2)*: Do you enjoy reading the judicial decision (court case) on your own?

| | | | Gender | | |
			Male	Female	Total
Enjoy reading	Yes	Count	3	14	17
		% within Gender	50.0 %	73.7 %	68.0 %
	No	Count	3	5	8
		% within Gender	50.0 %	26.3 %	32.0 %
Total		Count	6	19	25
		% within Gender	100.0 %	100.0 %	100.0 %

Enjoy reading * Gender Crosstabulation
Findings: *68 %* of the respondents enjoy reading the judicial decision (court case)

Table 1.3 *(Q3)*: Is the language in the judicial decision (court case) difficult for you to understand?

| | | | Gender | | |
			Male	Female	Total
Language difficulty	Yes	Count	5	12	17
		% within Gender	83.3 %	63.2 %	68.0 %
	No	Count	1	7	8
		% within Gender	16.7 %	36.8 %	32.0 %
Total		Count	6	19	25
		% within Gender	100.0 %	100.0 %	100.0 %

Language difficulty * Gender Crosstabulation
Findings: *68 %* of the respondents agree that the language used in the judicial decision (court case) is difficult

Table 1.4 *(Q4)*: Do you like the activity on Reader's Theatre (RT) that we have just conducted?

| | | | Gender | | |
			Male	Female	Total
Like RT activity	Yes	Count	6	17	23
		% within Gender	100.0 %	89.5 %	92.0 %
	No	Count	0	2	2
		% within Gender	0.0 %	10.5 %	8.0 %
Total		Count	6	19	25
		% within Gender	100.0 %	100.0 %	100.0 %

Like RT activity * Gender Crosstabulation
Findings: *92 %* of the respondents like the activity on Reader's Theatre

Table 1.5 (*Q5*): Do you agree that this Reader's Theatre activity could help you understand better the content of the judicial decision (court case)?

			Gender		Total
			Male	Female	
Understand better with RT	Yes	Count	5	16	21
		% within Gender	83.3 %	84.2 %	84.0 %
	No	Count	1	3	4
		% within Gender	16.7 %	15.8 %	16.0 %
Total		Count	6	19	25
		% within Gender	100.0 %	100.0 %	100.0 %

Understand better with RT * Gender Crosstabulation
Findings: *84 %* of the respondents agree that Reader's Theatre could help them understand better the content of the judicial decision (court case)

Table 1.6 (*Q6*): If this Reader's Theatre activity is to be carried out in your law classes, could it help you understand better the content and thus promote and motivate reading the judicial decision (court case) among the Foundation Law students?

			Gender		Total
			Male	Female	
Understand better with RT	Yes	Count	5	16	21
		% within Gender	83.3 %	84.2 %	84.0 %
	No	Count	1	3	4
		% within Gender	16.7 %	15.8 %	16.0 %
Total		Count	6	19	25
		% within Gender	100.0 %	100.0 %	100.0 %

Understand better with RT * Gender Crosstabulation
Findings: *84 %* of the respondents agree that Reader's Theatre could make them understand better the court case and thus this could promote and motivate them more in reading the judicial decision (court case)

observed that they are very enthusiastic and for the first time most students have paid attention to the lesson on court case. The activity has also helped them understand better the content of the court case because they could analyze it as they are listening to it. The lecturer could help them more in trying to make them understand the legal terms used in the case after the activity is done. The data is shown in Table 1.5 where 84 % of the students have answered that through this Reader's Theatre activity, it could help them understand better the content of the court case. We could see that after the Reader's Theatre activity was carried out, the lecturer asked questions pertaining to the case and most students could answer them. This justified further that they have understood the content of the case as compared to when they were asked to read the case on their own. Therefore, when they have understood better the content of the court case, this could later promote reading the court case among the students. With this Reader's Theatre activity, the students will be motivated to read more the court case before coming to class, and when the Reader's Theatre activity is carried out, it will make them feel more excited to follow the case when it is being "acted out." Even though it was found out that in Table 1.1 only 32 % of the students admitted that the court case is "dry" and in

Table 1.2 68 % said they enjoy reading the court case by themselves, this does not mean that they do not like the Reader's Theatre activity. The Reader's Theatre activity is not only about enjoying the acting part of it but it is more about wanting them to read it together and understand better the content of the court case. We also hope we could help them be able to apply these legal concepts in the court case when they sit for their final examination and when they become lawyers in the near future. In Table 1.3, with 68 % of the students feel that the language in the court case text is difficult to understand proves that they need this Reader's Theatre activity to help them be more fluent and this in turn could help them read the text accurately and recognize the difficult words automatically. Earlier in the literature review, we have discovered that it is undeniable that fluency is very crucial and has a critical role in a student's reading process because it is just like a bridge between word recognition and comprehension [6]. Even though fluency will not guarantee comprehension, comprehension will be difficult without fluency. Therefore, with the help of Reader's Theatre, students will be fluent and this will help them to comprehend a text better. This in turn would promote reading because they will not be intimidated by the difficulty of the text. It is found that when students constantly stop reading when they stumbled on difficult or unknown vocabulary, the meaning will be distorted and this makes the reading process long and tedious [7]. With the help of Reader's Theatre, students could develop more interest and could minimize these problems because when they become proficient readers, they could use the higher-order thinking skills such as analyzing, interpreting, drawing conclusions, and inferring meaning from the texts [3]. This could make reading a meaningful and shorter process.

Here, the lecturer could help them with the meaning of the difficult words and also help them to pronounce the words correctly. Therefore, this will help them be fluent readers. When this happens, they could understand the meaning better. Lastly, when asked the question in Table 1.6 whether this Reader's Theatre could promote and motivate them to read the judicial decisions (court case), 84 % of the students agreed because when they could understand the case better through this activity, then they would want to read it! To "promote reading" here means that we want the students to read the case/cases without feeling burdened and we could see that with this activity being carried out, they would want to read it before coming to class because they said they want to be involved in the Reader's Theatre activity where they could play out the roles in the court case. We also asked them to give comments (independent answers) and 68 % of the students gave positive comments on the Reader's Theatre activity. To quote one of the comments, "I enjoy it very much. I like the way they conduct the RT and it is like hearing the case for real. I felt like I am in a court."

Conclusion

To conclude, even though Reader's Theatre is usually carried out in a language lesson especially when teaching reading, this action research that we have conducted has proven that it could also be carried out in a law class where the students are asked

to read and analyze the judicial decisions (court case). The court case text is just like a play-like script and the students can perform the Reader's Theatre activity based on the characters in the text. Another important factor we have observed is that the lecturer could reinforce the teaching and learning of the legal concepts after the Reader's Theatre activity. He or she could not only help the students on the correct pronunciation of the words but also explain further on the case discussed and elaborate more on the abbreviations used in the text. The teaching and learning process of the judicial decisions (court case) is more meaningful here with the help of the Reader's Theatre activity. Most importantly, students enjoy the lesson more as compared to not having the Reader's Theatre activity. In addition, this could definitely promote reading the judicial decisions (court case) among the Foundation Law students of UiTM Kuantan.

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Chapter 2
The Use of Ar-Rahnu by Islamic Bank Customers in Malaysia

Wei-Loon Koe and Nor Zalindah Abdul Rahman

Introduction

The history of pawnbroking services in Malaysia can be dated back to the fifteenth century, during the glorious time of the Sultanate of Malacca [1]. Later, the Hakka clan of Chinese community has controlled most of the conventional pawnbroking services in the country, even until the early 1990s [2]. However, due to the rapid growth and development of Islamic financial business, the pawnbroking has become popular among the public in the form of either conventional or Islamic pawnbroking services. Without any doubt, the establishment of Ar-Rahnu acts as another option for people to borrow money on a short-term basis, especially among the Muslims. As mentioned by Amin and Chong [3], Islamic pawnbroking services serve as an alternative to get financial assistance conveniently for consumers who have difficulties in getting the loan approvals from banks. Indeed, it is a much better and safer choice for getting short-term financial aids than from illegal moneylenders or loan sharks or better known as *Ah Long*.

Conventional pawnbroking which operates based on the concept of interest may not be religiously acceptable for the Muslims. Furthermore, it could also be regarded as a *haram* practice. It is well understood that *riba* and *gharar* are prohibited in Islam. Thus, Ar-Rahnu which adheres strictly to Islamic laws has been welcomed by the Muslims in the country as a Halal choice of borrowing cash money quickly and easily. In addition, Ar-Rahnu is not only suitable for the Muslims; it also appears to be a good system which provides benefits to all of society regardless of religion and ethnicity [4]. As Malaysia consists of people from different religions, races, and beliefs, Ar-Rahnu definitely has the potential to grow further.

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Although Ar-Rahnu has been established long time ago and it is a system suitable for all people, there are scant studies related to it. Throughout the years, studies have been conducted to investigate the consumers' perceptions on Ar-Rahnu (e.g., Sam et al. [5], Appannan and Doris [6], and Othman et al. [7]). Although researchers such as Amin et al. [8] and Amin and Chong [3] have attempted to study the factors influencing the intention and acceptance of Ar-Rahnu, there are still many rooms for further research and improvement. Due to the above limitations, this study is carried out to examine the intention to use Ar-Rahnu among Islamic bank customers.

Literature Review

The Islamic-based pawnbroking system, or also called Ar-Rahnu, can be defined as "a method of providing short-term financing to a person by pawning her jewelry to banks or pawnshops as a security" [[3]: p. 8181]. According to Bhatt and Sinnakkannu [9], the system is operated based upon the Syariah principles of (1) *Qardhul Hasan* or benevolent loan, (2) *Wadiah Yad-Amanah* or trustworthiness, (3) *Al-Ujrah* or safekeeping, and (4) *Wadiah Yad Dhamanah* or safekeeping with guarantee. In short, Ar-Rahnu can be regarded as an Islamic pawnbroking system operated based on *aqad* (contract) and trust between the lender and borrower, in which no interest is imposed, but involves certain *upah* (fees). One major specialty of Ar-Rahnu is that it only allows gold as the collateral because of its advantages such as high resell value, easy to determine the price, and easy to keep safely [10].

Ar-Rahnu is a good and *Halal* option for getting short-term loan easily, quickly, and safely. Indeed, Adnan [11] has explained several significant weaknesses found in conventional pawnbroking system; among them are decrease in quality of jewels after the pawning period, higher interest rate, low collateral value, illegible pawn ticket, and no return of surplus after the goods have been auctioned off, just to name a few. Thus, it is believed that Ar-Rahnu can be regarded as a better choice than conventional pawnbroking. Bhatt and Sinnakkannu [9] have identified the following advantages of Ar-Rahnu: (1) based on Syariah principles which are an interest-free form of loan; (2) easy to apply, fast approval, and guaranteed safety of the jewelry; (3) lower fee than conventional pawnbroking; (4) fixed storage fee; (5) long financing term; (6) no penalties; and (7) surplus auction receipts returned to the customer.

According to Ajzen [12], intention affects the ways a person behaves and it can be regarded as a good prediction for behaviors. In other words, people engage in a particular behavior due to their intention. This study adapted the theory of reasoned action (TRA) by Fishbein and Ajzen [13]. Apart from the two original variables, attitude and social influence, three additional variables were included; they are religious obligation, attractive price, and trust. The three variables are added to increase the predictability of the model.

"Attitude" is a factor that has been suggested by Fishbein and Ajzen [13] in their theory of reasoned action (TRA). Attitude has been found to be an influential factor in predicting people's intention in various areas. Specifically, Amin and Chong [3] identified that attitude has significantly influenced customers to use Islamic pawnbroking. Other studies have also found that attitude significantly influenced customers' intentions on choosing other Islamic banking products and services, such as Qardhul Hassan financing [14], diminishing partnership home financing [15], and Islamic personal financing [16]. Therefore, the following hypothesis is suggested:

H1: There is a correlation between attitude and intention to use Ar-Rahnu.

"Subjective norm" is an original factor in theory of reasoned action [13]. It is frequently referred to social influence. Amin and Chong [3] found that social influence has significantly influenced the customers' intentions to use Ar-Rahnu. In addition, researchers such as Taib et al. [15] and Amin et al. [16] had unanimously concluded that subjective norm played an important role in influencing customers' intentions to take up Islamic financing packages. Hence, the following hypothesis is proposed:

H2: There is a correlation between social influence and intention to use Ar-Rahnu.

People use Islamic pawnbroking when they have high adherence to Shariah [3]. Many studies have shown the religious obligation is significant in affecting customers' intentions. For instance, Haque et al. [17, 18] showed that religiosity influenced the young Muslim customers' purchasing behaviors. In addition, Amin et al. [16] determined that religious obligation has significantly influenced customers to use Islamic personal financing. Okumus [19] also found that the primary reason for customers to use Islamic bank products was religion. As such, the following hypothesis is developed:

H3: There is a correlation between religious obligation and intention to use Ar-Rahnu.

As charges from Islamic pawnbroking are lower than conventional pawnshop [20], it should not be neglected in this study. Amin et al. [16] found that price has influenced customers' intentions to use Islamic personal financing. Similar findings were also obtained in Amin et al. [14], in which price has influenced the bank customers' acceptance of Qardhul Hassan financing. In addition, according to Appannan and Doris [6], cheap cost of loan was the most important factor that caused the public to pursue Islamic pawnbroking. Thus, the following hypothesis is suggested:

H4: There is a correlation between attractive price and intention to use Ar-Rahnu.

Trust in the company can be defined as "customer believes in the value and trustworthiness of the services that are offered by the organization" [21]. Trust exists when the seller and the buyer have faith in their transaction partners [22]. Jarvenpaa et al. [23] indicated that trust has increased customer intention to purchase a product from a company. Thus, the following hypothesis is proposed:

H5: There is a correlation between trust and intention to use Ar-Rahnu.

Table 2.1 Results of
reliability test

Variables	Cronbach's alpha
Attitude	0.92
Social influence	0.86
Religious obligation	0.88
Attractive price	0.94
Trust	0.84
Intention to use	0.86

Research Methodology

The respondents of this study were the customers of Islamic banks. Following the previous studies performed by Amin et al. [8], this study also employed convenience sampling in choosing the respondents. A total of 450 questionnaires were distributed; however, only 377 questionnaires were returned and deemed usable. Thus, the response rate was about 84 %.

The instrument developed for this study was a self-administered questionnaire. The questionnaire was adapted from previous studies such as Amin et al. [16], Jarvenpaa et al. [23], Metwally [24], Metawa and Almossawi [25], and Taib et al. [15]. It consisted of three sections. The first section gathered the demographic information. The second section gathered the information on factors influencing customers' intentions to use Ar-Rahnu. Meanwhile, the third section was designed to determine the intentions to use Ar-Rahnu.

Reliability test is important to determine the internal stability and consistency of the data collected [26]. The value of Cronbach's alpha (α) is used to indicate the reliability level. The closer the α value is to one, the higher the internal consistency reliability [26]. The results are summarized in the Table 2.1. It can be seen that all the variables used in the questionnaire recorded an α value greater than 0.80, indicating that the questionnaire had internal consistency. As such, the reliability test supported the appropriateness of the instrument used in the study.

As for data analysis, all data collected were analyzed using Statistical Package for Social Science (SPSS). Various analyses such as reliability of the data, descriptive analysis, and correlation were performed. The results of the analyses are presented in the following section.

Data Analysis and Findings

Respondents' Background

Table 2.2 depicts that 194 of the respondents were male (51.5 %), while 183 of the respondents were female (48.5). Furthermore, majority of the respondents were working adults between the age of 21 years old and 50 years old (75.9 %). In terms of race, 80.1 % of respondents were Malay ($F = 302$), followed by Indians 10.6 % ($F = 40$),

Table 2.2 Respondents' profiles

	N=377	
Demographic	F	%
Gender		
Male	194	51.5
Female	183	48.5
Age		
≤ 20 years old	48	12.7
21–30 years old	130	34.5
31–40 years old	92	24.4
41–50 years old	64	17.0
51–60 years old	33	8.8
≥ 61 years old	10	2.7
Race		
Malay	302	80.1
Chinese	33	8.8
Indian	40	10.6
Others	2	0.5
Education levels		
Primary	21	5.6
Secondary	203	58.3
Preuniversity/diploma/degree	142	37.7
Postgraduate	11	2.9
Monthly income		
Below RM1,000	134	35.5
RM1,001–RM2,000	106	28.1
RM2,001–RM3,000	71	18.8
RM3,001–RM4,000	50	13.3
Above RM4,001	16	4.2

Chinese 8.8 % ($F=33$), and the remaining 0.5 % of the respondents were from other races ($F=2$).

The results show a good prospect for Islamic-based pawnshop because it has gained the attention from the non-Muslims in the country. As for the education level, most respondents were well educated. However, there were more respondents with secondary-level education ($F=203$; 58.3 %) than pre-u/diploma/degree level ($F=142$; 37.7 %). In terms of monthly income, more than half of the respondents ($F=311$; 82.4 %) were considered as low- to middle-level income earners who draw a monthly salary of less than RM3,000.

Correlation Analysis

In this study, Pearson's correlation coefficient (r) is used to measure the strength of relationship between independent factors (i.e., attitude, social influence, religious obligation, attractive price, and trust) and dependent factor (i.e., customers' intention

Table 2.3 Correlation coefficient and strength of relationship

Correlation coefficient (r)	Strength of relationship
0	No relationship
0.01–0.30	Weak
0.31–0.70	Moderate
0.71–0.99	Strong
1	Perfect

Table 2.4 Table of correlations

		Intention to use Ar-Rahnu
Attitude	Pearson's correlation	0.235**
	Sig. (2-tailed)	0.000
Social influence	Pearson's correlation	0.187**
	Sig. (2-tailed)	0.000
Religious obligation	Pearson's correlation	0.265**
	Sig. (2-tailed)	0.000
Attractive price	Pearson's correlation	0.342**
	Sig. (2-tailed)	0.000
Trust	Pearson's correlation	0.363**
	Sig. (2-tailed)	0.000

**Correlation is significant at the 0.01 level (2-tailed)

to use Ar-Rahnu). The r-value is between −1 and +1. The absolute value indicates the strength, while the sign (+or −) indicates the direction of the relationship. The scales below were outlined by Elifson et al. [27] and can be used to interpret the relationship between independent variables and dependent variable (Table 2.3).

As shown in Table 2.4, it is found that all the five independent variables were significantly and positively correlated to customers' intention to use Ar-Rahnu (p-value<0.01). The results indicate that when factors such as attitude, social influence, religious obligation, attractive price, and trust increase (or decrease), the customers' intention to use Ar-Rahnu also increases (or decreases).

To explain further, attitude, social influence, and religious obligation were having a low strength of relationship with customers' intention to use Ar-Rahnu, with r-value of 0.235, 0.187, and 0.265, respectively. In addition, moderate strength of relationship was found in between attractive price ($r=0.342$) and trust ($r=0.363$) and customers' intention to use Ar-Rahnu. Thus, all the five hypotheses (H1, H2, H3, H4, and H5) suggested were supported. It is worth mentioning that the results found in this study were consistent with the previous studies, in which customers' intention to use Islamic banking product, such as Ar-Rahnu, is correlated to factors such as attitude [3, 14–16], social influence [3, 15, 16], religious obligation [3, 19], attractive price [6, 14, 16], and trust [22].

Conclusion and Recommendations

Due to the lack of studies in investigating factors influencing the intention and acceptance of Ar-Rahnu, this study is performed with the aim to examine the intention to use Ar-Rahnu among Islamic bank customers. Based on the literature review, attitude, social influence, religious obligation, attractive price, and trust have been identified as the five independent variables, while customers' intention to use Ar-Rahnu serves as the dependent variable. From the correlation analysis, significant positive correlations were found between the five independent variables and the dependent variable. Furthermore, all the hypotheses suggested were supported.

This study has undoubtedly provided a platform for relevant parties such as Islamic pawnshop operators to generate new strategies that can effectively attract the public to use Ar-Rahnu. It is therefore recommended that Ar-Rahnu services should be advertised and promoted by using suitable strategies such as focusing on low charges and developing a good relationship with the customers. In addition, illegal moneylending activities should be strictly prohibited to encourage the general public to go for Ar-Rahnu when they require quick cash money.

This study is not without any limitations. For future researchers, it is suggested that more variables should be included and a model is to be developed to accurately predict the customers' intention to use Ar-Rahnu.

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Chapter 3
Retailers' Perspective on Electronic Reservation Services in Malaysia

Zazaleena Zakariah, Nursyahidah Alias, and Mohd Norafizal Abd Aziz

Introduction

The rapid development and commercialization of information and communication technologies (ICTs) for the travel and tourism industry has prompted hotels and other enterprises in this sector to increasingly adopt the technology. Hotels traditionally use a variety of distribution channels, including distributing through other properties within their chain, joining marketing consortia or other types of affiliation organizations, and outsourcing to representation or third-party reservation companies. Most hotels also use intermediaries such as travel agents, tour operators, or incentive houses. Even with the limitations of today's technology, millions of customers are still using electronic reservation service, and it is believed that as performance advances, the number of customers will increase as well. Responding to the widely used electronic reservation service, the study is conducted to determine perceptions and preferences of hotel retailers towards the electronic reservation in Malaysia. Moreover, the study provides recommendations which can be used by hotel retailers in improving their electronic reservation.

Literature Review

The popularity of the Internet, both as an interface to all resources on the Web and as an advertising medium, is rapidly increasing. In the travel and tourism industry, travel products and services appear to be well suited to Internet marketing because of their distinctive high-priced, high-involvement, intangible, heterogeneous,

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high-risk, and well-differentiated characteristics. Ab Hamid and Cheng [1]) stated that the increasing numbers of online users' worldwide firms are compelled to take advantage of the Internet technology. The major advantages offered by the Internet as a business medium over traditional medium include [2–4] the following:

1. High global visibility, instantly.
2. A rich medium for multimedia content.
3. A chance to compete against much bigger players on an even playing field.
4. Precise targeting of clientele: visitors come to one's page only if they are looking for something that one can offer.
5. Exact count of viewership: magazine circulation figures are very illusory and often inflated.
6. Estimating what percentage of readers spent time on your ad is impossible; if it is on the Web, one can obtain detailed statistics, down to the time of visit, visitor's Internet (IP) address, and software platform used.
7. Easy to use feedback forms: the user merely clicks some buttons and types out a few words without cutting a tear-out, filling it in and mailing it – assuring increasing responses.
8. Interactive Web sites could contain photographic product or service documentation or even virtual reality walk-throughs (using Virtual Reality Modeling Language (VRML)), where the user could interact with the advertisement.
9. Flexibility: one's ad on the Web could change every day, even though one usually pays for an ad to be carried for an entire year. In fact, Web sites that do not change often do not get many visitors or responses.
10. Online billing and, in the case of products like software, online delivery. A credit card billing facility could be built into the Web site, if the server and the bank both support it. Many banks do, and some even offer a direct debit service for one to use from one's own Web pages.
11. Online reservations: central reservation systems accessible globally could be built inexpensively.

Electronic Retailers

Electronic retailers are retailers that sell and market products and services through an online storefront [5]. Electronic retailers usually conduct their business using Internet as a communication medium, transaction, and distribution channel. One of the advantages of being electronic retailers is because the retailers will be able to market their products or services on Internet medium that have no boundaries which can be accessed from anywhere and at any time. This marketing strategy involves less cost and is more efficient compared to other marketing campaigns. Besides, electronic retailers can produce an online catalogue to be viewed by customers. Online catalogue will increase flexibility and potential for interactivity. Moreover,
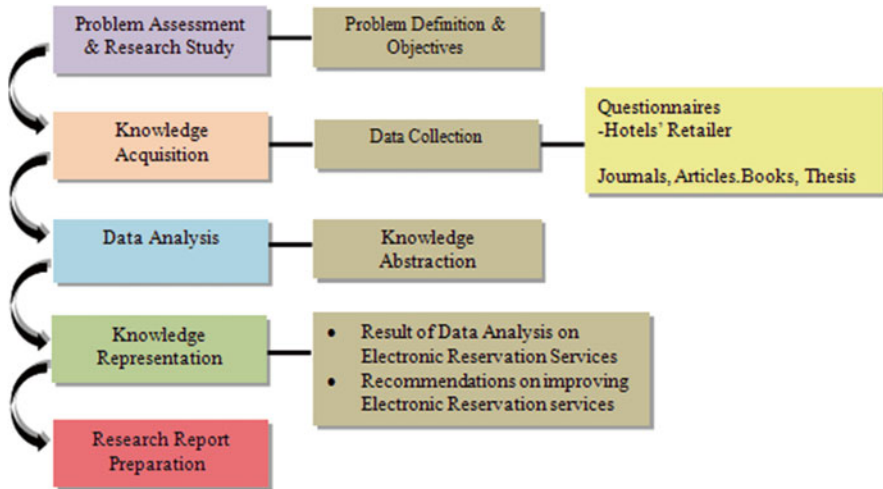
Fig. 3.1 Research approach and methodology

electronic retailers are able to understand their customers' buying habits better by determining which products or services are viewed most frequently by customers. In the process of attracting more customers, electronic retailers should differentiate themselves from other retailers by using three differentiation methods which are convenience, reliability, and service quality [5].

Methodology

To accomplish the study objectives, a suitable research approach and methodology have been used. The approach has been taken from Zakariah [5]). Based on the approach, five steps need to be taken into consideration in carrying out the study. See Fig. 3.1.

The five steps are as follows:

- *Problem assessment and research study*
  Problem assessment and research study is the first step taken in the study process. By undergoing these processes, few problems that arise regarding the study topic are identified and assessed. Through the identification, objectives of the study are recognized.

- *Knowledge acquisition*
  Knowledge acquisition is the next step taken. In this stage, data and information needed are collected. Data and information are divided into two categories which are primary data and secondary data.

Primary Data

Primary data are acquired by distributing questionnaires. Primary data are used as main sources of data and information for this study.

- *Questionnaires*
  Fifty copies of questionnaires are distributed to five randomly selected hotel retailers that apply the electronic reservation services in carrying out their business affair. Three of the hotels are international hotels and the others are local hotels. The hotels are Shahzan Inn Kuantan, Vistana, Holiday Inn, Ritz-Carlton, and JW Marriott. These hotels are randomly selected as representing different areas in Malaysia. Through the questionnaires, data and information regarding retailers' perceptions towards the electronic reservation services are gathered. Other than that, retailers are required to give suggestions and recommendations to improve the service quality. Retailers' perceptions are assessed by using the 11 dimensions of electronic service quality. The 11 dimensions are reliability, security, efficiency, ease of use, information, appearance, linkage, structure and layout, support, communication, and incentives which have been explained in detail in research model developed by Zakariah [5]. The questionnaires are divided into two sections. Section A required respondents to fill in questions regarding their demographic information and profile. Respondents are provided with multiple-choice answers in this section. Section B consists of questions that are derived from the 11 dimensions stated above. Each question is provided with a five-point scale starting with 1-Strongly Disagree, 2-Disagree, 3-Neither, 4-Agree, and 5-Strongly Agree.

Secondary Data

Secondary data is obtained through four ways: revising existing journals and articles related to the topics and revising related sources from the Internet, books, and thesis. Secondary data are used as additional information in the study to support the primary data.

- *Data analysis*
  The process of knowledge acquisition followed by data analysis involves the abstraction of knowledge based on data and information gathered from previous activities. In this stage, data and information are analyzed and documented for the next stage. Data are analyzed using SPSS 15.0.

- *Knowledge representation*
  Knowledge representation process includes presentation of data analysis on electronic reservation services and recommendations on improving electronic reservation service quality.

- *Research report preparation*
  The last process of this study is preparing complete research report which consists of all data and information that were gathered through this study.

Research Model

Research model that has been chosen is a research model of electronic service quality that was adopted by Zakariah et al. [6]. The model was chosen as it represents all aspects of characteristics related to this study. The model consists of 11 determinants that were ranked in order of importance and were clustered into two major dimensions which are incubative dimension and active dimension. Feinberg et al. [7] have identified 25 factors that combine to be an index of electronic customer relationship management (ECRM) activities of the firm with another 17 additional features defined by Feinberg et al. [7]. Li et al. [4] have compiled the 42 factors and analyzed whether the factors are implemented by hoteliers.

Results and Discussions

In this part, there are three subtopics which will be explained, namely, retailers' perception, correlation coefficient test, and Cronbach's alpha test.

Retailers' Perception Towards Electronic Reservation Service

Table 3.1 shows the results of hotel retailers' perception towards electronic reservation for hotel services based on 11 electronic service dimensions. For Shahzan Inn, 74.29 % of the hotel respondents agree that the most important factor in electronic reservation service is reliability, while only 60.00 % of the respondents agree that good appearance is important in an electronic reservation service. 92.00 % of the respondents of Vistana agree that linkage is important in attracting customers to use the electronic reservation service by the hotel. 74.50 % of the respondents have the same opinion that Vistana provides good support in their electronic reservation service. For Holiday Inn, 84.46 % of the respondents agree that incentive can attract customers to use electronic reservation service, while 76.51 % have the same opinion that the hotel provides reliable service through their electronic reservation service. For JW Marriott, 80.00 % of the respondents claim that incentives and linkage are vital factors in persuading customers to use electronic reservation, while 62.86 % of the respondents have the same opinion that the hotel provides efficient service in the electronic reservation service. According to the study, 95.00 % of

Table 3.1 Hotel retailers' perception towards electronic reservation service

	Hotels retailers: perceptions (%)				
E-service quality dimensions	Shahzan Inn	Vistana	Holiday Inn	JW Marriott	Ritz Carlton
Reliability	74.29	79.43	76.51	73.88	82.45
Security	71.00	79.00	78.33	72.86	82.14
Efficiency	73.33	80.67	82.22	62.86	79.05
Ease of Use	68.80	84.00	86.22	74.86	89.14
Information	61.00	79.50	83.33	69.29	86.43
Appearance	60.00	85.00	83.89	76.43	91.43
Linkage	67.00	92.00	82.78	80.00	95.00
Structure &Layout	66.67	88.67	79.26	78.09	94.29
Support	65.00	74.50	81.67	69.29	68.58
Communication	66.67	82.00	82.22	77.14	80.95
Incentive	66.00	88.20	84.44	80.00	84.28

Fig. 3.2 Level of retailers' perception towards electronic reservation service
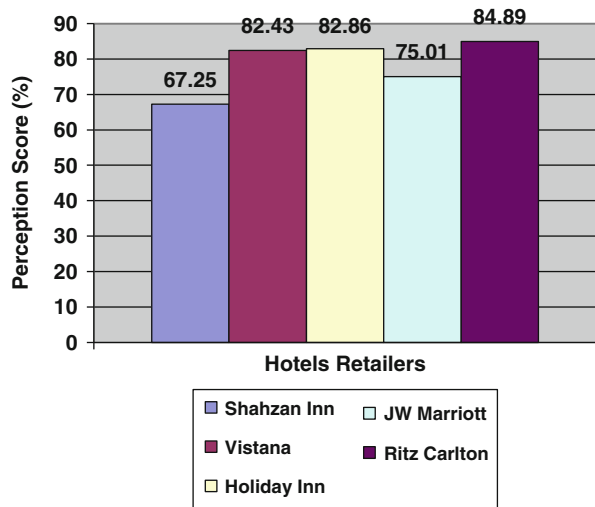
Ritz-Carlton respondents agree that the hotel provides good linkage as the service is important and 94.29 % of the respondents agree that structure and layout is important. However, only 68.58 % of the respondents agree that support is crucial in implementing electronic reservation service.

The hotel retailers' perception scores are summarized in Table 3.1 and also presented in Fig. 3.2 to enhance understanding and getting a clearer view of the study result. Figure 3.2 shows that Ritz-Carlton has the highest perception score which is 84.89 % compared to other hotels. Ritz-Carlton is taking serious consideration on four electronic service quality dimensions which are ease of use, appearance, linkage, and structure and layout. Holiday Inn has the second highest perception score with 82.86 %. Holiday Inn has the highest percentage perception towards one of the electronic service quality dimensions which is ease of use. The perception score is followed by Vistana with 82.43 %. Vistana has the highest perception

Table 3.2 Summary results of retailers' correlation coefficient test

Hypothesis	Correlation coefficient value	p-value
HI2: There is positive relationship between retailers' perception and reliability dimension	0.706**	0.01
H13: There is positive relationship between retailers' perception and security dimension	0.396*	0.05
H14: There is positive relationship between retailers' perception and efficiency	0.729**	0.01
H15: There is positive relationship between retailers' perception and ease of use	0.781**	0.01
H16: There is positive relationship between retailers' perception and information	0.836**	0.01
H17: There is positive relationship between retailers' perception and appearance dimension	0.862**	0.01
H18: There is positive relationship between retailers' perception and linkage dimension	0.797**	0.01
H19: There is positive relationship between retailers' perception and structure and layout dimension	0.800**	0.01
H20: There is positive relationship between retailers' perception and support dimension	0.483**	0.01
H21: There is positive relationship between retailers' perception and communication dimension	0.761**	0.01
H22: There is positive relationship between retailers' perception and incentive dimension	0.792**	0.01

*significant at 0.05; **significant at 0.01

percentage compared to other hotels in 1 out of 11 electronic service dimensions which is incentive. JW Marriott is the fourth highest hotel that obtains 75.01 % score and the hotel has implemented all electronic service dimensions averagely. Shahzan Inn has the lowest perception score with 67.25 % of the electronic service quality dimension to their organization. Shahzan Inn should improve in their appearance quality as the hotel respondents claim that the hotel does not provide good appearance if compared to other hotels.

Correlation Coefficient Test

To determine the relationship between the retailers' perception and the 11 electronic service dimensions, which are reliability, security, efficiency, ease of use, information, appearance, linkage, structure and layout, support, communication, and incentives, correlation coefficient test was conducted. If result of the test conducted shows significant value, the dimension is considered as having positive relationship with hotel retailers' perception, and if not, the dimension has no relationship with hotel retailers' perception.

Table 3.2 shows the results of the correlation coefficient test that has been carried out. The result shows that there is a statistically significant positive relationship

Table 3.3 Retailers' summary results of Cronbach's alpha test of reliability

E-service quality dimensions	Alpha value	Result
Reliability	0.8398	Consistent and reliable
Security	0.8425	Consistent and reliable
Efficiency	0.7419	Consistent and reliable
Ease of use	0.9255	Consistent and reliable
Information	0.8894	Consistent and reliable
Appearance	0.9387	Consistent and reliable
Linkage	0.9362	Consistent and reliable
Structure and layout	0.8532	Consistent and reliable
Support	0.7695	Consistent and reliable
Communication	0.6257	Inconsistent and not reliable
Incentive	0.8352	Consistent and reliable

between hotel retailers' perception with all 11 electronic service quality dimensions, which are reliability, security, efficiency, ease of use, information, appearance, linkage, structure and layout, support, communication, and incentive. This is because most hotel retailers provide facilities that fulfill those 11 dimensions in ensuring customer satisfaction in their electronic reservation service.

Cronbach's Alpha Test of Reliability

In evaluating the hotel retailers' perception of electronic reservation service, Cronbach's alpha test was conducted in order to determine the reliability of each of the 11 electronic service quality dimensions which are reliability, security, efficiency, ease of use, information, appearance, linkage, structure and layout, support, communication, and incentive. If the alpha value of each dimension is higher than 0.7, the dimension is considered consistent and reliable. If the alpha value is below 0.7, the dimension is inconsistent and not reliable.

Table 3.3 shows the summary results of Cronbach's alpha test of reliability. From the test conducted, the result shows that ten out of 11 electronic service quality dimensions are consistent and reliable. The ten dimensions are reliability, security, efficiency, ease of use, information, appearance, linkage, structure and layout, support, and incentive.

Conclusion

The study of electronic reservation for hotel services has been carried with two objectives that need to be achieved. The objectives are to identify hotel retailers' perception towards the electronic reservation service quality provided by them and to provide recommendations and suggestions for retailers that can be used in

improving their electronic reservation. The study was conducted by distributing questionnaires to five hotel retailers, where each hotel is given ten questionnaires to be filled in. The study is based on 11 dimensions of electronic service quality. Both groups of factors are used in assessing customers' and retailers' perception. In assessing electronic reservation for hotel services, ECRM features that have been implemented in the electronic reservation service have been taken into consideration. This study also found that few hotel retailers ignored support dimension in their electronic reservation service.

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Chapter 4
Parenting Behavior of Mothers and School Adjustments of Adolescents in Malaysia

Rozumah Baharudin, Nor Sheereen Zulkefly, Hong Chi Yee, Chiah Wan Yeng, and Lim Hui Jun

Introduction

Adolescents make up about one-third of the 27 million population of Malaysia. Although a majority of these adolescents are expected to be in school, there remain substantial proportions of them who are left behind. It was reported that adolescents' enrolment rates for 2005–2009 in secondary schools in Malaysia were lower when compared to the primary school levels [1]. The report indicates that the country's net enrolment in secondary schools for boys was approximately 66 % and for girls, 70 % [1]. These statistics reflect that a considerable number of adolescents are unable to benefit from the educational programs and services provided by the government to foster their development. Various sections in the Malaysian society are concerned that these school dropouts could further escalate the problem of adolescents' involvement in numerous antisocial behaviors, such as promiscuity, gangsterism, bullying, stealing, vandalism, substance abuse, delinquency, and crime [2–7].

Mental health problems are increasingly becoming an issue within the adolescents' population in Malaysia. Past studies provided evidence on the prevalence of stress [8–10] and depression [10, 11] among this younger generation. School-related problems especially academic pressure were noted as the main contributor to adolescents' experience of stress [8, 9]. Most schools in Malaysia are regarded as environmentally stressful due to its high academic demands. Stress may be good to

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a certain extend for the adolescents as it can motivate them toward optimal learning and performance. Nonetheless, overexposure to stress could lead to mental health problem such as depression.

Put together, the aforementioned information reflects on the vulnerability and adjustment issues confronting Malaysian adolescents. Thus, it is deemed necessary to examine factors that influence behavioral adjustment of Malaysian adolescents. Few studies in Malaysia have examined the precursors of and pathways to behavioral adjustment, specifically school adjustment among adolescents. Nevertheless, the few studies have employed samples that either are disadvantaged, small in size, or restricted in age range. This study uses data from a national study [12] to describe patterns and precursor of school-related behavioral adjustment among a large and representative sample of Malaysian adolescents. Understanding the factors that shape adolescents into being well-adjusted and law-abiding citizens is important if Malaysia were to succeed in its human capital investment programs and achieving its developed status in the year 2020.

School Adjustments

Based on the developmental science framework, adolescents' behavioral adjustment is perceived as integrated whole rather than separate parts (i.e., cognitive, behavioral, and social). Using this perspective, the concept of school adjustments in previous studies was reviewed. A two-year longitudinal study measured school adjustment with grades, absenteeism, and self-reported scholastic self-concept [13]. In another longitudinal study [14], indications for school adjustments included academic, behavioral, and social factors as reported by teachers, parents, and peer. In Ueno and McWilliams' study [15], school adjustments were measured based on engagement and attachment. Hence, it seemed that school adjustment is not limited to measurement of adolescents' cognitive ability in school such as grade point average (GPA) but also includes other dimensions that tap into adolescents' behavioral and social competence in schools.

Adolescents' school adjustment could be predicted by a range of environmental support provided during early childhood and early adolescence [16]. Factors like teacher support, parental control, attachment to school, and peer support are possible predictors for school adjustments [17]. Besides, Carlson and colleagues [16] found that quality of parental guidance of child activity and quality of home environment during early childhood provided a platform for adolescents' school functioning. Moreover, favorable parenting behavior by close adults such as interest and encouragement in school activities has also been found to prevent school trouble. In a study where parenting in single mother household was investigated, it was found that maternal monitoring and school involvement promoted adolescent's school achievement [12]. Based on the literature on factors that lead to adolescents' school adjustment, it appears that quality of parenting behavior plays an important role to promote success of adolescents in the school context.

Adolescent-centered approach in gathering information could provide various benefits. One of the main benefits documented by Spera [18] was "children's reports of parenting behaviors provide the theoretical linkage to their own thoughts, emotions, motivations, and behaviors as it occurs within the family context' (p. 464)." In fact, it was shown that adolescents' perception of high maternal warmth would positively predict their grade point average (GPA) [19]. However, the contribution of parental control on adolescents' school adjustment was less clear. Contradictory to this finding, Frey et al. [17] revealed that parental control accounted for a large variance in enhancing adolescents' school motivation. Perhaps, parental control is helpful for adolescents in handling the developmental challenges during the transition from middle to high school. In the Western context, parental control manifested in consistent discipline and monitoring were found to foster decrement in adolescents' conduct problem behaviors [20]. Whereas in the Asian context, high level of parental control is an instrumental parental measure that decrease adolescents' externalizing behavior, enhance social behavior, and maintain academic competence [21, 22].

Research Gap

While failure to adjust in the school context potentially jeopardizes adolescents' opportunity for future university enrollment and job success, there is debate over whether a broad parenting behavior or a specific school-related parenting behavior would be more instrumental to ensure adolescents' adjustment in school. As specified in the study by Baharudin and colleagues [12], father and mother's academic-related parenting practices such as parental school involvement are keystones to adolescents' academic performance. Other content-specific parenting such as taking part in school activities has also been found to contribute to adolescents' cognitive development. Nevertheless, other studies have noted that broad parenting behavior is equally important in predicting adolescents' school outcomes [23–25]. Past literature highlighted the orthogonal dimensions of responsiveness and demandingness in the parent-child socialization context, which provide insights to how elements of warmth and support, as well as monitoring and discipline, influence adolescent development. According to Darling and Steinberg [26], content-specific parenting is no doubt a strong parenting tool to enhance specific developmental outcomes in adolescents; yet, broad parenting dimensions such as responsiveness and demandingness are beyond and greater than the effects of content-specific parenting practices. They elucidate the function of broad parenting behavior as an emotional climate that influences all area of adolescents' development. Hence, it is imperative for this study to investigate such behavior on adolescents' school adjustment.

Malaysian studies tend to focus more on specific dimension of schooling, particularly academic performance. In Hanafi's [27] study, academic achievement was assessed based on examination results pertaining to four main subjects, namely, Malay, English, Science, and Mathematics, taught in schools. Another study among technical secondary school students [28] measured academic performance based on

subject grades made available to the researcher. A multidimensional aspect of school adjustment is yet to be found in the Malaysian studies. Hence, this study adopted the developmental science framework to define school adjustments as the adolescents' cognitive abilities (academic achievement), feelings toward the school (school connectedness), and behavior in school (trouble at school).

A study by Shek [29] indicated that adolescents with positive perception of their family functioning (including paternal and maternal parenting styles) had better adjustment compared to those with poor perception of family functioning. In a later study, Shek [30] further noted that adolescents experiencing positive parenting demonstrate positive behavioral adjustment. Similarly, Liu [31] revealed the significant impact of parental warmth on early adolescents' school achievement. Despite the fact that high level of parenting quality would cultivate school adjustments among adolescents, parenting quality might differ among mothers and fathers [32]. In general, mothers are well informed of adolescent's daily activity as compared to fathers. Adolescents also tend to report higher attachment with their mothers than their fathers [33]. Hence, maternal parenting is expected to offer a better socialization background for adolescents' school-related adjustments. Compared to mothers, fathers are being constantly noted as being less involved in children's school activities [34]. Thus, focusing on adolescents' perception on maternal parenting behavior would provide practical implementation of school level support and intervention programs.

Gender has been shown to be a consistent factor to differentiate adjustment scores in terms of school liking and school avoidance [35]. Although the difference was small, girls generally had more positive feelings toward schools than boys. Moreover, in the mother-child dyad, females tend to be closer and receive discipline from their mothers compared to males [36]. Females were also found to achieve better grades when parenting dimensions were included in the analytical model relating parental support, monitoring, and harsh punishment to children's well-being [37]. In addition, when comparing between females and males on the link between parenting patterns and adjustment, males illustrated a higher and significant correlation between supportive guidance and GPA [38]. Hence, this study examined gender differences with regard to quality of maternal behavior and school adjustments.

Lastly, research investigating the links between parenting behavior and adolescents' school adjustment has utilized a less robust analysis. Kurdek et al. [39] recommended investigation to go beyond multivariate linear links between school adjustment and family variables in order to identify how the three aspects of school adjustments synergistically relate to the maternal warmth, hostility, consistent discipline, and monitoring. Hence, the study hopes to divulge more information on the relations between quality of parenting behavior and multiple dimensions of school adjustment simultaneously by using a structural equation modeling (SEM). The use of SEM would allow a more parsimonious model in explaining the linkages between all the study variables [40]. Thus, the purpose of this study was to validate the model of maternal parenting behavior (warmth, hostility, monitoring, and discipline) and adolescent's school adjustments (academic achievement, school connectedness, trouble at school).

Theoretical Framework

A synthesis of the literature reviewed indicates that the human ecological theory [41] provides a comprehensive framework to investigate social phenomena linking adolescents' school adjustment and parenting milieu. As has been put forth by the theory [41], the microsystems in adolescents' developmental context such as the family, school, and neighborhood have most direct influences on adolescents' onto-genic development. This is based on the central concept of the theory which focuses on an individual as an interactive entity that constantly transacts with the environment. Continuous interactions with significant others in the environment would have profound implications on adolescents. Hence, as adolescents have most contact with individuals in the family system, its overall functioning is critical to predict adolescents' ontogenic development. Along the line, human ecological theory postulates that parents who are competent in terms of their parenting behavior would produce adolescents with good developmental outcomes. In addition, the theory speculates the occurrence of interaction in the mesosystems when adolescents' perception of their parents' parenting competency affects their adjustment in school.

   In summary, the utility of human ecology theory is relevant in the context of this study. Two microsystems, namely, adolescents' family and school contexts, would be used to illustrate how adolescents' perception toward their mother's parenting behavior relates to their self-reported school adjustment. Although concepts portrayed in this study are not new, this study extends the examination of mother's parenting behavior into warmth, hostility, consistent discipline, and monitoring. Further, this study expands concept of school adjustment into three dimensions, namely, mean score of academic achievement, school connectedness, and trouble at school. In other words, this study aims to develop a model of maternal behavior and dimensions of school adjustments in a more comprehensive manner. In particular, the use of school connectedness and trouble at school allows representation of school adjustment in a more complete manner. Hence, the use of the human ecology theory is deemed appropriate in establishing the conceptual framework as shown in Fig. 4.1.

Methods

Participants and Procedures

Using probability proportional to size cluster sampling, 2,868 adolescents (44.2 % boys, 55.8 % girls) were recruited from urban and rural secondary schools in six selected states in Malaysia. Consents were obtained from the related parties before distributing a self-administered questionnaire to the respondents at their respective schools. Mean age of the adolescents was 14.35 years and their mothers, 43.01 years. Most of the adolescents were Malays (59 %), and the remainder were Chinese
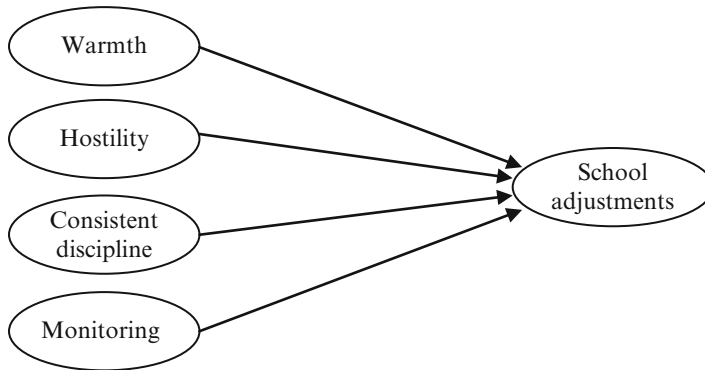
Fig. 4.1 Conceptual framework

(13.3 %), Indians (10.5 %), and others (17.2 %). A majority (87.4 %) of the adolescents lived in two-parent families, with moderate size (mean number of children was 4) and monthly income (RM3474 or USD1135.30).

Measures

Quality of Maternal Parenting Behavior

Parenting scale was used to assess the quality of parenting behavior in four parenting dimensions, i.e., warmth, hostility, consistent discipline, and monitoring (Simons and Conger [42]). All four subscales consist of four items, respectively. Adolescents indicated the frequency of certain parenting behavior displayed by their mothers toward them. Total score was generated based on the sum of items in each subscales. Warm and hostility scales were rated on a 7-point Likert scale, while consistent discipline and monitoring were rated on a 5-point Likert scale. Items were ranged from the lowest frequency, "*never*," to the highest frequency, "*always*." Higher scores indicated a greater level of the particular parental quality. Items asking the frequency of mothers caring, act lovingly, helping out, or appreciate the adolescents' ideas were used to measure mothers' warmth. While hostile parenting was assessed by the respondents' response on how often their mothers got angry, shout, criticize, or argue with them.

In order to assess mothers' consistent discipline, items such as "How often does your mother give up when she asks you to do something and you don't do it" were asked. Mothers' monitoring was rated on items which asked adolescents on how well their mothers know their whereabouts and talk about their life. Internal consistency was evident in past studies [42] with coefficient alpha ranging from .68 to .83 for four subscales. For this study, internal consistencies found were .77, .68, .50, and .69 for warmth, hostility, consistent discipline, and monitoring, respectively.

School Adjustments

Three aspects of school adjustments measured in the study were trouble at school, school connectedness, and academic achievement [43]. The first two dimensions employed scales adapted from Add Health Project [44]. Trouble at school was assessed with a 4-item scale related to trouble getting along with teachers, students, getting homework done, and paying attention. These items were measured on a 5-point Likert scale ranging from 0 (*never*) to 4 (*everyday*). Total raw score was generated using the four items as an indicator of trouble at school. Adolescents were also asked to answer five items that represented school connectedness, such as feeling close to people at this school and happy to be at this school. Items were measured on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Internal consistency was high for both scales, with .80 and .82, respectively. Academic achievement was measured based on score average. Students reported marks obtained for each subject (Malay, English, Mathematics, History, Islamic or Moral Education, Civic and Citizenship Education, and Science) taken in the previous school examination. In the case of Science stream upper secondary students, scores for Science subject were the average score of science subjects, namely, Biology, Chemistry, and Physics, whichever was taken.

Data Analytic Strategy

The study utilized structural equation modeling (SEM) to test the plausibility of the model illustrated in Fig. 4.1. The research objectives were examined by evaluating the overall model fit and the significance and direction of the regression estimates in the model. Additionally, the fit model was then tested for gender invariance in order to cross validate the structural model. Prior to testing the structural model fit, preliminary analyses were carried out to construct-validate the measurement scale used in this study. The analyses involved estimating a measurement model to ensure that the quality of maternal parenting behavior scale constructed by four dimensions was adequately measured. The fit of the measurement model was adequate, chi-square χ^2 (98) = 939.07, p = .00, root mean squared error of approximation (RMSEA) = 0.55, Tucker-Lewis Index (TLI) = .86, and comparative fit index (CFI) = .90. The significant model chi-square is expected as the sample size was large. Large sample size magnify the effects of small specification errors and more likely produce type II error [45]. Hence, multiple measures of fit were used. Collectively, the confirmatory factor analysis model indicated that parenting behavior formed by four constructs was measured well by remaining a minimal of four indicators in each dimension.

Subsequently, the hypothesized structural model was estimated using full information maximum estimation likelihood methods. This feasible method is preferred to the conventional pairwise or listwise deletion in improving the statistical power. Both absolute and relative goodness-of-fit indices were used to evaluate the model.

Model chi-square (χ^2) and RMSEA as the absolute fit indices measured the magnitude of discrepancy between sample and fitted covariances matrices [46]. Hu and Bentler [47] suggested a cutoff value close to .06 for RMSEA as indicator for a good model fit. Nonsignificant chi-square result at 0.05 threshold is an indicator of good fit [48] as well. However, the chi-square goodness-of-fit indices are sensitive to sample size; large sample size may result in rejection of the model. To overcome this problem, Bentler [49] recommended using other goodness-of-fit indices which include comparative fit index (CFI) and Tucker-Lewis Index (TLI). Tucker and Lewis [50] suggested that values near 1.00 are a sign of good fit, while Hoyle [51] introduced values greater than 0.90 as indicating good fit for both relative fit indices. In order to cross validate the model across gender, two steps of analysis were conducted. First, an unconstrained model was developed by testing the structural path across male and female samples simultaneously, which resulted in a baseline chi-square value. Next, the structural paths were constrained equally between the two groups, thus producing another chi-square value that is tested against the baseline value for any statistical significant differences. Based on past findings, it is expected that there will be differences in the chi-square value between the constrained and unconstrained models.

Results

The study led the way of investigating the impact of parental behavior of mothers on adolescents' school adjustments in Malaysia through a rigorous analyzing method. A model of maternal parenting quality on school adjustments among adolescent was hypothesized at the beginning of this study. Prior to conducting the structural analysis, this study performed bivariate analysis on all the variables understudied (see Table 4.1).

Results showed that maternal warmth was positively related to consistent maternal monitoring and three school adjustment variables (i.e., Trouble at school, Connectedness and Academic achievement) but it was negatively related to maternal hostility. Maternal hostility was found to positively relate to consistent maternal discipline and negatively relate to consistent monitoring, trouble at school, school connectedness, and academic achievement. Meanwhile, consistent discipline was found to negatively relate to consistent monitoring and the three school adjustment variables. As expected, consistent maternal monitoring was found to positively relate to the school adjustment variables. Correlational analyses further indicated that trouble at school, school connectedness, and academic achievement were all positively interrelated.

The hypothesized study model of maternal parenting behavior and adolescents' school adjustment was tested using SEM. Upon inspection, the study model revealed inadequate fit statistics. In order to improve the study model, modification indices were reviewed. It was suggested that three pairs of error terms to covary: item 1

Table 4.1 Correlation matrix

	WM	HS	DS	MN	TROSCH	SCHCONN	ACAAC
WM	–	−.077***	−.028	.426***	.235***	.288***	.119***
HS		–	.322***	−.059**	−.065**	−.082***	−.124***
DS			–	−.038*	−.067**	−.085***	−.059**
MN				–	.185***	.188***	.242***
TROSCH					–	.440***	.112***
SCHCONN						–	.088***
ACAAC							–

WM warmth, *HS* hostility, *DS* discipline, *MN* monitoring, *TROSCH* trouble at school, *SCHCONN* school connectedness, *ACAAC* academic achievement

*$p<.05$; **$p<.01$; ***$p<.001$

Table 4.2 Summary of model fit

Model	χ^2	Df	p	CFI	TLI	RMSEA
Hypothesized	1,187.996	142	0.00	0.89	0.86	0.05
Revised	854.659	139	0.00	0.93	0.90	0.04

CFI comparative fit index, *TLI* Tucker-Lewis Index, *RMSEA* root mean squared error of approximation

and item 2 of warmth scale, item 7 and item 8 of hostility scale, and item 1 and item 2 of monitoring scale. Given that the covariance suggested had common cause and compromise the theoretical integrity of the model, the paths were freed. The revised study model yielded a good fit to the data. The comparison of fit indices for both hypothesized and revised model is displayed in Table 4.2.

The resultant model as illustrated in Fig. 4.2 was estimated and found to fit the data well. The factor loadings on all constructs were reasonably adequate and in logical directions for the sample. Factor loadings were commonly required to be greater than 0.3 and statistically significant ($p<0.05$) in social science research to be accepted as part of the construct [40, 52]. Although all factor loadings were found to be significant, academic achievement surprisingly appeared to load relatively poor on school adjustment. The variance in mean score accounted for was only 4 % when all predictors were considered. It was possible that the testing of academic achievement using average marks may have caused biasness in the data. The utilization of this constant criterion failed to take into account the significance of discrepant performance at various points in the continuum of school life [53]. Thus, a more complete achievement battery should be employed in future studies to fully depict a broader domain of cognitive aspect in school adjustments. Nevertheless, interpretation of the data was continued with great caution.

The structural regression weights of the structural model were somewhat consistent with the past literature. As hypothesized, mother's warmth significantly associated with less trouble at school, greater school connectedness, and better achievement ($\beta=0.37$, $p<0.001$). Inconsistent with past findings, mother's hostility was not a significant factor of adolescents' school adjustment. Although mother's
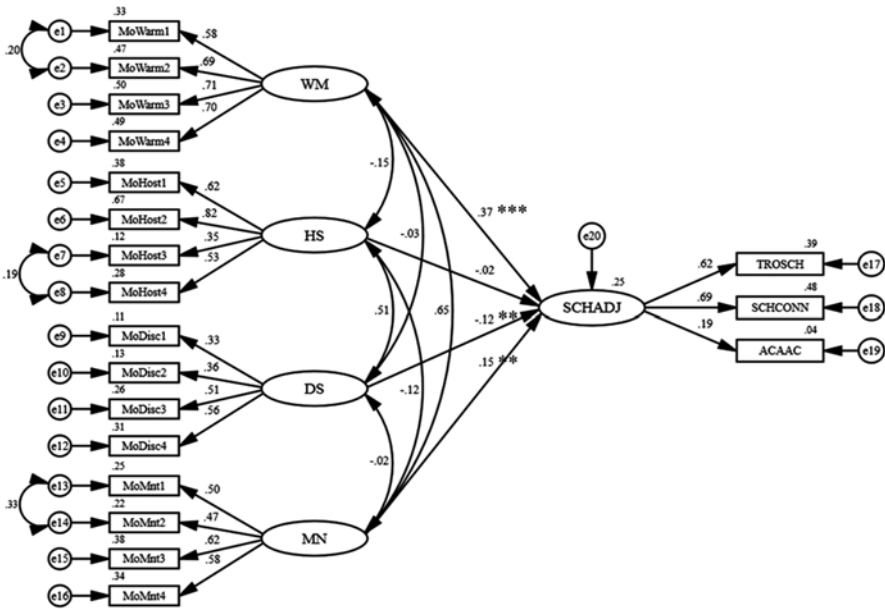
Fig. 4.2 Revised structural model with standardized estimates (*Note*: *WM* warmth, *HS* hostility, *DS* discipline, *MN* monitoring, *SCHADJ* school adjustment, *ACAAC* academic achievement, TROSCH = trouble in school, SCHCONN = school connectedness)

hostility was related to the three indicators of school adjustments at the bivariate level, the effect of mother's hostility was not uniquely associated with the adjustments of adolescents in the presence of other parental constructs. This finding calls for closer inspection. As predicted, both consistent discipline and monitoring of mothers significantly and positively predicted better school adjustments ($\beta_{discipline} = 0.12$, $\beta_{monitoring} = 0.12$, $p < 0.001$). These results correspond to prior research [12, 19, 22] that examined impacts of mother's parenting quality on children performance and behavior at school. It is noteworthy that mother's warmth was found to have the strongest prediction on the endogenous variable based on standardized estimates. Parents with warm parenting, generally express interests and involve in their adolescents' activities, and praise their accomplishments [54]. Hence, adolescents who perceived their mother as being supportive would develop a positive emotional climate and be able to perform and adjust well at school.

In order to cross validate the quality of parenting behavior on school adjustment model, multigroup analysis was conducted. The invariance test across male and female groups did not demonstrate deterioration in the model fit based on the nonsignificant change in chi-square values ($\chi^2(df = 4) = 10.864$, $p > .05$) (see Table 4.3). In other words, gender does not influence the relationship between parenting behavior and adolescent's school adjustments. This finding is in contrast to past studies [37, 38] where gender was found to affect the impact of parenting on adolescents' school adjustments.

Table 4.3 Multigroup modeling across gender

Model	χ^2	df	Critical value	χ^2 change
Unconstrained	1,025.693	278	14.86	10.864
Constrained	1,036.557	282		

Discussion and Conclusion

Results from this study tend to suggest that the way adolescents adjust their behavior in school is related to the quality of their interaction with their parents, particularly with their mothers. Thus, consistent with other studies [e.g., [29, 30]], this study emphasized the vital roles of parents in promoting well-adjusted adolescents. Findings from the study provide evidence of the validity of the full-fledged model which indicates that maternal warmth, consistent discipline, and monitoring promote better school adjustment in adolescents. On the other hand, adolescents with hostile mothers are more vulnerable to experience poor school adjustments. Consistent with the human ecological theory, the study emphasized the impact of interaction within the family ecosystem on adolescents' adjustments in the school ecosystem. In other words, how adolescents perceived themselves in their school environment, including their behavior at school and academic attainment, is closely related to the quality of parenting that they received from their mothers.

Contrary to expectations, the study found that the model linking quality of maternal parenting behavior and adolescents' school adjustment was stable across gender. The study found that the quality of maternal parenting behavior accounted for a very low variance in academic achievement, whereas it explained moderate variance for school connectedness and trouble at school. Thus, future researchers may wish to reexamine these relationships, perhaps using a more complete achievement battery to fully depict a broader domain of cognitive aspect in school adjustments.

Several limitations were identified in this study. Firstly, the study obtained information from a single source, which is self-reported data. Information obtained from other sources such as mothers, school report cards, and teachers' report for school adjustments would probably provide a more comprehensive explanation on the influence of parenting behavior and adolescents' school adjustment. Secondly, this study only focused on the role of maternal parenting behavior among mothers. It is plausible that adolescents' school adjustment may be affected by a paternal figure, which may account for the low variability in the model. Thirdly, using cross-sectional design may limit the study's ability to determine causality. In view of these limitations, results from this study must be treated with caution and may not be generalized to the adolescent population in Malaysia.

As a conclusion, findings from this study were in line with the theoretical framework with regard to the speculation of the interaction in the mesosystem. As expected, adolescents who regard their mothers to be competent in their parenting behavior are well adjusted at school. A competent mother would interact and promote adolescents' school adjustment, hence cultivating good academic achievement, school connectedness, and decreasing trouble at school. Thus, as the theory emphasized on

the family system in predicting the functioning of the adolescents' ontogenic development, this study recommends mothers to continue parenting adolescents by providing them with warmth, consistent discipline, and monitoring in order for adolescents to adjust well at school.

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Chapter 5
Numerical Visualization of Rudder Inflow as Effect of Increasing Angle of Attack

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Introduction

Systematic prediction of propulsion system design is crucial towards efficient propulsion. Mainly contributed by the propeller, it is thrusting forwards by screw movement and flow passing these twisted edges surrounding it. The hydrodynamic analysis of rotating propeller in the vicinity of a rudder is somewhat a complex one. It has become one of the most challenging problems in computational fluid dynamics (CFD) validation [1, 2], and it has been investigated conventionally using potential theory for decades. As the year progresses, CFD has now become a practical tool in solving propeller flow problems via Reynolds-averaged Navier-Stokes (RANS) solver. As ships are becoming larger and their power consumption is also increasing, high axial momentum behind a ship propeller may induce strong cavitation on the surface or discontinuities in the ship rudder. The propeller wake intrinsically has the contracted slipstream tube in the condition of uniform flow. However, it has specific angles of attack to the left (port) and right (starboard) sides of the rudder blade, which is located behind a propeller as exhibited in Fig. 5.1.

The differences in incident flows towards the rudder have affected its lift forces and ships' manoeuvrability. To obtain sufficient lift forces in the rudder, an excessive rudder angle may be required in the actual operation of ship. On the other hand, an increased rudder angle induces a large amount of violent rudder cavitation and may cause cavitation erosion of its surface. Securing sufficient lift has often conflicted with the trials of reducing rudder cavitation in both full-spade and semi-spade rudders. Rudder cavitation could have a negative effect on ships from hydrodynamic and structural viewpoints. If strong cavitation on the rudder results in serious damage,

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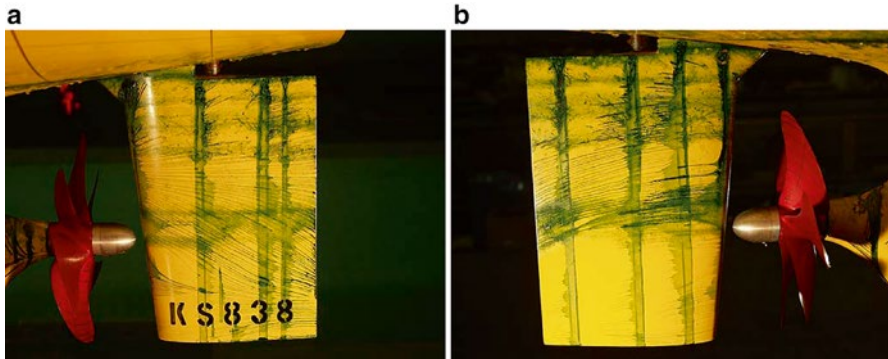
Fig. 5.1 (**a**) Flow paint streaks on the port side of rudder [2]. (**b**) Flow paint streaks on the starboard side of rudder [2]
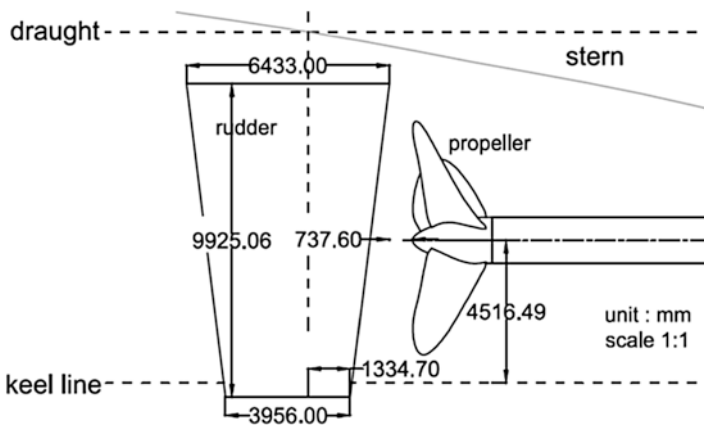
Fig. 5.2 Sketch of semi-spade rudder incident flow caused by propeller wake

considerable time and cost would be necessary to maintain or repair a rudder eroded by cavitation. Therefore, it is very important to inspect flow behaviour around the rudder when the propeller is ahead of the rudder.

Propeller and Rudder Models

A five-bladed Wageningen B 5-88 series propeller is considered. This is a different kind of propeller used to propel the Tenaga Class LNG carrier which is intended for research purpose. It is a fixed pitch and the axis of the propeller is parallel with the free-stream direction. The existence of hull as shown in Fig. 5.2 was intended to simulate the non-uniform incoming wake pattern. In the simulation, the non-uniform wake pattern was defined to replace the available function in the ANSYS FLUENT.

The placement of hull before propeller and rudder hence should make an adequate simulation results due to the defined non-uniform wake source.

Analytical Procedure Behind Simulation

As dealing with complex geometry like propeller and rudder, it is quite difficult for direct simulation of turbulence. Using time-averaged technique such as Reynolds-averaged Navier-Stokes (RANS), it is used to simplify the instantaneous RANS [3]. The equations are as follows:

$$\rho \frac{\partial u_i}{\partial x_i} = 0 \tag{5.1}$$

$$\rho \frac{\partial}{\partial x_j}\left(u_i u_j\right) = -\frac{\partial p}{\partial x_i} + \rho \frac{\partial}{\partial x_j}\left[v\left(\frac{\partial u_i}{\partial x_j} + \frac{\partial u_j}{\partial x_i}\right)\right] - \frac{\partial}{\partial x_j}\left(-\rho \overline{u_i' u_j'}\right) \tag{5.2}$$

in which u_i and u_j ($i, j = 1, 2, 3$) are time-averaged velocity components; x_i and x_j ($i, j = 1, 2, 3$) are coordinates in surge, heave and sway directions, respectively; density of fluid (ρ), time-averaged pressure (p), kinetic viscosity of water (v) and Reynolds stress term $\left(-\rho \overline{u_i' u_j'}\right)$. For proceeding calculations, standard k epsilon turbulence model is used. The transport equations of standard k epsilon turbulence model are as follows:

$$\rho \frac{Dk}{Dt} = \frac{\partial}{\partial x_j}\left(\alpha_{k\mu_{\text{eff}}} \frac{\partial k}{\partial x_j}\right) + P - \rho\varepsilon \tag{5.3}$$

$$\rho \frac{D\varepsilon}{Dt} = \frac{\partial}{\partial x_j}\left(\alpha_{k\mu_{\text{eff}}} \frac{\partial k}{\partial x_j}\right) + C_{1\varepsilon}\frac{\varepsilon}{k} P - C_{2\varepsilon}\rho\frac{\varepsilon^2}{k} \tag{5.4}$$

in which k represents the turbulent kinetic energy, ε is dissipation ratio of k, and t being time, while ρ and x_j are already defined in Eqs. 5.1 and 5.2. μ_{eff} is the turbulent kinetic energy and P represents the production of turbulence kinetic energy. $\alpha_k = 1.0$ and $\alpha_\varepsilon = 1.3$ are the inverse effective Prandtl number of k and ε, respectively, while $C_{1\varepsilon} = 1.44$ and $C_{2\varepsilon} = 1.92$ act as constants of the model (Tables 5.1, 5.2).

Modelling Setup

Steady analysis of propeller-rudder interaction was analysed using multiple reference frame method to simulate the interaction between the rotor and stator domains. The mesh elements consist of two parts: moving mesh and stationary mesh. Unstructured

Table 5.1 Geometrical parameters of propeller and rudder

Description	Symbol	Value
Diameter	D	7,700 mm
Pitch-diameter ratio	P/D	0.94
Expanded area ratio	A_E/A_O	0.88
Number of blade	z	5
Rudder height/D	L/D	1.289
Rudder height/chord	L/c	1.9107

Table 5.2 Measurements of open water tests (OWTs) computational configuration

	Description	
Name	OWT 1	OWT 2, propeller and rudder
Ds	3.6D	3.6D
Dr	1.4D	1.4D
Lsi	2D	2D
Lso	6D	6D
Lr	1.4D	0.75D
Lmr	0.7D	0.214D
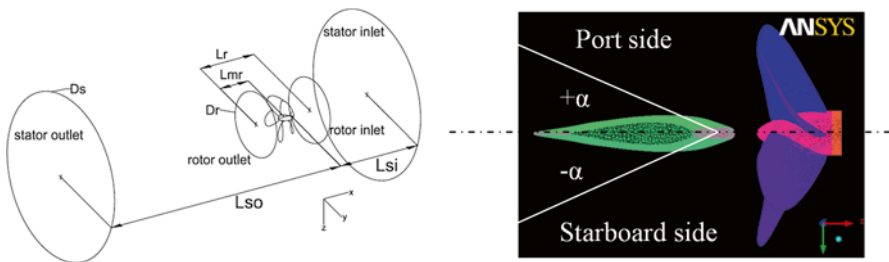
Fig. 5.3 (**a**) Computational configuration domain. (**b**) Definition of angle of attack (AoA) (α) ahead of rudder leading edge

grids are used in both domains. The size of computational domain was referred to [4]) for the open water test (OWT 1) (a description to Fig. 5.3 is available in Table 5.2), where *Lmr* is measured from middle hub and *D* and *L* are referring to propeller diameter and domain length.

The flow regions are assigned into several categories:

- The inlet – velocity inlet assumed, assigned value, the characteristic dimension and turbulence model values
- The outlet – pressure outlet is assumed
- Propeller blades and shaft – nonviscous wall
- Outer boundary – nonviscous wall

Tests were performed at full scale. The rudder rests at three designated positions: AoA = 0°, −7° and −20° positioned 0.0958D from top of hub as per classification requirement (information regarding angle of attack is available in Fig. 5.3b). The
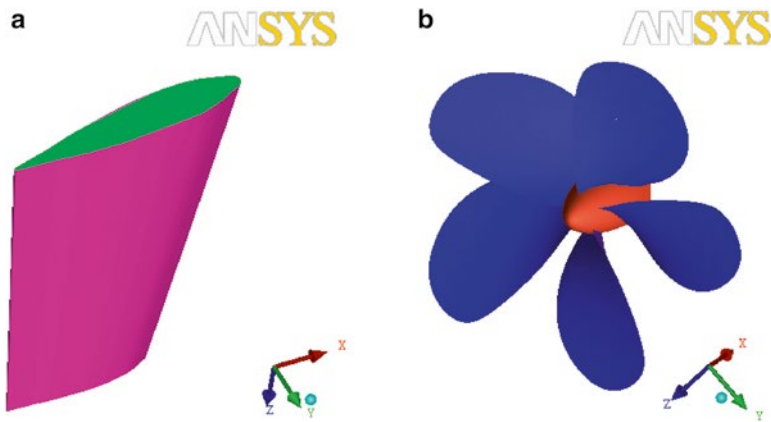
Fig. 5.4 Computational model from left: (**a**) rudder and (**b**) propeller

solver setting was based on Mitja Morgut [1]. The advance speed, V_A, was fixed at 6.687 m/s. The stator inlet was designated as velocity inlet, while the stator outlet was designated as pressure outlet with normal atmospheric pressure.

Regarding the solver setting, pressure-based calculation with absolute velocity formulation and steady flow were selected. Total number of mesh elements for rudder AoA$=0°$, $−7°$ and $−20^0$ is averaged at 1.8 million, while OWT 1 and OWT 2 count for 1.485 million in average. Fluid domain was specified as fresh water and aluminium for solid domain.

Proceeding to solution methods, simple pressure-velocity coupling was selected with second-order upwind for momentum turbulent kinetic energy and turbulent dissipation rate. Detailing the boundary conditions, velocity inlet was selected for stator inlet with intensity and viscosity ratio of 10 for the turbulent specification method. Pressure outlet is defined for the stator outlet with zero gauge pressure and similar turbulent specification as stator inlet. All convergence rests at 0.001 (Fig. 5.4).

Results and Discussion

Figures 5.5 and 5.6 show that the pressure distribution at starboard side was higher than the one at port side, it means that the flow goes on the negative AoA as Fig. 5.3. Time-averaged pressure field is proposed to analyse the AoA and shows similar AoA values of 0°, −7° at the region on rudder. However, it increases to −20° by those effects as the inflow comes to the rudder. The maximum pressures are located at absolute $Z=0.7R$ near the upper rudder face view from port side and lower rudder face of starboard side. These may happen due to clockwise movement of the propeller slipstream. This is the phenomenon where tip vortices sourcing from propeller attacks rudder surface. As the rudder deflects more, significant pressure drop can be noticed at absolute $Z=0.7R$ port side of rudder leading edge. This is likely the
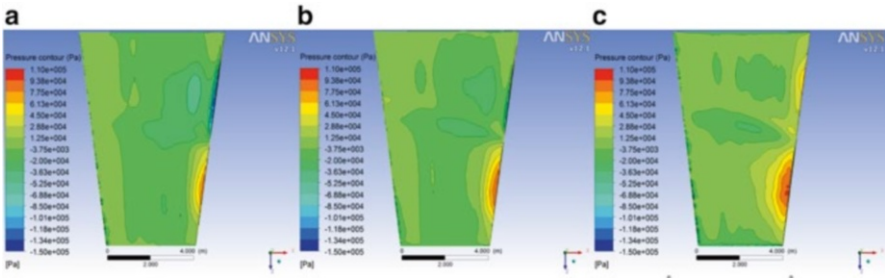
Fig. 5.5 Rudder pressure contours starboard side views from left: (**a**) AoA = 0°, (**b**) AoA = −7°, (**c**) AoA = −20°
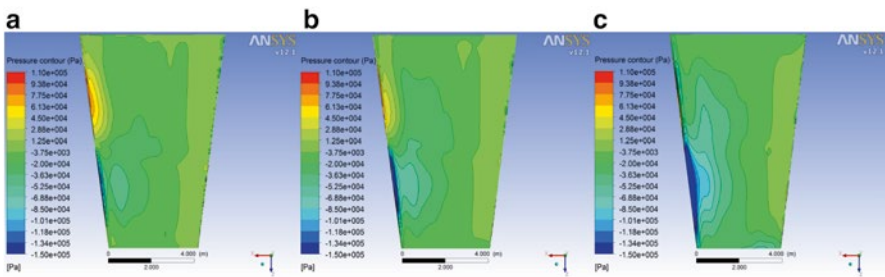
Fig. 5.6 Rudder pressure contours port side views from left: (**a**) AoA = 0°, (**b**) AoA = −7°, (**c**) AoA = −20°

occurrence of cavitation inception, in which the lower pressure values as indicated in Figs. 5.5 and 5.6 have crucial effects on the cavitation and flow separation, as claimed by [5]. Next figures represent rudder ambient velocity contours in XZ cross-sectional plane positioned right after the rotational domain ($X = -0.291$ m) (Fig. 5.7).

As we can see, significant amount of velocity difference are noticed at the region of $Z = 0.7R$, near the top side of rotating propeller. The amount of velocity becomes larger as the rudder started to deflect and slightly lower as the rudder deflects to −20°. An indicator of tip vortex cavitations may prevail here, in which regions of high velocity tailing from propeller tip is a sign of lower pressure compared to fluid at rest (Bernoulli's law). This may happen due to typically low advance velocity on the upper side of a rotating propeller, viewed from propeller back. High propeller blade angle of attack is the cause to the lower pressure and therefore experiences higher velocity.

Conclusions

The flow of propeller-rudder interaction has been investigated using RANS modelling. Significant differences in terms of induced velocity field and pressure distribution could be noticed. Prediction and inspection of flow behaviour could be made
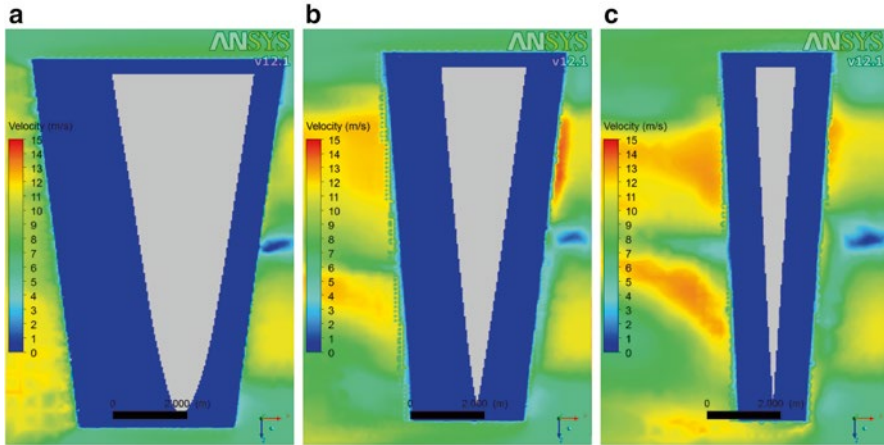
Fig. 5.7 Velocity contours of surrounding fluids starboard side views. From left: (**a**) AoA = 0°, (**b**) AoA = −7°, (**c**) AoA = −20°

possible in order to locate the cavitation susceptibility as early precaution to structural assessment of rudder. These characteristics are important for further assessment, especially durability of propeller and strength assessment for safety manoeuvring. This moving reference frame method provides an adequate solution for the determination of time-accurate solution to predict the propeller and rudder interaction.

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Chapter 6
Narcissism as Predictor of Facebook Usage Among Students in a Malaysian Public University

Maria Chong Abdullah, Lim Mei Ling, and Samsilah Roslan

Introduction

The emergence of social networking site (SNS) has earned notably popularity among adolescents and young adults. There are various types of SNS such as Facebook (FB), MySpace, Friendster, Flickr, and so on. SNS vary in the forms of function. For instance, Match.com serves as a dating site which aims to match and help people to look for a partner, while other social networking site such as Bookcrossing.com brings people with common interest together [1]. As the role of social networking sites is becoming more and more salient, the number of users in these sites is also growing rapidly.

One of the leading social networking sites that have been used extensively is FB. FB has drawn millions of users [2, 3] and is said to have become one of the most popular SNS in this era. Today, it is estimated that the number of FB users is more than 800 million worldwide if compared to two years ago, which were approximately over 500 million [2]. This includes country like Malaysia which has achieved a total of 12,060,200 FB users in year 2011 [4]. In fact, Malaysia has become the fourth highest "Facebook users per country population" in Asia (18 %). In terms of age group, adolescents and young adults tend to be the main contributors to Facebook usage. Youngsters aged between 18- and 24-year-old are the dominant age group who become the heavy Facebook users. With regard to this phenomenon, this study aimed to investigate FB usage among undergraduate students as past research has indicated that the average amount of time spent on FB among undergraduate students ranges from 30 min [5] to over 2 h daily [3, 6]. The types of activities

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involved among these FB users include creating and customizing own profile with photos, uploading and "tagging" photos to be shared with their FB friends, updating status and wall posts and news feed, and most commonly communicating with FB friends via private and public messaging. This implies that a great deal of time and energy has been spent by undergraduate students on FB activities in their daily life in campus. One major concern that can be raised in relation to FB activities among undergraduate students is the impact of such activity on their academic performance in university.

What has led young adults like university students to engage in FB usage? One of the factors that have been consistently and extensively tested in research about its importance in predicting SNS usage is the personality trait known as extraversion. High degree of extraversion was said to lead to another dispositional trait of narcissism, which refers to a grandiose and inflated self-concept, as well as needs for admiration [7, 8]. Narcissism is one of the personality traits which involve an inflated self-concept. It is also known as a person's self-absorption [9]. A narcissist tends to expose himself more frequently than those who are not. A study done by Mehdizadesh [10] has demonstrated a significant relationship between narcissism and FB activity, in which there was a positive correlation between narcissism and the frequency of checking Facebook per day, as well as the duration spent on this site per session.

Objectives and Significance of the Study

By investigating the level of FB usage among undergraduate students as well as the role of narcissism as a predictor of FB usage, the findings in this study are hoped to create awareness and provide evidence with regard to FB usage to people or parties who are involved in educating university students such as the Ministry of Education, university administrators, lecturers, academic advisors, psychologists, counselors, as well as parents in addressing the issues on excessive use of SNS in campus which might impede students' academic performance. Rouis et al. [11] in their study on FB usage among university students have found that extensive use of FB by students with extraverted personalities leads to poor academic performance. Despite the enormous number of users in FB, the study of FB usage among Malaysian undergraduates is still limited and scanty. Therefore, it is important for this study to be carried out to further investigate the usage of FB and how it relates to personality traits such as narcissism. Hence, this study aims to explore FB usage among undergraduate students enrolled in one of the public universities in Malaysia. Specifically, this study has the following objectives:

1. To identify the level of Facebook usage among students
2. To identify gender differences in Facebook usage among students
3. To determine the relationship between narcissism and Facebook usage among students

Facebook (FB) Usage, Narcissism, and Gender Differences in FB Usage

FB usage can be defined as the activities an individual involved in when using FB. Since Facebook provides a variety of features, there are many activities users can be involved in when they are using FB, such as updating status, uploading photo, sending message or even opening a chat room, creating events, and so on. Some of the features are specially developed with the purpose of allowing users to maintain relationship with their friends, while some of the features appear to be associated with narcissism. In this study, FB usage is measured in three dimensions: number of friends, time spent on FB per day, and the emotional connectedness to the site. Hence, FB usage can be operationally defined as the activities users are involved in the three constructs which are mentioned earlier. Facebook Intensity Scale (FBI) will be used to measure the three dimensions in FB usage.

Narcissism can be defined as a personality trait which involves an inflated self-concept. It is a person's self-absorption [9]. Campbell et al. [12] investigated the construct of narcissism and self-esteem in association with positive self-view. It includes a grandiose but fragile sense of self, with the fixation of success and demands for admiration [13]. Narcissism has a linkage with a highly positive yet inflated self-view, an extending sense of uniqueness [14] as well as entitlement (i.e., having unreasonable expectations of favorable treatment) [15]. Narcissists usually maintain positive self-view by applying different intrapersonal and interpersonal strategies [12]. Generally, narcissism is linked to a series of self-regulatory agenda, which included great degree of relationship formation, high level of promoting the self, and agentic self-presentation instead of communal tendency. In relation to that, narcissists often use various strategies to gain positive self-views [12] and demonstrate high degree of exhibitionism such as showing off, as well as paying much attention on physical appearance [16]. Central to this study, narcissism is operationally defined as the sense of entitlement, interpersonally exploitative, having authority over people, self-sufficiency, superiority, and exhibitionism. Narcissism Personality Inventory-16 (NPI-16) will be used to measure the narcissism among the respondents. The dimensions of narcissism being measured are entitlement, exploitativeness, authority, self-sufficiency, superiority, and exhibitionism.

The relationship that exists between narcissism and FB usage was reported in several studies. Buffardi and Campbell [7] investigated the role of narcissism in personal Web page on Facebook. The results of this study suggested that people with higher narcissism were involved in higher quantities of interaction on FB, and they were found to display more self-promoting criterion in their Web page. Another study which was conducted by Mehdizadeh [10] among undergraduates in New York University posited that individuals with higher level of narcissism but lower level of self-esteem were associated with higher amount of online activity and disclosing more self-promotional content. Gender differences in FB usage were also examined in past studies. Studies by Raacke and Bonds-Raacke [17] and Moore and McElroy [18] have reported significant relationship between gender and FB usage. Raacke and Bonds-Raacke [17] reported that males have more FB friends than females
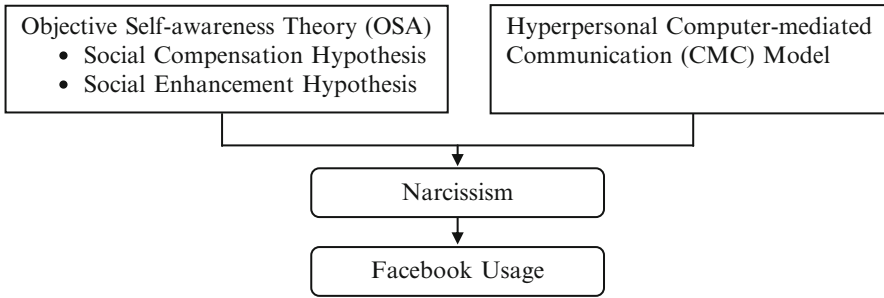
Fig. 6.1 Theoretical framework of the study

which contradict with [18] who stated otherwise. On the contrary, studies by Ellison et al. [5] and Thompson and Lougheed [19] have found no significant differences between gender and the number of FB friends, as well as the time spent on FB.

Theoretical Framework

The theoretical framework of this study is shown in Fig. 6.1, in which the Objective Self-awareness Theory (OSA) and Hyperpersonal Computer-Mediated Communication (CMC) Model were used as the basis in determining the relationship between narcissism and FB usage among university students. According to OSA which was proposed by Duval and Wicklund [20], the most crucial core of self-evaluation was the orientation of conscious attention [21] and human experience the self as both subject and object [20]. This theory which consists of the social compensation and social enhancement hypothesis focuses on the attention of self, which is also referred to as objective self-awareness. This awareness can be gained by the existence of Internet which a person can express himself by using the different features in FB for self-promotion. Besides OSA, the CMC model which was proposed by Walther [22] posits that users in CMC tend to self-promote in a social-desirable way in order to maintain a positive self. This includes selectively presenting the positive things about oneself. The CMC model explains how CMC contributes to higher engagement in online intimacy. In sum, CMC offers a pathway for people to feel ease to use SNS because of the higher self-presentation features found in SNS [23]. This model posited that people who have higher level of narcissism will demonstrate higher level of FB usage.

Conceptual Framework

Figure 6.2 depicts the underpinning conceptual framework of this study, suggesting the existence of the relationship between narcissism and FB usage among students. In addition, a demographic variable which is gender was included in the framework as findings from past studies have shown contradictory results regarding the relationship between gender and FB usage.
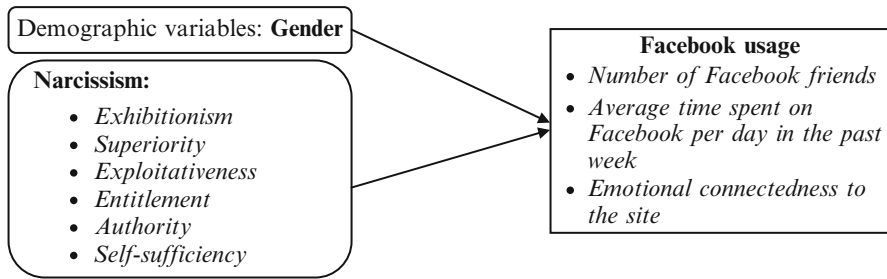
Fig. 6.2   Conceptual framework

Method

This study employed a quantitative approach with a descriptive correlation design. The accessible population in this study is undergraduate students enrolled in a public university. A total of 302 students aged 19–24 ($M = 22.18$, SD $= 1.23$) were selected from 8 programs from the Faculty of Educational Studies as participants using cluster random sampling technique. The samples comprised of 85 males (28.1 %) and 217 (71.9 %) females. The students involved in this study ranged from first year to fourth year of study.

Two sets of research instruments were utilized for data collection, namely, Facebook Intensity Scale (FBI) and Narcissism Personality Inventory-16 (NPI-16).

Facebook Intensity Scale (FBI)

Facebook Intensity Scale (FBI), developed by Ellison et al. [5], was used for assessing the three dimensions of FB usage among the respondents. The scale contains two items and six statements in which respondents were required to state the number of FB friends they had (item 1), the time they spent on FB (in minutes) per day during the past week (item 2), and how emotionally they were connected to FB (6 items). Examples of the statements in this section are as follows: "Facebook is part of my everyday activity" and "I feel I am part of the Facebook community." These six items are rated from 1 ("strongly disagree") to 5 ("strongly agree"). Hence, the overall scores for these six items range from 6 to 30, indicating three levels of emotional connectedness to the site: low, moderate, and high (Table 6.1). The three levels of emotional connectedness to FB were determined by dividing the difference between the minimum and the maximum score by three. The emotional connectedness scale of FBI was reported to obtain a Cronbach's alpha of .86, indicating a reliable instrument to assess respondents' emotional connectedness to FB in this study.

Table 6.1 Classification of the scores for emotional connectedness to Facebook

Score	Emotional connectedness to Facebook
Below 14	Low
14–21	Moderate
Above 21	High

Narcissism Personality Inventory-16 (NPI-16)

Narcissism Personality Inventory-16 (NPI-16), developed by Ames et al. [24], was utilized for assessing the narcissism level of the respondents. The NPI-16 is a shorter version of the NPI-40 initially developed by Raskin and Shaw [25]. The NPI-16 is a unidimensional measure of narcissism which contains 6 subscales such as exhibitionism, superiority, exploitativeness, entitlement, authority, and self-sufficiency and 16 items written in forced-choice format. Each item consists of one pair of statements with one statement that reflects narcissism and the other that reflects non-narcissism. Example of one of the items is as follows: "I really like to be the center of attention" (first statement) and "It makes me uncomfortable to be the center of attention" (second statement). NPI-16 was said to have earned notable face and internal validity for capturing narcissism tendencies [24]. Obtaining a Cronbach's alpha of .70, the NPI-16 was proven to be a reliable instrument in this study.

Results and Discussion

The Level of Facebook Usage Among Undergraduates

The level of FB usage among the respondents was scored in three dimensions: number of FB friends owned by the respondents, the average time they spent on FB per day in the past week, and their emotional connectedness to the site (FB). Findings show that the number of friends owned by the respondents ranged from 10 to 2,100. However, on the average, they were reported to have 572 FB friends (SD = 372.46). 3.3 % (*N* = *10*) were reported to have 2,100 FB friends. With regard to the average time they spent on FB per day in the past week, the results varied greatly, ranging from 0 to 720 min (12 h). On average, the respondents were found to spend 163.5 min (2 h, 73 min) on FB per day in the past week (*SD* = 144.0). As for respondents' emotional connectedness to FB, the score ranged from 6 to 30 (*M* = 18.6, SD = 4.88). Based on the three levels of emotional connectedness as mentioned earlier (in the instrumentation section), respondents in this study were reported to demonstrate moderate (*M* = 18, SD = 4.88) emotional connection to the FB site.

Table 6.2 Results of independent sample *T*-test on gender differences in Facebook usage

Facebook usage	Gender	N	*M*	*SD*	*T*	*p*
Number of Facebook friends	Male	85	605.91	403.98	.999	.32
	Female	217	558.29	359.46		
Average time spent on Facebook in the past week (minutes)	Male	85	164.29	154.04	.060	.95
	Female	217	163.19	139.96		
Emotional connectedness to Facebook	Male	85	18.33	4.66	−.660	.51
	Female	217	18.74	4.97		

This indicates that the undergraduate students being investigated have a larger number of FB friends ($M = 572$) as compared to students studying in foreign or local universities. For example, the number of FB friends reported by college students in the study conducted by Kalpidou et al. [26] was between 200 and 250. As for the study conducted locally, Liza and Wok [27] reported an average number of FB friends of 349 among the Muslim students in their university. The average time spent on FB reported in this study is found to be consistent with the past studies by Ross et al. [28], Raacke and Bonds-Raacke [17], Thompson and Lougheed [19], Kalpidou et al. [26], and Junco [29]. Finding from this study also indicates that respondents spent a significant amount of time on FB which was 163.5 min (more than 2 h) per day. As for the dimension of emotional connectedness to FB, majority of the students reported to have moderate emotional connectedness to this site indicating that the engagement to this site is not overly strong. The emotional connectedness to FB can be considered a brand new dimension being investigated in this study as there was little research done on investigating this dimension. Thus, the finding from this study shared some light on the emotional connectedness among undergraduate students to the site.

Gender Differences in Facebook Usage

The results of independent *T*-test in Table 6.2 reveal that there were no significant differences in the mean scores of all the FB dimensions such as the number of FB friends ($t = .99$, $p = .32$), time spent on FB ($t = .99$, $p = .95$), and emotional connectedness to FB ($t = −.66$, $p = .51$) between male and female students.

This finding is consistent with the findings found in the studies done by Ellison et al. [5] and Raacke and Bonds-Raacke [17]. For example, Ellison et al. [5] stated that there was no significant difference between gender and FB intensity, while Duval and Wicklund [20] found there were no significant differences between gender and the number of FB friends, as well as and the time spent on FB. However, this finding is inconsistent with what was reported by Raacke and Bonds-Raacke [17] who revealed that males have more FB friends than females and Moore and McElroy [18] who stated otherwise. The nonsignificant difference between gender and FB usage found in this study suggests that, in general, both males and females have the same level of usage on this site.

Table 6.3 Relationship between narcissism and Facebook usage

Facebook usage	Pearson correlation (r)
Facebook friends	.32**
Average time spent on FB per day in the past week (minutes)	.13*
Week (minutes)	302
Emotional connectedness to Facebook	.35**

$*p \leq 0.05$ (2 tailed), $**p \leq 0.01$ (2 tailed), $N = 302$

Table 6.4 Simple linear regression on narcissism as a predictor

Variable	Number of FB friends			Time spent on FB			Emotional connectedness to FB		
	$F = 34.78, t = 5.90, p = .000$			$F = 4.87, t = 2.21, p = .03$			$F = 41.6, t = 6.45, p = .000$		
	B	R^2	β	B	R^2	β	B	R^2	β
Narcissism	40.07	0.10	0.32	6.07	0.02	0.13	0.56	0.12	0.35

Note: B = unstandardized beta; R^2 = adjusted R^2; β = standardized beta

Relationship Between Narcissism and Facebook Usage

Results in Table 6.3 indicate significant and positive relationships between narcissism and all the three FB usage dimensions, namely, the number of Facebook friends ($r = .32$, $p \leq 0.01$), average time spent on FB per day in the past week ($r = .13$, $p \leq 0.05$), and the emotional connectedness to FB ($r = .35$, $p \leq 0.01$). These results indicate that students who portray higher level of narcissism tend to have more FB friends, spend more time on FB, and demonstrate higher level of emotional connectedness to the FB site. Based on the results also, narcissism was found to show stronger relationship with the number of FB friends and emotional connectedness as compared to average time spent on FB. This also indicates that students who have high value of narcissism often recruit more FB friends and use this site as one of the strategies to gain positive self-views through self-exhibition.

Three linear regression analyses were conducted to examine to what extent FB usage among undergraduates was predicted by narcissism. Results depicted by Table 6.4 show that narcissism among students predicted 10 % ($R^2 = .10$) of the variance in the number of FB friends connected to them, 2 % ($R^2 = .02$) of the variance in time spent on FB, and 12 % ($R^2 = .12$) of the variance in emotional connectedness to the site. These findings indicate that narcissism is a significant predictor of FB usage among students in terms of the number of FB friends, time spent on FB, and emotional connectedness to FB.

The significant relationships found between narcissism and the three dimensions of FB usage in this study indicate that narcissism plays a significant role in FB usage among university students. This means the number of FB friends, time spent on FB, and emotional connectedness increase as students' level of narcissism increases. In other words, narcissism predicts FB usage among university students.

This supports the Objective Self-awareness Theory (OSA) and the Hyperpersonal Computer-Mediated Communication (CMC) Model which posit that people who have higher level of narcissism will have higher level of SNS involvement such as FB usage. This finding supports previous findings which state that narcissism was positively related to the number of FB friends [30]. Since FB provides a system which allows everyone to be able to view the number of friends one has, the great number of FB friends allows narcissists to present themselves as more favorable and friend-rich and utilize this site to self-promote in their desirable way [7, 31]. On top of that, the great amount of time spent on FB by students with higher level of narcissism showed that they are more likely to stay on this site as compared to those with lower level of narcissism. Finding in this study also reveals that narcissism predicts students' emotional connectedness to the site. This means that those with high level of narcissism tend to be more emotionally connected to the site as compared to those with lower level of narcissism. With the variety of features on FB which allows people with higher level of narcissism to self-promote, it is more likely that they will spend a lot of time on this site and, hence, develop a greater affinity and emotional connectedness towards it.

Conclusion

Based on the results obtained from this study, we can conclude that university students are spending a great deal of time and energy in FB activities in campus regardless of their gender differences. They are also very much connected emotionally to the site. Their involvement in FB is associated with narcissism which is one of the psychological traits possessed by them. In fact, narcissism has been proven as a predictor of FB usage among university students. Hence, it is suggested that education administers, educators, counselors, and public at large to monitor FB activities among students to ensure they do not demonstrate excessive use of FB site but rather focus more on curriculum and co-curriculum activities. Preventive programs which promote and encourage students to interact with each other in an offline environment should be implemented in order to form a healthier psychological behavior among them. The data obtained in this study is found to support the OSA Theory and the Hyperpersonal Computer-Mediated Communication (CMC) Model pertaining to SNS involvement, particularly FB usage. Hence, psychologists and counselors who wish to design intervention programs to overcome SNS/FB addiction among university students ought to consider narcissism as one of the aspects that need to be included in the treatment.

There are several limitations in this study that need to be addressed for future research. First, this study only involved undergraduate students aged from 18 to 24 in one of the faculties in a public university. Hence, it is recommended that future research should cover a wider range of age among the respondents and involve more students from more faculties or more institution of higher education. Another limitation of this study is that this study only investigates only one psychological factor

which is narcissism in explaining FB usage. It is suggested that future research may examine other personality traits such as extraversion, conscientiousness, openness, and so on in relation to FB usage. The impact of cultural differences on FB usage can also be included in future research. This study only examined FB usage in terms of the number of friends, time spent on FB, and the emotional connectedness to the site. Hence, other features of FB which are related to narcissism such as types of self-promotion which include status updates, photo uploading, and description about self can be included in future study as well to find out the way FB users display their self-presentation and self-promotion behavior.

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Chapter 7
Managing Event: Environmental Friendly Perspective

Noorsuraya Mohd Mokhtar, Ab. Razak Said, and Zuria Akmal Saad

Introduction

Events are among the important industries in Malaysia. According to [1], events have been recognizing as potential sector that increases the country profit. Most of this event generates Malaysia's income via attractions such as business purposes, investment on the local products, cultural events, and location. Events can be categorized according to meeting, conference, incentive, exhibition, convention, and corporate event [1]. According to [1], the increasing number of this sector provided the good infrastructure and invested about RM 327.8 million in 2008, where the amount will increase year by year.

Basically, every event contributes to environmental effect that rises from the amount of energy use, transportation and logistics, and rubbish disposal. Therefore, this study is commissioned to identify the event organizer concern toward environmental friendly issues during organizing event. It was believed that organizing event brings more profit to the organizations; however, it gives negative impact to the environment as well. According to [1], meeting, incentive, conference, and exhibition give impact to environment by the increase level of energy used and rubbish disposal. According to [2], organizing event can contribute to changing climate, but there is little study done on potential environmental impact related to organizing events. Reference [1] emphasized that there is less study focused in discussing environmental challenge in organizing event. Therefore, it is important to minimize the impact when organizing an event.

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Literature Review

Nowadays, environmental sustainability has become an important theme in event management [3]. Therefore, every major sport or entertainment event organizer emphasizes on the issues of environment. The principles of sustainability or green refer to the environmental, economic, and sociocultural aspects of event development and suitable balance which need involvement from management, political leadership, and the informed participation of all stakeholders to ensure adherence and congruence to a sustainable philosophy and management.

Environmental Issues

Many programs have been done to create awareness on environmental issues which have been left behind while organizing mega sports event in Asia. In order to fully appreciate the context of the study, it is necessary to explore in depth the studies previously done by researchers such as [4–6] who focused on environmental issues while conducting mega sports event. The nature of the relationship in this study is derived from the environmental aspect such as transport, parking and traffic, waste management, and noise. This is in line with the study done by [6] that stated hosting event gives negative impact to society such as increase traffic, noise pollution, and parking restriction. Besides that, environmental issues also include venues of the event itself such as the destruction of land, water quality issues, and implication to the wildlife population during the implementation of the event [3]. Moreover, [5] stated that transport (parking and traffic), waste management (general rubbish collection, litter, recycling, and the provision of toilets), and noise as major environmental impacts usually occur during and after organizing the event.

According to [7], media will not only cover the activities during the event but also to the site management of the event. Reference [5] agreed that many organizers put high priority on expeditious and economical issues rather than their events. Reference [3] highlighted major problems that occur when hosting mega event in Asia even though most of the event organizers promote themselves as "green" and are aware of the environmental issues, but sometimes they also mostly neglect the environmental aspect, for example, during Olympic Games in Beijing, China, where the organizer emphasized on reducing old habits like spitting in public and littering in the campaign during the event [4]. However, [4] study only focuses on society, business, and management impact on hosting a mega sports event in Asia where it does not clearly discuss the environmental issues.

Reference [3] stated that even though the event organizers had recognized and minimized their event's ecological footprint at the venue level, it is still not fully supported by the public. This happens because it is not easy for the event organizer to create public awareness pertaining to sustainability issues.

In line with the study done by [5, 8] agreed that assessing the organizer should be done by focusing on water and power consumption, energy usage in transport to and from events, and waste generation and disposal while creating ecological footprint of the FIFA World Cup. Many academic texts have been written on festival and event, organizing event, convention and exhibition management, and event tourism, but most of the texts on event management pay very little attention to the environmental aspect [5]. Therefore, this research focused on the issues of managing environmental friendly events conducted by public and private organizations. This was the preliminary study that focuses on several events conducted in Pahang.

Research Methodology

The objective of this study was commissioned to identify the event organizer concern toward environmental friendly issues during organizing event. This research uses the quantitative method whereby it employs the use of questionnaires as the primary mode of data collection. This study was conducted with respondents consisting of event organizer in Pahang states. Pahang was chosen because it is in close proximity to the researchers. Approximately 100 questionnaires were distributed convenient to Temerloh, Jengka, Kuantan, and Jerantut, where the organizer had the experience of organizing the event such as meeting, sports and recreation, fund raising, community education, and family day. The return rate for this survey was 51.

The questionnaire was designed based on the guidelines done by [9]. The questionnaire consisted of two parts. Part A covered the demographic details of the respondents. Part B is related to respondents' awareness pertaining to environmental issues in event planning, event execution, and after the event. The questions emphasized on venue selection and equipment, food preparation, communication process during planning phase, and recycling activities conducted during the events.

The responses were measured on a 5 Likert scale (strongly disagree, disagree, neutral, agree, and strongly agree). The statistical package in the Social Science Software (SPSS) Version 20 was used to conduct the data analysis after the entire set of distributed questionnaires was collected from the respondents.

Results and Discussion

Participants for this exploratory study were event organizer in Pahang state. A random sample of 100 samples was obtained and only 51 samples were returned for analysis. As shown in Table 7.1, the 52 organizations were comprised of 4 sectors which from statutory body were 51 %, from private sector 25 %, from government 7 %, and from nongovernment organization 5 % (NGO). Overall out of 51 organizations, 34 have acted as host of the event and the other 17 were the organizer.

Table 7.1 Demographic background of respondents

	Frequency	Percent
Organization name		
Private organization	13	25.5
Governmental organization	7	13.7
Statutory body	26	51.0
NGO	5	9.8
Involvement		
As the host	34	66.6
Organizer	17	33.3

Table 7.2 Highest event expenses

Expenses	Frequency	Percent
<100,000	23	45.1
100,001–500,000	11	21.6
500,001–1,000,000	4	7.8
1,000,001–1,500,000	9	17.6
>1,500,001	4	7.8

Table 7.3 Readiness to engage in environmental conservation

Engagement	Frequency	Percent
Volunteer	45	88.2
Money	2	3.9
Monthly deduction	1	2.0
Refuse to make a contribution	3	5.9

Table 7.2 shows the highest event expenses ever conducted; 23 out of 51 organizations spend more than RM 100,000. Meanwhile 11 of them were spending about RM 100,000–500,000 in handling events. It was shown that half of the organizations involved in handling big events. There were only four organizations that had conducted events below RM 1,500,000 (Table 7.2).

Discussing the engaging to the environment conservation, 88.2 % of the organization was ready to engage in environmental conservation as volunteer. In terms of monthly deduction, there was only one organization that is ready to commit. However, three of the organizations refuse to engage with the environment conservation.

The most important element in planning the events was venue selections. Table 7.4 shows that the respondents put high priorities on environmental aspect when selecting venue and equipment ($M=4.3137$). It shows that most of the organizations were aware about the importance of the location with high environmental care. Surprisingly, the respondents also agreed that the location must be accessible ($M=4.1961$) and provide ample parking space ($M=4.0588$), which also encourage the use of vehicle among participants.

Table 7.5 shows that the respondents prefer to hold a meeting face to face ($M=4.2157$). It also shows that the registrations of participants were done manually ($M=39,412$). However, there were two items that can be considered as not green enough such as the respondents' feedback toward the use of technology to send tentative program via e-mail ($M=3.1961$) and participate in online discussion ($M=3.1373$).

Table 7.4 Mean score of venue and equipment

No	Venue and equipment	Mean
1	The chosen location is concerned with and prioritizes environmental care	4.3137
2	Place that offers technical support	4.2941
3	Location must be accessible	4.1961
4	Venue that provides ample parking space	4.0588
5	Registration of participants is done manually	3.9412
6	Purchase new equipment	3.5686
7	Technical support staffs come in separate vehicles	2.8824

Table 7.5 Mean score of preparation before event

No	Venue and equipment	Mean
1	Face-to-face meeting	4.2157
2	Registration of participants is done manually	3.9412
3	Memo and minute of meeting is sent via online	3.7451
4	Using both sides while printing	3.6667
5	Stationery and notebooks used are from recycled materials	3.5882
6	Promotional material usually consists of items that are recyclable	3.5686
7	Use scrap paper to take notes and related matters	3.3725
8	Program is tentative and event information is relayed to all participants via e-mail	3.1961
9	Online discussion	3.1373

Table 7.6 Mean score for after the events

No	After the events	Mean
1	Participants are required to give their feedback using the given feedback/evaluation forms	4.0588
2	The after-event garbage is usually handled by the maintenance division	3.7843
3	It is not easy to get feedback/responses from participants online	3.6275

Table 7.6 shows respondents' feedback pertaining to after the events. The mean score ($M=4.0588$) showed that the host/organizer distributes the evaluation forms in order to get the response about the event. This will contribute to the use of a lot of papers depending on the attendance of the events. The host/organizer prefers to use hardcopy form compared to online feedback because it is hard to get the online feedback from the attendees with the mean score ($M=3.6275$).

Conclusion

In conclusion, the growth of event management sector could create negative effects to the environment. Although it is proven that this sector creates advantages to the country's revenue, it is important to achieve balance and with high concern on environment.

The findings from the survey revealed that most of the organizations were ready to be engaged in environmental conservation voluntarily. However, they refused to involve in environmental conservation if they need to spend their money. Full commitment from all event organizers, stakeholders, and participants is needed to ensure successful implementation of green practices in event management.

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Chapter 8
Malaysia's New Economic Model and Innovative Capability Development: A Focus on Knowledge Workers in MSC Malaysia

I.S. Rosdi and K.W. Chew

Introduction

Innovation is central to an organization's sustainable competitive advantage, and it depends on an organization's management of its knowledge stocks or intellectual capital [3]. Malaysia's New Economic Model (NEM) is focused on ensuring a sustainable and robust economy, increasing innovativeness, and achieving high-income levels [8]. Through the country's 10th Malaysia Plan (10MP), special programs and funding for businesses are geared towards encouraging higher research and development activities and innovation [19].

Knowledge is crucial for firms to come up with new products, services, and processes to meet customer needs and create competitive advantages [7]. More importantly, knowledge resides within individuals in organizations, which means that firms need to facilitate communication and exchange among individuals in order to gain new insights and capabilities [6]. It is found that specific strategies can be deployed to encourage individual employees to acquire, share, and apply knowledge towards organizational value creation [13]. Hence, the focus should be on the field of human resource management (HRM) which is specifically concerned with the management of people in organizations.

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Focus on MSC Malaysia

Recognizing the critical importance of ICT in the knowledge economy, the Malaysian government created the Multimedia Super Corridor (MSC Malaysia) in 1996 to increase the momentum of the country's national ICT development. MSC Malaysia is a 15 km×50 km area (750 km²) stretching from the Petronas Twin Towers to the Kuala Lumpur International Airport and includes Cyberjaya as the technology core as well as Putrajaya as the country's administrative capital. Its aim is to attract the world's leading ICT companies to locate their industries in MSC Malaysia. The Multimedia Development Corporation (MDeC) was formed as the government agency responsible for its direction and administration. Local and foreign-based companies can apply for "MSC Malaysia status" to enjoy government incentives and benefits such as tax exemptions and research grant accessibility. However, to obtain the "MSC Malaysia status," firms would need to employ a substantial number of knowledge workers, be a provider or heavy user of multimedia products and services, and provide technology transfer to contribute towards the development of MSC Malaysia. There are 2,380 MSC Malaysia status companies as of April 2013 [16].

The success of MSC Malaysia status firms requires effective management of the human capital that underlies its operations. Adequate supply of qualified knowledge workers for MSC Malaysia becomes a national imperative. Human capital is needed to drive technology and knowledge transfers which would in turn lead to the growth of Malaysian ICT small and medium-sized enterprises [16]. Hence, it is perceived that innovation, knowledge management, and human capital management issues are important in the context of MSC Malaysia.

Problem Statement

HRM research points to the important role of HRM in firm innovation, but few have managed to explain "how" exactly it does so [5,6]. There seems to be a need for a framework to capture how HRM strategies in MSC Malaysia status firms can contribute to developing the firms' innovative capability.

Research Question and Research Objective

This paper seeks to address the following question: How can human resource management strategies be utilized in building organizational innovative capability in MSC Malaysia status organizations? In answering this research question, this paper aims to identify a research framework to capture the link between HRM strategies and innovation in MSC Malaysia status firms.

Literature Review

Innovation

Innovation refers to a planned and drastic change in an organization or its existing products and processes with the intention of gaining competitive advantage over competitors [5]. The process of innovation is commonly equated with a continuous pursuit of new and unique knowledge [17]. How a firm utilizes its knowledge base will determine its innovative output [23].

A firm's innovative capability refers to its ability to utilize skills and knowledge to successfully digest, master, and improve existing technologies and to create new ones [12]. Incremental innovative capability refers to the capability to generate innovations that refine and improve existing products and services, namely, incremental innovation. Radical innovative capability refers to the capability to create major transformations of existing products, services, or technologies, thus making the prevailing technologies obsolete, namely, radical innovation [2]. Radical and incremental innovative capabilities of firms utilize intellectual capital in different ways.

Intellectual Capital

The term intellectual capital is widely used to refer to the summation of all types of knowledge that firms utilize for competitive advantage [24]. There are three types of intellectual capital within the firm [6]. Human capital comprises of the knowledge, skills, competencies, and experiences of employees Bontis (1998). A firm's social capital refers to knowledge that is embedded in firms' relations with its employees, customers, shareholders, suppliers, and others in the external environment [4]. Organizational capital is the infrastructure comprised of hardware, software, databases, manuals, policies, and other storehouses of knowledge [4]. Different components of intellectual capital influence a firm's innovative capability [1].

Knowledge Management Capacity

Knowledge management (KM) is an approach to utilize individual expertise and knowledge to enable organizational value creation [22]. KM literature features knowledge acquisition, knowledge sharing, and knowledge application as the three factors of a firm's knowledge management capacity [15]. Existing literature recognizes the positive influence of KM on a firm's innovation performance [3]. There seems to be a mediating role played by intellectual capital in the KM-innovative capability link [14].

Human Resource Management Framework for Innovation

Knowledge resides in individuals [17], and specific strategies can be deployed to encourage individual employees to acquire, share, and apply knowledge towards organizational value creation [13]. Human resource management (HRM) refers to activities performed by managers to attract, retain, and manage the performance of employees so that they contribute to achieving organizational goals [11]. A firm's HRM system, commonly referred to as "HR configuration," refers to the combination of HRM strategy, HRM policies, and HRM practices used to manage human capital. Subsequently, the cluster of multiple "HR configurations" within a single firm is termed "HR architecture" [13]. HRM is linked to firm innovation via HR configurations that support organizational knowledge renewal and firm innovation [20].

HRM practices under the entrepreneurial HR configuration encourage the internal workforce to explore new ideas in unfamiliar territories outside the firm. Those of the egalitarian HR configuration eliminate vertical and hierarchical barriers to enhance cross-level interaction, while the ones under the collaborative HR configuration reduce horizontal barriers to improve cross-functional interaction and cooperation. HRM practices under the documentation HR configuration focus on creating and filling up knowledge storage device, and those under the technological HR configuration support the use of information technology tools for knowledge management. The framework also captures that HR configurations have positive relationships with specific components of intellectual capital which include human, social, and organizational capital [24]. A firm's KM capacity mediates the effects of HR architecture on its intellectual capital [10].

Research Framework

This paper focuses on the work of Rosdi and Chew [20] which proposes a framework that links HRM to firm innovation via HR configurations that support organizational knowledge renewal and firm innovation. The proposed framework to capture the link between HRM strategies and innovative capability in MSC Malaysia status firms is presented below (Fig. 8.1).

Recommendations

MSC Malaysia needs the necessary human resources to succeed. Much of the discussion on human capital for MSC Malaysia centers on the issue of knowledge workers. The term "knowledge worker" was coined by Peter Drucker in 1989, referring to individuals who possess knowledge as a "powerful resource" and whose knowledge work is of an "intellectual nature" [9]. Since then, the term has been defined differently
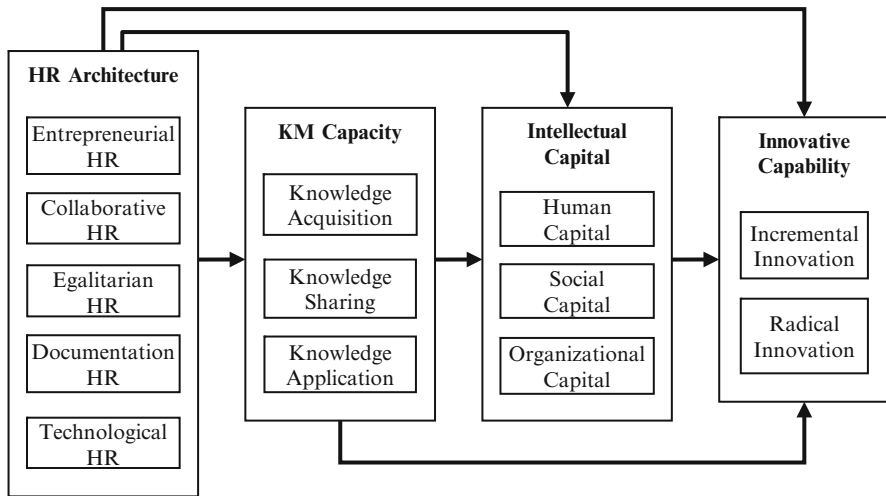
Fig. 8.1 Integrated HRM-KM capacity-intellectual capital-innovative capability framework

by various researchers. In general, knowledge workers are highly qualified professionals whose challenging work is mainly about utilizing knowledge in solving unstructured tasks and problems [21]. They are highly valuable to the organization due to the core competencies within them, and they pose a special management challenge to organizations [9].

Knowledge Workers in MSC Malaysia

In the context of MSC Malaysia, knowledge workers are defined as those workers who are "directly involved in technical development and deployment of products and services…" and possess at least five or more years of professional experience in multimedia/ICT industry, a university degree or a diploma in multimedia/ICT discipline in addition to two or more years of related working experience, or a masters degree or higher in any discipline [16]. This paper would like to highlight the importance of studying the HRM-innovation framework from the perspective of knowledge workers in MSC Malaysia as these workers are the critical movers of the national ICT initiative.

While HRM strategies and policies merely reflect management intentions regarding its employee management activities, HRM practices are not merely intentions, but are actual and observable management activities, as observed and experienced by employees themselves. Managers can only attest to organizations having particular HRM strategies and various HRM policies, but the strategies and policies would be meaningless if employees do not perceive them in the form of actual practices that have some effects on their well-being. Hence, it would be best to ask the

intended beneficiaries, who are the employees themselves [18]. For the study on the role of HRM in driving innovation in MSC Malaysia status companies, it is therefore recommended that the issue be studied from the perspective of MSC Malaysia knowledge workers.

Contributions of This Study

This study contributes to identifying a suitable HRM framework for the building of intellectual capital and innovative capability in MSC Malaysia organizations. The HRM-innovation link is applicable to all organizations in general, but especially to those that place high priorities on utilizing strategic HRM in driving firm innovation. Moreover, knowledge worker management issues are of high relevance to knowledge-intensive industries.

Suggestions for Future Research

It is recommended for future research on HRM and innovation to involve companies with evidence of actual innovative capability (output). This is because investigating the internal environment of these innovative firms would allow better understanding of the link between workforce management and organizational innovative capability as compared to studying companies in general.

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Chapter 9
Integration of Visual Cues in an Augmented Reality Application for Enhancing the Learning of Engineering Concepts

Manjit Singh Sidhu

Introduction

The use of computer simulations is providing unique insights into the way the world works [1]. Students can now experiment real problem-solving task in a virtual world of complex, dynamic systems in a way that was impossible before. Therefore numerous technologies have emerged and are being used in the educational sector to produce a better knowledge society. Some of these technologies include the use of software, interactive white boards, multimedia, and virtual reality. Most studies found in the literatures also reported the advantages and disadvantages of these technologies [2–5]. On the other hand the learning and understanding process of the information presented and learned from the previously mentioned technologies has not improved much [6]. A more recent technology, i.e., augmented reality, is becoming popular and being tested by many researchers to see if it could help learners visualize and understand the learning process better. Augmented reality (AR) is commonly known as the ability to overlay computer graphics onto the real world. Unlike immersive virtual reality (VR), AR interfaces allow users to see the real world at the same time as virtual imagery attached to real locations and objects. AR concepts also use tangible user interface (TUI). Unlike physical interface whereby the user may interact with the software via a mouse or keyboard connection, TUI uses wireless interaction. Further details on how this technology works are given in [7, 8]. The motivation of the research aims to look at alternative solutions to visualize engineering problems using AR and visual cues to enhance the learning process.

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Visual Cues

In classical communication studies a message is encoded by the source, transmitted through a channel, and decoded by a receiver. In advertising the message is put into words and pictures by a creative team, approved by a client, and distributed through a medium like television or magazines, and assuming it gets attention, it is decoded by the targeted audience. In order for the audience to make sense of the information, the message has to use appropriate signs and symbols to stimulate the individual's perceptual system into action. To further enhance multimedia and virtual reality, visual and sensory cues have also been used in learning applications. Visual cues are used as signals or reminders to teach; remind; recall memory for learners from various backgrounds, i.e., by using flash cards; and link them to various types of literal, symbolic, and metaphoric meanings [9]. An example of symbolic cue is the use of icons which could give literal meanings, i.e., a picture of something. On the other hand metaphor is a figure of speech in which a word or phrase that ordinarily designates one thing is used to designate another. Sensory cues include visual cues, auditory cues, tactile cues, haptic cues, olfactory cues, and so on. Sensory cues play an important role in theories of perception, especially theories of appearance (how things look). These cues bring to mind something from past knowledge or previous experience that provides a framework of meaning that can be used to interpret a particular sign. The concept of cueing is very important to visual communication because much of past experience is filed in memory as a visual element [9].

In multimedia learning, information is presented through visual and/or auditory channels via multiple formats, such as graphics, on-screen text, and narrations [10]. In a learning environment, visually searching relevant information held in the working memory may become difficult for learners and lead to high extraneous load [10]. Learners may perceive and comprehend information from obvious yet irrelevant parts of graphical representations, resulting in poor learning and performance [11]. Visual cueing is one of the techniques to direct learners' attention in the multimedia environment. Visual cueing is the addition of non-content information (e.g., arrows, circles, and coloring) to visual representations. Research studies by [12, 13] have shown that visual cues are effective to guide learners' attention to animations in multimedia environments. Koning [11] has listed several types and functions of visual cues as shown in Table 9.1.

Table 9.1 Type and function of visual cues

Type of cueing	Function of cueing
Color	Guiding attention
Arrows	Highlights relations
Text	Guiding attention
Movement	Guiding attention
Luminance contrast (spotlight effect)	Guiding attention

Table 9.2 Applications using visual cues

Applications
1. *Multimedia application description*, *objectives*, *and results* – Automatic speech recognition (ASR) systems. The use of audio and visual information in the speaker-independent continuous speech recognition process makes the performance of the system better compared to the ones with only the audio information. The experimental results show a remarkable increase of about 10 % in the recognition rate in the AVSR compared to the audio only ASR and 20 % compared to the video only ASR for an SNR of 5 dB
2. *Virtual reality application description*, *objectives*, *and results* – Effect of visual cues on human performance in navigating through a virtual maze. The results of an experiment in which three different visual cues were tested for their benefit toward users' navigation in a 3D virtual maze. The experiment varied the form of visual cue: a 2D map, a 2D map with a directionally ambiguous cue, and a 2D map with a directional cue. Eye tracking data was collected and analyzed to examine the correlation between the type of visual cue presented and the navigational efficiency of the user through the virtual maze. The directional cue was most effective in the time taken by users to reach the center of the maze. Results of this study have implications for VE design as well as for game development

As a result, visual cueing has the potential to facilitate selecting relevant information, which is one of the essential processes for active learning [11]. From the cognitive load perspective, a number of studies have found that visual cueing is an effective method to reduce extraneous load in multimedia learning environments [14, 15]. Listed in Table 9.2 are two example studies that were found from the literature that researched on using visual cues in their multimedia and virtual reality applications.

This study aims to implement suitable visual cues such as color, text, or arrows, audio explaining concepts, and animated mechanisms to see if this method could help students in understanding the mechanisms of an engineering problem presented in an AR environment.

Since visual cues have not been used and tested in an augmented reality engineering application for learning, in this paper a 3D augmented reality (AR) application for teaching engineering was developed and tested. Seven patterns of visual/auditory sensory cues were embedded into the AR application to see if it could help students visualize an engineering problem, i.e., slider crank mechanism. Sensory cues may include visual cues, auditory cues, tactile cues, haptic cues, olfactory cues, and others. Sensory cues play an important role in theories of perception, especially theories of appearance (how things look). The six visual cues employed in this research for visualizing the slider crank problem are (1) change color, (2) display slider crank, (3) display 2D diagram, (4) display axes, (5) display trail/path, and (6) display all mechanisms. Only one auditory cue was used (Fig. 9.1).
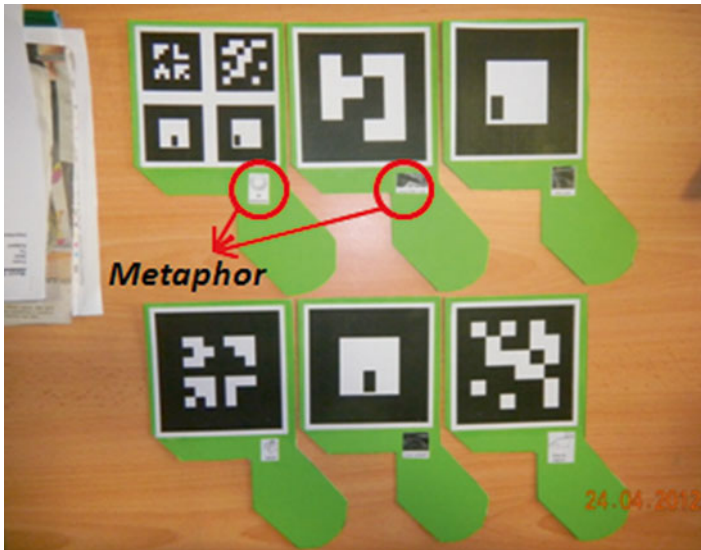
Fig. 9.1 Markers to display the visual cues

Overview of the Augmented Reality Application

The application tool implemented in this research consists of three components: tangible user interface, display component, and rendering component. The tangible interface mimics a textbook problem-based interface for user interaction. A list of six markers are the only physical props provided to the user/learner to display the visual/audio cues on the display and visualize in the form of 3D model or animation as shown in Fig. 9.1. The markers are used to allow the camera to calculate its respective orientation and distance, necessary for real-time renderings.

The coordinate information of a particular cue is generated as soon as the camera recognizes the maker being shown and translated into the AR environment. The system setup is shown in Fig. 9.2, framework process in Fig. 9.3, and system architecture in Fig. 9.4.

Visualizing the Engineering Concepts Using Cues

This section briefly explains the learning and visualization process using the visual cues used in this study. As mentioned earlier in sections "Visual cues" and "Overview of the augmented reality application", six visual cues and one auditory cue were designed and used to see if students could recall and link the theory learned earlier in the traditional classroom. Each marker is used to perform a different task and display a cue. One of the cues used to display all the engineering mechanisms in the

Physical setup

Webcam

Marker

3D Display – Crank Shaft

Fig. 9.2 System setup

- Markers interaction

Tangible interface

Slider crank mechanism interaction

- Web camera

Input component

Materials for processing visual cues

- Display cues

Processing component

Components for AR environment

- Panda AR Toolkit Library

AR rendering component
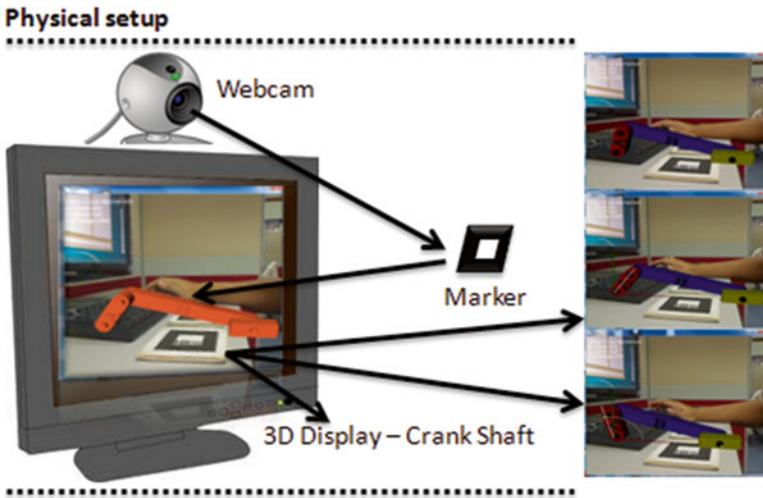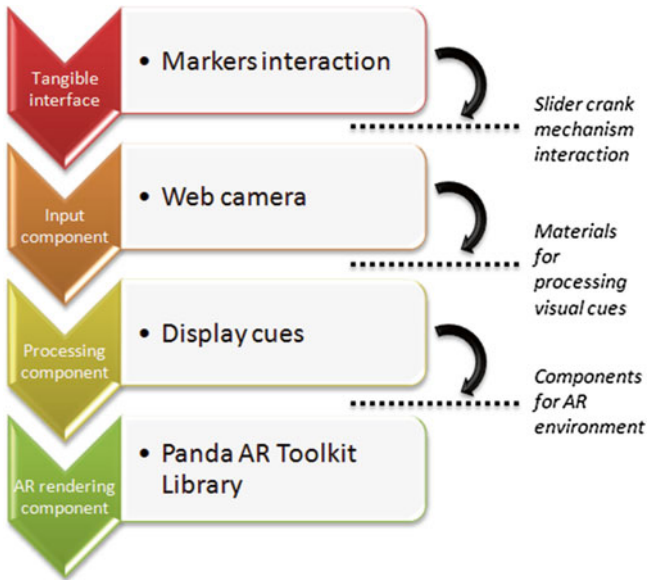
Fig. 9.3 The framework of system

slider crank problem is shown in Fig. 9.5. The system also narrates the user about the objectives and gives a brief explanation about the problem. Since not all users were familiar by interacting with the system using tangible user interface (TUI), we also designed the keyboard user interface that functions (alphabets used to perform

Fig. 9.4 The system
architecture
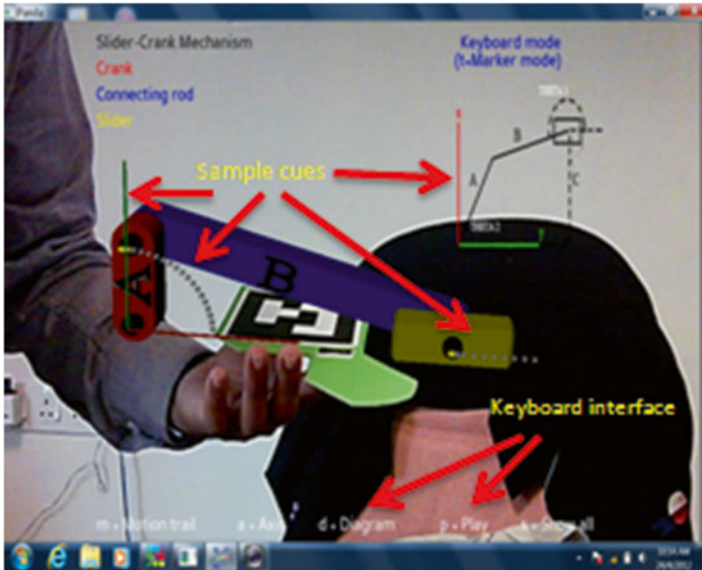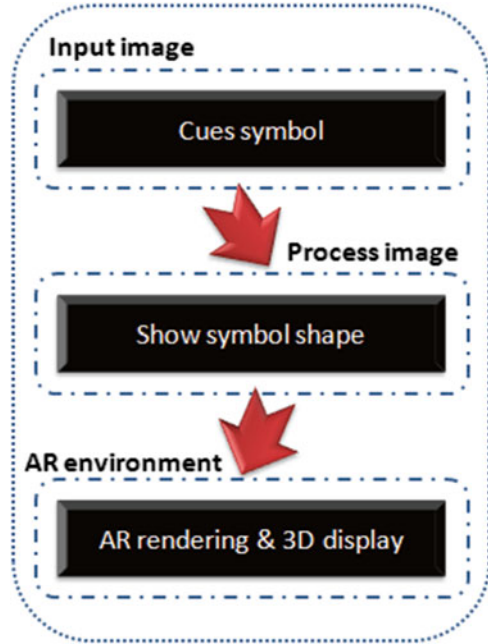
Fig. 9.5 All cues used in the system

a particular task) the same as the TUI. Examples of using single visual cues are
shown through Figs. 9.6, 9.7, 9.8, 9.9, and 9.10. Figure 9.6 depicts the cue to show
the axes, Fig. 9.7 depicts the cue to show the motion trail of the slider crank, Fig. 9.8
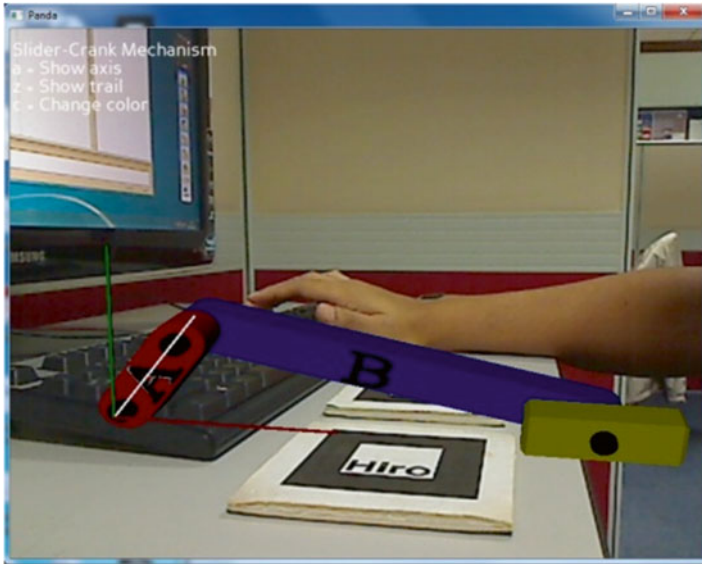
Fig. 9.6 A single cue to show the axes
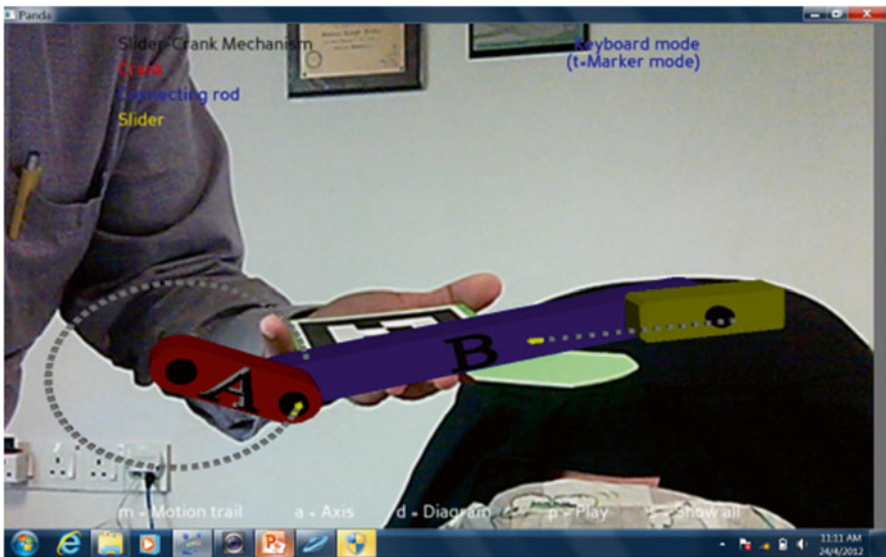
Fig. 9.7 Motion trial of the slider crank

depicts the cue to show/change the color of the slider crank, and Fig. 9.9 depicts the cue to show the 2D diagram. The student may also see multiple cues (two or more) by using two markers such as the one shown in Fig. 9.10 (showing the trail and the 2D diagram of the slider crank mechanism).
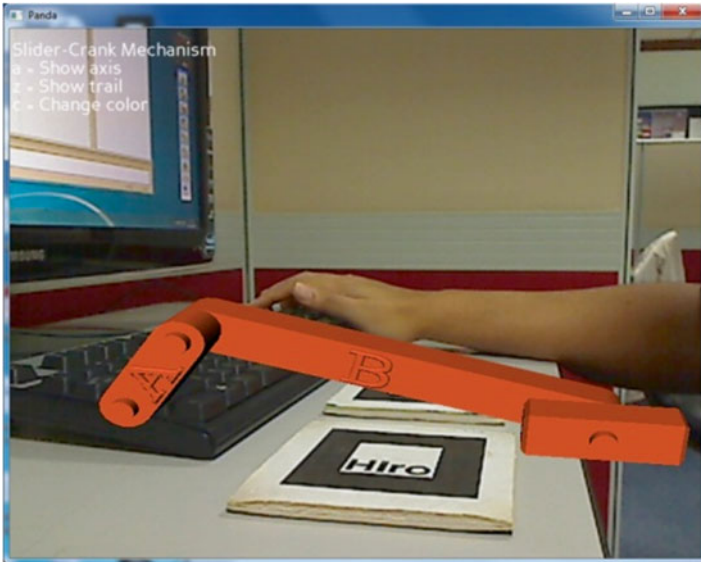
Fig. 9.8 Changing the slider crank color
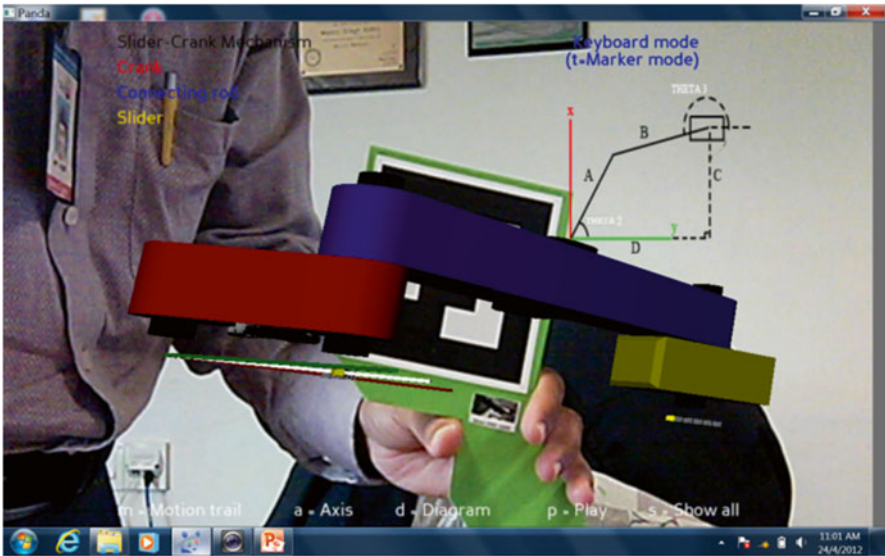
Fig. 9.9 Displaying the 2D diagram
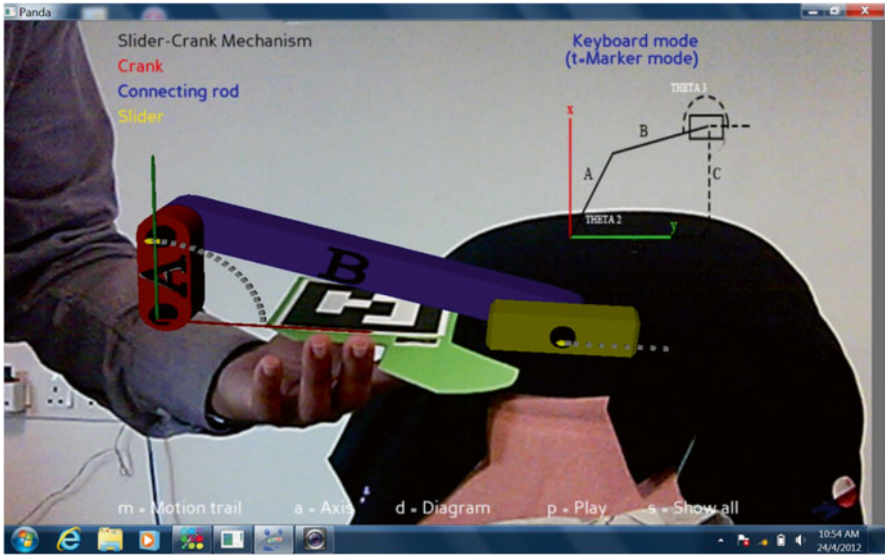
Fig. 9.10 The trail and the 2D diagram (multiple cues)

Conclusion

Newer technologies are changing the way students learn today. In this study, a novel system architecture was designed and developed using augmented reality technology. Visual cues were employed to see if it could further enhance the learning of engineering problems. The design was found to be useful and forms a new foundation to develop other applications that could enhance the learning process such as reducing the cognitive workload when a single cue is used to display a particular engineering concept in the problem presented to the user. The next stage of the research is to test and see if students could understand the concepts of engineering better with the appearance of visual cues. The technology limitations in this study are also the future aims of the study.

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Chapter 10
Innovation on Product Life Cycle Through Environmental Management Systems Standards Towards Malaysia Polypropylene Firms' Eco-efficiency

Wan Khamaruddin B Hj Wan Musa, Sariwati Bt Mohd Shariff, and Ismail B Ahmad

Introduction

Malaysian's polypropylene (PP) firms need to strategize a more proactive approach to address the pollution issues [1] to minimize the level of environmental impact to safeguard nature, their employees, neighboring residents, and the community at large. To date, although there are no serious reports on environmental incident by polypropylene products, campaigns to ban on the use of the products especially for plastic bags are increasing within the state government in Malaysia. Instead, claims that PP are non-biodegradable and take more than 100 years to degrade extremely upset the public. PP firms require to comply with legislation such as the Environmental Quality Act 1974 (Act 127), Environmental Quality Regulations 1979, and Environmental Quality Regulations 2007. As innovation could stimulate growth and competitiveness [2], the needs for PP firms to further innovate on its current practice is a must. Thus, innovation of EMS is crucial to ensure industry environmental performance complies with regulations and also to improve industry efficiencies. Moreover, there is a need to examine environmental management in developing countries where some scholars contend that environmental degradation and lax environmental standards are more predominant [3]. Accordingly, a variety of CSR strategies have been introduced, including significant investments in innovative activities regarding products and management [4], investments in human and ecological capability [5], and policies with integration of economic, natural, and social capital [6]. The degree of firm's efficiency depends on the level of environmental innovation since the environment is recognized as one of

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the important contextual factors and a driving force for organizational performance [7, 8]. The innovation process entails the stages of idea generation, project definition, design and development of products or services, green technologies, marketing, and commercialization [9]. Henceforth, this paper attempts to gain a detailed insight and discuss on how environmental management systems (EMS), innovation on product life cycle, environmental performance, government regulations, and corporate social responsibility improve polypropylene (PP) industry efficiencies in Malaysia.

Problem Statements

In Malaysia, 34 PP companies out of 811 manufacturers, representing only 4 % (4 %), had established environmental management systems (EMS) accredited with ISO1400:2004 certification [10]. The environmental issues such as pollution, disposal of chemical and toxic wastes, global warming, and depletion of natural resources (crude oils and energy) have forced the PP industries to integrate environmental considerations in managing their businesses and to demonstrate the best environmental practices in the global market [11–15]. Thus, more PP (plastic) manufacturers need to take up aggressive roles to manage their significant environmental impacts and to reduce pollution arising from their operations and activities [12–14, 16]. The presence of marine litters on beaches and in the oceans caused damages to marine ecosystems, the aesthetic quality of beaches, recreational and fishing interests, risks to health, and the human food supply chains, as well as impacts to life and natural ecosystems due the irresponsible disposals of PP wastes. PP wastes are not biodegradable, bulky, and resist incineration. It does not undergo decomposition by bacteria under the soil and causes landfill pollution at a greater rate (http://EzineArticles.com). For those reasons, Malaysian states and federal governments had taken proactive strategies to discourage the use of PP bags in retail supermarkets. This is to reduce volume of plastic wastes on landfills and rivers. Hypermarkets in Penang, Selangor, Johor, and Melaka had started a "no PP bag campaign" on Saturdays since July 2009.

Literature Review

Environmental Management System (hereafter termed as EMS) is defined as "the part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing, and maintaining the environmental policy" ([17], article 3). It is a systematic management approach for firms' environmental planning, environmental management programs, auditing, and corrective action in association with its environmental policy and objectives. EMS adopts the Deming

principles of quality management systems, plan, do, check, and act (P-D-C-A) techniques that inevitably involve the whole organization. Most of the environmentally proactive firms have met the demand of environmental regulations by introducing innovations on products, production, and managerial processes. Environmental innovations are also consists of new or modified processes, techniques, systems, and products to avoid or reduce environmental "damage" [18]. They may also lead to "win-win" situation characterized by both economic and environmental benefits ([19] Frondel et al. in press-a) due to the characteristic positive spillover that are accompanied by the internalization of negative environmental effects. A majority of evidence seems to conclude that, for most measures of performance, environmental regulation does in fact have a positive impact on firm's efficiencies as suggested by Porter (1991). The results of several studies in the literature have found such a positive relationship between government regulations and environmental management that improved performance [20], thereby supporting Porter's hypothesis. Sustainable organizations preserve through best management practices in using natural resources and keeping the feasibility of earth's ecosystems that integrate into the products and services for market planning and growth [21]. In fact, eco-efficiency is a subset of ecological ethics that focuses on relationships with nature, utilization, and conservations of natural resources [22]. Eco-efficiency urged organizations to achieve more value from lower inputs of materials and energy. Firms' eco-efficiency involved the essential ingredients for economic and ecological progress that are necessary for economic prosperity.

Proposed Conceptual Framework

The conceptual model examined has been developed through an examination of literature covering all aspects of Environmental Management Systems (EMS) and Environmental Performance shown in Fig. 10.1. EMS implementation in an organization begins with a comprehensive assessment (qualitative and understanding) and evaluation (quantitative and objective) of its operations and activities to determine how each and every process in the organization impacts the environment. Basically, an organization has to carry out an intensive initial environment review (IER) to determine the baseline performances for its production, category, volumes, quantity of substances, resources, and wastes used and generated. After these initial processes, only then the environmental objectives and targets and environmental management programs are planned to address the identified significant environment aspects and impacts and to improve business performance and efficiencies of the organization. Plans are deployed throughout the organization, usually through steering and working committees. The EMS system is evaluated to determine business and environmental performances and effectiveness. Based on the above summary, this study proposed a conceptual model on how EMS and innovation (independent variables) propagates business performances (dependent variable) and government regulations as mediating variable
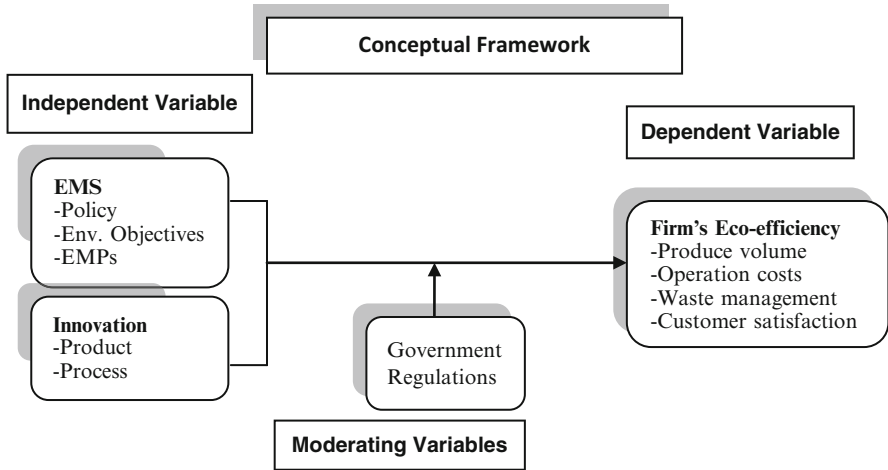
Fig. 10.1 Conceptual framework

Preliminary Results and Findings

The pilot study was carried out to ascertain the reliability and validity of the questions in the questionnaire as the survey instrument. Reliability focused with the stability, dependability, predictability, consistency, and accuracy and related to the extent to any measuring procedure yields the same results on repeated trials [23, 24]. Cronbach alpha analyses were done to test the reliability of the instruments. According to Nunnally [25], Cronbach alphas should be more than 0.6 to indicate reliability of instruments. The Cronbach alpha (α) for the ten constructs ranged from 0.833 to 0.871, indicating the reliability of the instrument, and the overall Cronbach alpha (α) 0.853 confirms the instrument is reliable. The reliability scores for the constructs, dimensions, and total number of items in the questionnaires are shown in Table 10.1.

The correlation matrix in Table 10.2 shows that all the values are greater than 0.30. Hair et al. [26] suggested that a correlation greater than ±0.3 are considered to meet the minimal level, ±0.40 are considered more important, and ±0.50 or greater are considered practically significant. It has also been suggested that a correlation greater than ±0.35 for a sample size of 250 should be considered statistically significant. In this study, all the items are assigned appropriately, and the scores are higher to their respective construct.

Factor loadings greater than 0.30 are considered to meet the minimal level; loadings of 0.40 are considered more important; if the loadings are 0.50 or greater, then they are considered highly significant [26, 27]. Factors having eigenvalues greater than one are considered significant, and all other factors with eigenvalues less than one are considered insignificant and are disregarded. The factor analysis results listed in Table 10.3 show that all the items in seven constructs formed a

Table 10.1 Total number of items and the reliability scores for constructs and dimension of the questionaires

Constructs	Number of items	Cronbach alpha (α)
Complying with environmental regulations	251	.846
Limiting environmental impact beyond complying with regulations	251	.857
Preventing environmental accidents	251	.850
Lessening the impact of environmental accidents	251	.833
Educating employees about the environment	251	.849
Educating the public about the environment	251	.866
Environmental performance	251	.871
Environmental performance	251	.846
Complying with environmental regulations	251	.857
Limiting environmental impact beyond complying with regulations	251	.850

Table 10.2 Items to construct correlation matrix for environmental analysis

Environmental construct	1	2	3	4	5	6	7
Complying with environmental regulations	1	.709	.585	.640	.557	.370	.314
Limiting environmental impact beyond complying with regulations	.709	1	.541	.526	.462	.305	.480
Preventing environmental accidents	.585	.541	1	.815	.458	.310	.343
Lessening the impact of environmental accidents	.640	.526	.815	1	.700	.423	.363
Educating employees about the environment	.557	.462	.458	.700	1	.472	.423
Educating the public about the environment	.370	.305	.297	.423	.472	1	.694
Environmental performance	.314	.280	.343	.363	.423	.694	1
Environmental performance	.314	.280	.343	.363	.423	.694	1

Note: Item numbers in the table are same as the item numbers in the instrument; correlation is significant at the 0.01 level

single factor with eigenvalue greater than one. For each of the ten constructs, the factor loadings are more than 0.30 and accounts for more than 30 % of the total variance; thus it could be concluded that the seven of environmental modeling constructs have good construct validity.

Henceforth, the study shall proceed with the second stage with the actual survey on identified 34 PP companies with ISO 14001:2008 certification out of 811 plastic companies registered under Malaysian Plastics Manufacturers Association.

Conclusions

Polypropylene (PP) industry is perceived as one of the causes for environmental pollution due to the generation of nondegradable plastics products; thus, it must exercise more aggressive roles to reduce pollution to the environment. The PP organizations have to react and demonstrate commitments and proactive operational

Table 10.3 Factor analysis

Environmental construct	1	2	3	4	5	6	7
Complying with environmental regulations	1						
Limiting environmental impact beyond complying with regulations	.709	1					
Preventing environmental accidents	.585	.541	1				
Lessening the impact of environmental accidents	.640	.526	.815	1			
Educating employees about the environment	.557	.462	.458	.700	1		
Educating the public about the environment	.370	.305	.297	.423	.472	1	.
Environmental performance	.314	.280	.343	.363	.423	.694	1

and business strategies to minimize the environmental impacts to the environment so as to protect the earth from pollution, global warming, and greenhouse gas effects. At the same time, PP organizations also need to ensure business sustainability with meaningful business results and performances and reduced costs and to remain competitive. Hence, the duties of care and responsibilities towards environmental protection should not be placed solely on these organizations but the society at large, which encompass the government and its regulations, other industries, and consumers, and all other developed and developing countries in the world also must have a fair share towards environmental pollution. EMS practices in PP organizations need to impose innovations to stimulate business and economic growth and competitiveness. Thus, innovations in EMS are crucial for eco-efficiencies and business performances that comply with government environmental regulation.

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Chapter 11
Initiative of Developing E-Counseling System: Importance and Application in UNITEN

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Introduction

What Is E-Counseling?

E-counseling is another way of counseling where the session is done by exchanging emails between the counselor and the clients online. It may or may not involve facial expression exchange from both parties, but it has been proven effective in dealing with some counseling and even psychological issues. Roy and Gillet [1] mentioned that counseling through email has its therapeutic values where it provides time for client to sort out their thoughts, feelings, and emotions, and some clients even reported feeling of being able to control their decisions. Since 2008, counseling in UNITEN has been conducted by the traditional face-to-face method. Although it is reliable and effective, it is also time consuming and unable to reach out to many. Realizing this, guidance and counseling unit (GCU) of UNITEN has taken the initiative of developing the web system www.gcuuniten.webs.com to tackle this matter. The website provides email exchange and chatting services where counseling is conducted online.

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Materials and Methods

Research Background

E-counseling has been introduced at almost the same time Internet was discovered. It has been proven to be successful in a lot of public and private higher learning institutions that provide counseling and mental health care both locally and internationally. King [2] from ACT Department of Education and Training of Canberra, Australia, insists that e-counseling allows greater access to career development counseling without limiting time, location, and language. Students are able to get targeted advices and correct information rapidly. It also attracts the target users with its other applications on the web page.

Research Objectives

This research is concerned with the objectives to:

1. Establish e-counseling services for UNITEN students and staff.
2. Provide e-counseling services for UNITEN students and staff.
3. Monitor the satisfaction and effectiveness of the services provided.

Research Methodology

This project was conducted by several IT staff and lecturers from College of Foundation and General Studies (CFGS) and GCU. A general survey and pilot test have been conducted on the awareness and the special needs of the population. The system was developed according to the responses collected from the general survey. The system was attached with the UNITEN main website. It was monitored and improved for the duration of 12 months. The survey was done on 60 random UNITEN students that have tried out the website for a week. The students later filled in a feedback form and the result was analyzed using SPSS.

Benefits of E-Counseling

It allowed clients to ponder and analyze their dilemma from different perspectives without the feeling of being watched or judged [1]. Typing out their feelings and emotions was also a therapeutic activity where it created a "disinhibition effect,"

which was a response where clients could be more open and honest when not face-to-face with the counselor. Rassau and Arco [3] studied that chat-based online using cognitive and behavioral technique (CBT) approach had been able to increase positive study behavior of students and decrease their anxiety level. Shiller's [4] research indicated that using social network such as Facebook has similar effect of self-therapy. Zelnick [5] indicated that after just one single session (lasted about 50–60 min), students showed a decrease in stress level which was also similar in a study conducted by King [2]. Another important benefit of e-counseling is that it significantly lowers blood pressure, improves lifestyle, and enhances quality of life [6]. In his research about providing counseling, guidance, and motivation through Internet for hypertension and heart patient, he found that it led to an almost double decrease in the blood pressure levels of participants compared to those who did not receive e-counseling. The motivational component in e-counseling has significant therapeutic values. E-counseling also improves mood for people suffering from depression. Using emoticons, a type of emotion icons used to express different kinds of emotions, while chatting during e-counseling session could also convey feelings and emotions better than using words alone. Metaphors, stories, and poetries also helped in explaining feelings and emotions without risking misinterpretations [7].

Alias, Hj Ninggal and Yahya [8, 9] also acknowledged the importance of e-counseling in government service as it made data keeping and organizing more systematic. Client data could be linked to human resource department database. E-counseling is time- and cost-effective where all psychometric testing and evaluation can be done by the client prior to counseling appointment. The result can also be communicated to the client or other relevant party more efficiently.

E-Counseling Client

The clients are those who live off campus, those who have packed class schedule, those with transportation problem, those who frequently travel away from the campus, those who have difficulty in social interaction, those who want to remain anonymous, and those who spend a lot of time on computers.

Architecture and Module Application of E-Counseling System

This section will be discussing two main categories of e-counseling system, which are as follows:

1. Architecture of system
2. Module application within system
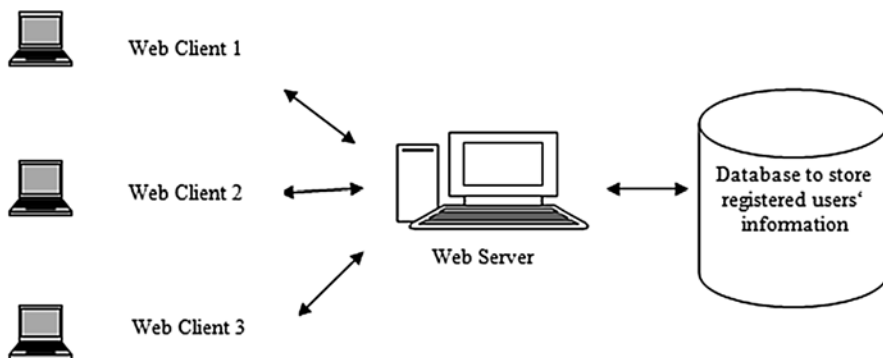
Fig. 11.1 Architecture of system

Architecture of System

This e-counseling system is developed with the aid of a free online website publishing tool, named www.webs.com. Generally, the system functions by applying the architecture of client-server, and it can be illustrated as shown in Fig. 11.1 below.

Web server refers to a computer which provides services or information where as web client refers to a computer which requests information from web server. By referring to Fig. 11.1 above, all web pages for e-counseling system will be uploaded onto a web server with the URL http://gcuuniten.webs.com. Users may access this system by using their own personal computer (which is also known as web client), as long as their computers have Internet connection. It is noticeable that the web server can deal with more than one web clients at a time, which means that many users can access to the web server at the same time.

A database had been developed to store information for all users who had registered themselves with the system. There are three main categories of users who had been utilizing this e-counseling system:

1. UNITEN students who require counseling services or information from e-counseling system
2. Counselors who provide both online and face-to-face counseling services or information to students
3. System administrator who maintains the performance of e-counseling system and uploads the latest counseling information into the system

Users may browse through the e-counseling system; however, only registered users are allowed to take part in the two main modules: forum and chatting, which will be explained in the next section.

Module Application Within System

This e-counseling system consists of 11 main modules, which are as follows:

1. Home module: This module acts as the main page of e-counseling system. Upon accessing http://gcuuniten.webs.com, users will be directed to this module automatically.
2. About us module: This module provides a brief introduction of UNITEN guidance and counseling unit's establishment.
3. Our counselor module: This module lists out information for all counselors available in guidance and counseling unit of UNITEN.
4. Our services module: This module introduces different types of guidance and counseling services provided by guidance and counseling unit of UNITEN.
5. Event calendar module: This module lists out all counseling events offered by guidance and counseling unit of UNITEN in calendar form.
6. Photo gallery module: This module shows all photos captured during guidance and counseling events.
7. News module: This module lists out all the latest guidance and counseling services offered, such as different categories of guidance and counseling workshop or training conducted.
8. Reading module: This module consists of useful guidance and counseling articles which are highly recommended by counselors.
9. Forum module: This module allows users to share and exchange guidance and counseling opinion among themselves. However, they will need to register themselves and log on to the system if they wish to participate in this module.
10. Contact us module: This module offers a few alternatives to students who wish to get counseling services from their respective counselors.
11. Chatting module: This module can only be joined by users who have registered and logged on to this e-counseling system. Within this module, the sender can exchange any guidance and counseling information with other online users (either students or counselors), and they will be able to gain feedback at the same time as long as their targeted receivers are still logged on to the e-counseling system.

Results and Discussion

Analysis of data as depicted in Table 11.1 illustrates that the feedback of e-counseling services total mean is skewed towards the value of 4 out of 5 in the Likert scale ($M = 3.72$; SD = .60). The value of 4 means "very nice" in the students' perceptions. The obtained mean score of 3.72 shows that the e-counseling service system was highly recommended by the students as it catered to their counseling needs.

Table 11.1 Descriptive statistics

	N	Min	Max	Mean	Std. dev
Overall	52	2.38	5.00	3.72	.60
Valid N (listwise)	52				

This is because the e-counseling system is more convenient and practical to the students as they can communicate with the counselors anytime and anywhere on and off campus.

It will also reach out to more students who are initially reluctant to attend face-to-face counseling sessions. This online chatting-based counseling approach will attract the students who are IT savvy and active through social networking. Thus, this delineates that the e-counseling service system is essential to students' personal and academic development.

Conclusion

In a nutshell, e-counseling has a lot of positive factors that aid conventional counseling services. With that, e-counseling has provided convenience for clients to communicate anytime and from any location. E-counseling protects the identity of the clients by remaining anonymous so that they can avoid from being embarrassed. Clients also may involve in self-reflection each time they are having online counseling session. The interaction can also serve as a record that allows both parties to review their improvement and progress. It will also ensure that the online counseling chatting sessions remain on the topic of discussion.

However, challenges that both clients and counselors have to face in e-counseling session must not be taken lightly. Clients need to be properly informed about the limitation of the website and also the proper safety measure that needs to be applied such as security of password or anything unique for electronic transmission [8].

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Chapter 12
Ecological Conceptualization of Halal-Haram Divide

Abdul Kabir Hussain Solihu

Introduction

Halal and haram are key Qur'anic conceptual terms that regulate Muslim dietary food in accordance with the Islamic *Shari'ah*. Discussion on halal consumer products has dominated the world market for decades. The annual value of the global halal food market was approximately USD632 billion in 2009 [2] and USD661 billion in 2010 ("Global Halal Food Market" [15]), with similar huge market value for halal pharmaceuticals, cosmetics, and other services. As a fast emerging economy where many developing countries compete to lead the race, halal venture is one of the few Islamic value-laden projects which non-Muslims will be ready not only to appreciate but also to invest in and promote. Such upsurge in the production and proliferation of halal products enormously serves the Muslim interest. Nevertheless, in a world of market-driven economy when market profit often clashes with the environmental interests and safety, there is a need to address halal and haram within a broader ecological framework. As noted by [7, p. viii], Muslims must look for alternative modality rooted in Islamic worldview which will enable them to "leapfrog" ahead to a more environmental friendly forms of economic expansion.

Literatures on Islamic perspective on contemporary ecological issues have been produced from different angles: theological, juristic, social, economic, and spiritual [12, 14]. However, one hardly finds studies on halal-haram consumption in ecological discourse, except in reference to Prophetic traditions that requires compassion for animal and halal slaughtering [23, pp. 146–150]. Addressing ecological issue solely from the perspective of animal rights or vegetarianism has led Foltz [13] to speculate that for future Muslims to constructively engage in ecological discourse,

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they could develop "metaphorical substitution" for meat eating during the Eid al-Qurban, as "not slaughtering the animal at all would be even more compassionate." Nonvegetarian Muslim ecologists see it the other way around [16, vol. 17, p. 117, [23, p. 149], since ecology, as Manzoor [21] observed, is part and parcel of worldview. This study is not to explain how ecological or non-ecological animal slaughtering is, but to examine halal-haram matrix within the broader ecological discourse. The first part introduces the concept of halal and haram in Islamic jurisprudence, followed by Qur'an's stance on ecological balance. The last part positions halal-haram divide under the matrices of *rizq* (provisions) and *haqq* (truth).

Defining Halal and Haram

Halal and haram are Islamic ethico-legal evaluative concepts that apply to human actions in their interactions among themselves and with other species in the natural world. Halal refers to what is permissible and lawful to consume, use, or engage in accordance with the Islamic Shari'ah. When applied to minerals, plants, or animals, it refers to what is permissible to eat or drink therein in accordance with the Islamic law. Its antonym is haram, referring to what is impermissible or unlawful. The Qur'an states: "O mankind! Eat of what is on earth, Lawful (*halalan*) and good (*tayyiban*); and do not follow the footsteps of the evil one, for he is to you an avowed enemy" (2:168; see also 5:4; 7:157).

The division of foodstuff into halal and haram is based on the benefit or harm the object has on human health. For example, it is haram to consume anything that is injurious or harmful to one's health or that which precipitates one's death on the basis of the Qur'anic injunction that: "and do not kill yourself; indeed, Allah is ever Merciful to you." (4:29); "And make not your own hands contribute to (your) destruction" (2:195).

Tayyib literally means "good" and "pure." It is an adjective that is often attached to halal to explicate the purity and hygienic dimension of halal, not to add any attribute which is not already embedded in halal. When used in the food context to describe halal, it means any good thing typically expected from the food, particularly nutrition, hygiene, healthiness, and wholesomeness.

Khabith is an antonym of *tayyib* often associated with haram to indicate its impurity and badness for one's health. Poisonous substance or unhygienic animals, for example, are haram for humans to consume because they are harmful to their health. Halal food when excessively consumed to the stage that it may lead to illness is equally haram because it is harmful to one's health in that particular context [4, p. 78]. In short, anything which is harmful or the harm of it outweighs its benefit to human health is pronounced as haram, while anything which is beneficial or the benefit of it outweighs its harm to human health is considered as halal [4, p. 25].

Later Muslim jurists theorized on explicating the initial rulings of things (*al-asl fi-al-ashya'*). According to some, it is *ibahah* (permissibility), a term closely related to halal; thus, everything is halal except that which the Shari'ah declares to be

haram. To others, it is haram and thus everything is initially haram except that which Shar'iah makes halal. Since the items identified as halal or haram are definite in the Qur'an and the Prophetic *hadith*, things which are not specifically catalogued as halal or haram will follow the rulings of their initial dispositions accordingly [6, p. 122, 4, pp. 14–15].

Halal and haram serve a grand purpose in regulating Muslim dietary system. Nevertheless, they are not applicable to nonhuman species when they interact with one another at the ecological level.

A Qur'anic Ecology

Halal-haram and ecology are interrelated, as items made halal or haram in nature are constituents of ecology. While halal-haram addresses their edibility by humans, ecology delves into their interactions, exploring the interrelationships of all living organisms, animals, plants, and their environment with a view to discovering the principles which govern the relationship [17, p. 5, 18, p. 4]. As a science, ecology is "the scientific study of the interaction that determine the distribution and abundance of organisms" [18, p. 2].

The Qur'an has been the primary reference of Islamic perspective on ecological issues [22, pp. 34–35, 24]. There are references to animals, birds, plants, mountain, sun, moon, stars, and many other celestial and terrestrial bodies. Few *surahs* of the Qur'an are named after animals or insects, such as *al-Baqarah* (the Cow), *al-An'am* (the Cattles), *al-Fil* (the Elephant), *al-Nahl* (the Bee), *al-Naml* (the Ants), and *al-'Ankabut* (the Spider). The Qur'an describes nonhuman species as *umam* (plural of *ummah*, meaning community, genera, colony), similar to that of human communities (6:38), and, occasionally, it records their behaviors (16:69; 29:41), interactions among themselves (27:18), and their communications with human beings (27:20–31).

There are indeed quite a number of Qur'anic verses that grant humans the right to enjoy many things in nature (see, e.g., 22:28–30; 23:21; 40:79–80; 79:30–33; 80:24:32; 6:141; 36:33–35). Such verses exhibit that many organic and inorganic objects in nature, the rivers and the seas, the animals, and plants, are made halal or haram to human consumption and use. Nevertheless, the objects of halal and haram and many others beyond that divide in nature are said to have an aesthetical value as well. In *surat* Fatir, some animate and inanimate objects are identified as constituents of biodiversity, including plants, animals, and mountains of different colors and tastes (35:27–28; 13:4). Indeed, the variation in human languages and colors partakes in this aesthetical value (35:28). *Zinah* (beauty), to use a Qur'an's term, is visible in celestial as well as terrestrial bodies (15:16; 67:5) irrespective of whether the object falls within the scope of halal-haram divide. It is remarkable to note that at some point, the Qur'an states that whatsoever on earth is made an ornament and embellishment for earth to try humans: "Surely We have made all that is on earth an embellishment for it in order to test people as to who of them is better in conduct"

(18:7). According to Jawhari [16], beauty is one of the magnificent creations of God which will not be appreciated in nature except by people of sound understanding.

In their functions, as consumable or aesthetical, these objects are said to be in constant worship to God and in celebrations of His praise (17:44; 24:41; 22:18) and are presented to be of grand God's *ayat* (signs) in nature pointing to the existence and unity of God (6:99; 13:4; 45:1–6; 31:11) [25, p. 79]. As custodians of other creatures in nature, humans are granted the right to consume whatever is hygienic but not to do *israf* (extravagance or wastefulness) (6:141; 7:31), a wanton consumption attitude that is tantamount to ecological degradation. They are also called to appreciate and preserve the beauty and majestic design in nature and not to violate biodiversity; failure to do so could lead to the destruction or disruption of great potions of God's signs in nature, denying future generations the right to witness such signs. As Abu-Sway [1] observed, "the destruction of the habitat of any species means the extinction of a Sign that, not only leads people to remember God, but also participates in praising God."

Now, one of the most dangerous creatures to humans on earth with more deaths caused by it than any other animal on the planet is the mosquito. Mosquitoes are vectors for many deadly diseases, including malaria, yellow fever, dengue, West Nile, and encephalitis. While the majority of mosquito species generally feed on flower nectar and animal blood, only females of some mosquito species feed on human blood to get the proteins necessary to lay eggs [11, 20]. To combat mosquito nuisance, scientists have developed various types of techniques to suppress the mosquito population, replace them permanently with genetically modified ones that will be unable to transmit parasites, or permanently wipe them off the earth [11, 26, 18, p. 464].

Nevertheless, mosquitoes do play important ecological roles. They are a primary food source for many species of insect, spider, salamander, frog, and lizard, and mosquito's larvae feed on organic detritus, decaying leaves, and other microorganisms. In Arctic tundra, from northern Canada to Russia, there is a brief period in which mosquito species are extraordinarily abundant, forming biomass that is a major food source for the migratory birds there. In the absence of the mosquitoes and their larvae, hundreds of species of mosquito-eating birds and fishes would have to change their diet to survive or go extinct which could eventually affect the food chain. By feeding on the waste products, mosquito larvae make nutrients available for the plant. Without mosquitoes, thousands of plant species would lose a group of pollinators [11].

Of all animals and insects mentioned in the Qur'an, mosquito is given a special recognition. Like other creations, the creation of mosquito is not based on *batil* (false judgment or flaw system) but on *haqq* (truth), on the same frame other creatures operate. In reference to mosquito, the Qur'an states:

> Surely Allah disdains not to set forth any parable – (that of) a gnat or anything above that; then as for those who believe, they know that it is the truth from their Lord, and as for those who disbelieve, they say: What is it that Allah means by this parable: By it He causes many to stray, and many He leads into the right path; but He causes not to stray, except those who forsake (the path) (2:26).

Fig. 12.1 Symbiotic relationship
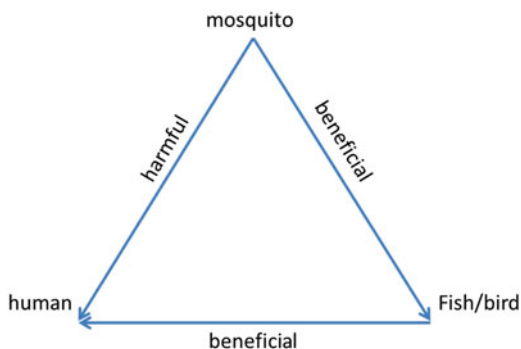
The *ayah* suggests that no matter how more or less insignificant, repugnant, or disgusting an object might seem to be within the prima nature, it is based on a meticulously designed and well-calculated system and thus worthy of recognition [16, vol. 1, p. 44; vol. 11, pp. 76–92].

It is remarkable to note that both mosquitoes and bees pollinate plants and feed on flower nectar to survive. But mosquitoes carry many types of deadly diseases, while bees produce honey that heals a variety of diseases. For the time being it is not clear whether honey can heal all the diseases created by mosquitoes or whether something can be combined in both creatures to solve part of our problems.

Because of the various harms they cause for humans coupled with their repulsive flavor [3, p. 14], mosquitoes might be haram for humans to eat, but they are beneficial (halal) to many species of plants, birds, and fishes which we feed upon. Likewise, pig is a creature of God that has the right to exist. Its haram status is only associated with human consumption or contact. Other than that, pigs play their ecological roles by scavenging any waste on the farm, including bugs, insects, dead carcasses of sick animals, and the like [5, 16, vol. 11, p. 79].

Such complexity in creation and the symbiotic relationships of the existents cannot be reduced to or deciphered within the halal-haram parameter. It has been reported that each year more than 15,000 new species are catalogued. Of 1.2 million already known and catalogued species or 8.7 million estimated to exist on the planet [8, 27], human species is simply one. It is inconceivable that what is harmful to humans will be equally harmful to all other species or what is meaningless to humans will remain so to others. The interplay between halal and haram is like *A-B-C* equation where *A* and *C* are collectively halal because they are beneficial to humans while *B* is haram because it is harmful to humans. However, *A* and *C* can perform their function only through the channel or within the existence of *B*. Ecologically conceptualized, haram things are simply haram for humans to consume or to make a direct contact with, but not necessarily haram for other nature's constituents upon which human existence and sustenance depend as shown in Fig. 12.1. Thus, in order to explore the meaningfulness of existence, particularly of haram objects, it is necessary to look beyond the halal and haram matrix.

Beyond Halal-Haram Matrix

The benefit-harm divide upon which halal and haram are based equally applies to other species in nature but without carrying halal and haram connotation. This means that halal and haram are relative terms. They do not apply to objects (irrespective of whether it is beneficial or harmful) in themselves but always only in their relations or contacts with humans.

A more generic term on which halal and haram can be subsumed is *rizq*. *Rizq* literally means "sustenance" and "provision." It is used in the Qur'an broadly to refer to any type of provision either to humans (2:60, 172; 5:88; 20:8; 67:15) or to nonhuman living beings (11:6; 29:60) to sustain life on earth. It is also used to designate provisions of the righteous people in the heaven in the Hereafter (3:169; 7:50; 19:62; 22:58; 38:54; 40:40). *Rizq Allah* or *rizqullah* means Allah's provisions, and al-Razzaq is one of the attributive names of Allah, which refers to Him as the Sustainer, the Bestower, and the Provider of all sustenance. Another Qur'anic term identical to *rizq* is *ma'ayish* (plural of *ma'ishah*) which means livelihoods. As stated in the Qur'an, Allah provides substance to all living beings and guides all to their respective means of livelihood:

> And the earth– We have spread it out, set thereon mountains firm and immovable, and produced therein all kinds of things in due balance. And We have provided therein means of livelihood (*ma'ayish*) for you and for those whose sustenance does not depend on you (15:19–20).

> How many are the creatures that carry not their own sustenance (*rizqaha*)? It is Allah who feeds (both) them and you: for He hears and knows (all things) (29:60; see also 11:6).

These nature's bounties are set in motion to prey on one another and to support human consumption within the matrix of *rizqullah*. According to 'Abd al-Jabbar (d. 414 or 415/1025), a Muslim Mu'tazilite theologian, God's *rizq* is created to facilitate life in general; thus, it is permissible for all – rational and nonrational – animals, and no one has monopoly over it or priority to prevent another from enjoying it (cited in [10, p. 54]). It is obvious, however, that not all types of *rizqullah* are permissible for humans to consume. Those items which are *tayyib* (nutritious and agreeable) to human nature are made halal for them to consume (2:172), while the *khabith* (impure, harmful) parts are made haram. In other words, both halal and haram, pure and impure provided in the prima nature, are all *rizqullah*, but humans are allowed to consume only halal part and to leave haram part for other living beings with which they rightfully share *rizqullah* (Qur'an, 11:6; 29:60), as indicated in Fig. 12.2. What is not agreeable to human nature may be agreeable to the disposition of other species and thus become their *rizq*.

Haqq is yet another Qur'anic keyword which perhaps goes beyond *rizq* and ontologically operates at a higher level of existence. It is used extensively in the Qur'an to mean "true" or "real." Its antonym is *batil*, meaning "false judgment or flaw system." It is used to refer to the Qur'an itself in the sense that it is true (2:91; 4:170; 32:3), revealed with truth (176, 213, 252; 3:3; 4:105; 5:48), and its accounts of historical narrations are true (3:62; 6:57). In fact, *al-Haqq* is also one of the attributive names of Allah (SWT) (22:6; 22:62; 23:116; 31:30).

Fig. 12.2 Al-Haqq matrix
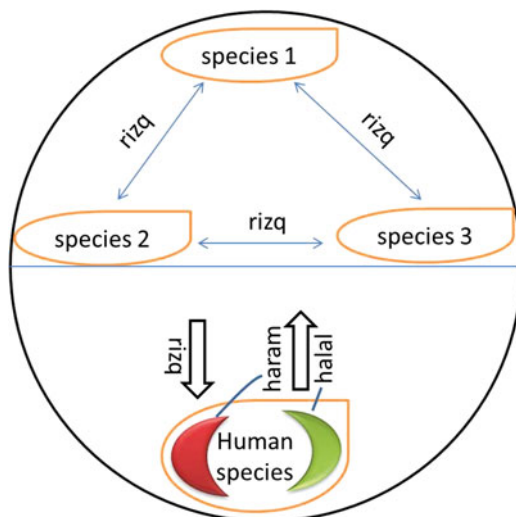
Now when the creation of the heaven and earth is discussed, the Qur'an often uses the same keyword to mean that everything in nature is created purposefully with *haqq*:

> And We did not create the heavens and the earth and all that is between them in sport. We did not create them both but with the truth, but most of them do not know (44:38–39; see also 6:73; 29:44; 30:8; 39:5; 45:22; 46:3; 64:3).

> And We did not create the heaven and the earth and what is therein purposelessly– that is the opinion of those who reject (God) or who are ungrateful (38:27; see also 21:16–18).

That means that the creation, the design, and the provisions of items that are made halal or haram are all founded on *al-Haqq*. That is why the Qur'an considers it as a grave sin to swap halal with haram by making what is halal haram or vice versa (5:87; 10:50; 16:116). Commenting on a swarming locust that attacked Egypt in April 1930 ("Locusts in Egypt," [9, 19]) while interpreting verses 35:27–28 in his *tafsir* (exegesis), Sheikh Tantawi Jawhari (d. 1940) linked the incident to divine design in nature. He explained that many living organisms, which sometimes appear to be disturbing, are purposely created to play important roles in ecology:

> These birds prey on worms and they themselves fall prey to others. Similarly, snakes and scorpions feed on insects. Among the sea fish some are predators, others are preys. In fact, decomposed bodies of human being and animal produce worms, indicating that nothing in existence is dysfunctional or idle. And now locusts would leave their habitat to invade human communities and their farms and devour their crops. Like the insects that appear during a particular season in a year and their predators among the animals are already awaiting them, locusts would come out in particular known years and their predators are waiting for them. Thus, nothing in nature is dysfunctional, idle or meaningless (*fala mu'ttil fi al-wujud*) [16, vol. 17, p. 117].

It is important to note that when other species are reportedly active in their search for their provision, as narrated in the Qur'an, it is out of the equation of

halal and haram. Guided by divine inspiration which is *haqq* (16:68–69), bees pollinate flowers and many other plants in its search for *rizqullah*. Similarly, a fish swallowed Prophet Yunus (Jonah) when he was thrown into the sea. As recorded in the Qur'an, "Had it not been that he (repented and) glorified Allah, He would certainly have remained inside the Fish till the Day of Resurrection" (37:143–144). That means that if not for the sake of his repentance and God's forgiveness, Prophet Yunus would have been digested by the fish whereby fish would have become his *qabr* (grave).

Other creatures are not subjected to halal and haram rule even though the Qur'an recognizes their constituents in nature, as indicated in Fig. 12.2. They rather operate under the system of divine provisions and guidance which they share with humans (20:50; 87:2–3). *Al-Haqq*, as applied to them, indicates their right to existence and equal provisions, the meaningfulness of their existence, and their constituents in the delicately balanced chain of being.

The distinctive role of humankind as *khalifat Allah* (vicegerent of Allah) is still visible within the ecological framework [21]. Over many creations of Allah, mankind is ranked the highest in the Qur'an with other creations being made subservient to him (*taskhir*) (17:70). In performing his role as *khalifat Allah*, man has been granted permission to use and explore many other creations. Yet with this unique opportunities come his greater responsibilities. He is a *ra'in* (shepherd) entrusted to nurture the herd and responsible for their conservation and preservation (*amanah*).

Conclusion

Halal and haram dietary law is not meant to divide the natural world into two poles in consumable terms, but to let Muslims enjoin healthy provisions as they perform their greater duty as *khalifat Allah* on earth. Food is definitely necessary for all living beings to survive. What is not edible for humans may be nutritious for other species. To eliminate the haram objects in the natural resources on the ground that they are harmful to humans is to construe nature anthropocentrically.

The study identified *rizq* and *haqq* as key Qur'anic terms that operate at a higher level under which halal and haram are subsumed and appropriated. While it is possible to reduce halal and haram to *al-Haqq* in the sense that what is made halal is truly beneficial and what is made haram is truly harmful, it will be preposterous to reverse the order by confining *al-Haqq* to halal and haram parameter.

Grounded on *haqq* and *rizq*, the ecological module as introduced to halal and haram discourse in this study will enable us to recognize our role in dealing with nature and duty toward other creatures. While the concept of *rizq* lets us appreciate halal and haram better through the intricate web of existents, the concept of *haqq* encourages us to explore the creation and design of other creatures and study the distinctive roles that each plays in the continuum and inextricable chain of being.

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Chapter 13
Dynamic Geometries in Traditional Malay-Muslim Art and Architecture: Evidence of Advanced Building Sciences in Malay Building Tradition

Hazman Hazumi and Harlina Md Sharif

Introduction

There are parts in a people's heritage that contain elements innate to their existence. These elements such as beliefs, values and customs are built from complex synchronisation of 'man', 'life' and the 'universal existence'. This composition serves as a primary identification of the people's history and is always connected to their civilisational achievements. Often, heritage is found unwritten and passed down from one generation to the next in the forms of credos and customs, embedded in their material culture. In this context, the Malay traditional arts and architecture serve both as tangible and intangible evidences of the Malay people's identity. Studying their peculiarities is a prerequisite in the efforts to understand their sciences and technological achievements. As art serves as a living form and documentation of historical records and the intangibles of a society [1], it is critical for the Malay traditional architecture and art to be recognised as an important cultural heritage that must be preserved.

The term 'dynamic geometries' or 'dynamic symmetry' [2] in this study refers to the mechanism and methodology applied in the investigation performed on the Malay house form and its woodcarving to determine the existence of symmetric design principles. The dynamic symmetry design principle serves as an analytical tool to assess the accuracy and consistency of the Malay house design with respect to its proportion and dimensions. The dynamic symmetry is adopted as an evaluation tool due to its quality as design principle, proven through its application and employment in classical architecture as well as ornaments. According to Hambidge:

> …The classical Greeks first used dynamic symmetry especially in their architectures such as the Parthenon in Athens and many useful items such as vases and ornaments. [3]

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Hambidge developed an understanding of dynamic symmetry proportional system that enabled him to extract a major method that serves as a parent mechanism, from which other methods of analysis were extracted in theory and practice of arts and architecture. The findings were translated into both arithmetic and geometric methods that can be converted into a series of accurate and empirical values. Adopting Hambidge's approach in the study of the Malay house leads to the uncovering of orderly principles of the Malay design and building tradition, which will be the evidence of advanced building sciences in Malay building tradition.

Research Objective

Present scenario indicates that the Malay wooden architecture is fast diminishing, with the knowledge embedded within its design ingenuity at risk of being extinct due to severed transmission of traditional wisdom. Without decisive measures taken to ensure the heritage is recognised and therefore preserved, it is highly probable that the history of the Malay people, recorded by their traditional arts, will be lost forever. The objective of the study, thus, is to reveal and exhibit the underlying principles responsible for the formative and aesthetic characteristics of the Malay house and its woodcarving. By employing advanced 3D digitisation documentation technique, the study establishes the presence of intricate but precise application of dynamic geometries, operating as underlying design principles, responsible for the Malay house's proportional design and aesthetic qualities of the woodcarving panels. The main objective of this study is to uncover the underlying Malay traditional house design principles, method and technique in order to impart loss knowledge and wisdom to the present generation. By uncovering the design principles that gave rise to such unique architectural and design qualities, the study strives to initiate attempts in reviving the traditional arts and its didactic values by means of education. This paper perceives that reviving the traditional knowledge is not only an important part in the effort of recognising the Malay traditional heritage; it is a vital tool in addressing the lost wisdom and building technology of Malay-Muslim world in contemporary architecture, art and design sciences.

Research Problem

The current conservation policies in the country are lacking in terms of listing and recognising the Malay traditional houses as critical Malay heritage artefacts [4]. This policy has seen many forms of traditional houses, such as Perak *Kutai* house, *Rumah Gajah Menyusu*, *Rumah Melayu Perabung Lima* and many more that could not be listed here, that were left unattended due to failure of being gazetted. Currently, the approach adopted in preserving the Malay architecture and art is by storing, thus exhibiting them in the compound of local museums,

universities and craft centres. Upon close examination, this approach has a negative impact on the appreciation of traditional arts as it not merely promotes artificial appreciation of the glorified past of the traditional architecture, but more importantly indicates our ignorance of traditional context and its values of wisdom, knowledge, art as well as sciences. This study views such approach as 'static', as artefacts are displayed mainly to serve decorative functions, in the similar way woodcarving panels today are detached from its architectural context, by exhibiting them as isolated objects.

Research Methodology

The critical step in any preservation attempts is documentation. Documentation allows heritage objects to be recorded as is, in situ, and thus provides accurate information on the state of the object. The recorded data must be sustainable and accessible to be used for future studies and evaluations. In this study, the use of advanced three-dimensional (3D) laser scanning and 3D rapid prototyping (RP) is adopted, as this technology provides millimetre accurate data of the heritage object, through a limited-touch approach, thereby guarding the integrity of artefacts, in which risks are being contaminated or destroyed due to excessive handling. The objective of using this technology is two speared: the first is to provide accurate data in terms of dimensions and commensurability of the house and woodcarving panels, in order to establish the presence of dynamic geometries as underlying design principles. The second objective is to initiate digital database of heritage items, which can be used for further studies. This paper focuses on the methodological approaches adopted by using the seldom applied technological measures, as a form of aid to sustainable conservation practice. The overview of the analytical stages and findings will be presented to enable appreciation of the use of the dynamic geometry as a tool in evaluating the Malay house archetypal form and its woodcarving design principles. The study postulates that the underlying design principles were not merely responsible for the traditional designs' aesthetic characteristics; they also governed the technique and method of construction.

Vitruvius [5] defines the concept of proportion in architecture as '… a correspondence among the measures of the members of an entire work, and of the whole to a certain part selected as standard'. Hence, the understanding of proportion required a certain form of system as a standard that enables precise determination of the relationship between parts to whole and vice versa. In this analysis, the dynamic symmetry system measures the horizontal measurement of the Malay house wall to wall dimensions against its vertical measurement of floor height, ceiling height and the pitch roof height, to determine the house's proportionate relation of its archetypal form and architectural design. This system uses standard numbers of dynamic rectangles such as $\sqrt{1}=1$, $\sqrt{2}=1.4142$, $\sqrt{3}=1.732$, $\sqrt{4}=2$, $\sqrt{5}=2.236$, $\varphi=1.618$, $\sqrt{\varphi}=1.272$ and $\varphi^2=2.618$, which subsequently are used to examine the accuracy of the Malay house archetypal form and its architectural design.

The dynamic symmetry tools such as its diagonal, reciprocal and complementary patterns can be devised into two approaches of analysing the proportions of the Malay house and its woodcarving. The first approach employs certain subdivisions of the house plan, which were collected from the measured drawing selected as the study samples, such as the areas defined by walls and columns. The second approach consists of fixing the proportional relationships of the voids and solids in an enclosed rectangle of an elevation or plan of a building. In this context the two approaches on proportional analysis as described by Jay Hambidge were adapted, inspired from the analytical analysis of the Parthenon and other Greek Temples. The study adapted identical approach on the Malay house and its woodcarving in order to examine the proportional composition of its architectural elements.

Acquiring Digital Database

The documentation exercise is carried out on selected samples consisting of 20 carving panels and 11 houses. The collected data was categorised into two interrelated categories:

(a) Archival material and data—consists of archived studies on related subjects in the form of photograph, measured drawings, building report, old computer hard drive, compact disc, floppy disc and any digital format. Where appropriate, old digital files were converted into updated file formats with new file extensions that may allow the data to be analysed. All other data were then documented digitally using appropriate software and hardware such as digital camera, flatbed scanner and typical computer workstation, which enable the process of importing old digital data into comprehensive collections of information in a single database that is easily accessible.

(b) Primary and actual data—the primary data was documented using 3D scanner or camera that provides impeccable, accurate reading of measurements of actual artefacts or objects. Samples were obtained from museum's collections, as well as private collectors. Data retrieved were compiled and stored in a digital database, accessible for detailed investigation. On-site inspection and scanning are performed on immovable artefact or object such as building and monument (refer to Fig. 13.1. Kampung Laut Mosque 3D scanning process, Fig. 13.2.; step-by-step digital data editing on Malay woodcarving samples).

The database created based on these two research exercises becomes a fountain of organised, processed and documented data. Since all the data are in digital format, using appropriate computer software may now be possible. The data can now be evaluated, reviewed and edited, depending on the set of analytical criteria imposed upon them. The 3D scanning of the architectural samples allows digital data of the documented building to be accessed, viewed from different angles, enlarged and reproduced in 2D formats (i.e. plans, elevations, sections). With the movable artefacts such as woodcarving samples, the digital data is used for 3D printing of the object, producing
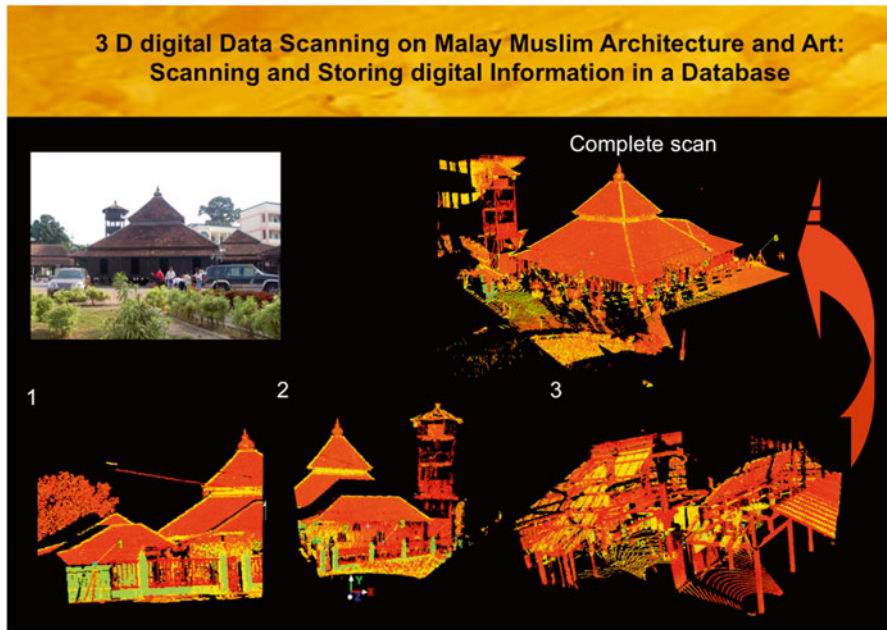
Fig. 13.1   Kampung Laut Mosque 3D scanning process

exact replica of the artefact at a scaled version (refer to Fig. 13.3a–c, rapid prototyping resampling on the original artefact sample).

Geometric Analysis

In the case of analytical study on the Malay-Muslim architecture and art, the dynamic geometry proportional system is used as the primary analytical tool in establishing that the Malay house conforms to the proportioning conventions through conscious design decision making. The geometric analysis consists of two types:

(a) The emphasis on the Malay woodcarving's analyses was on the basic form of the overall dimensioning of the woodcarving design. Samples were categorised according to their types of motifs used in the carving design theme, namely, geometrical, floral, vegetal, cosmic and calligraphy or inscription themes. A visual analysis was then conducted to establish any design application that may indicate the formal cause of the carving design, shape and dimensioning. In this analysis, no attempt is made to classify the carving regional influence of the design motifs and style, as the origins of many of these samples could not be verified, and selected samples were taken at random based on its carving
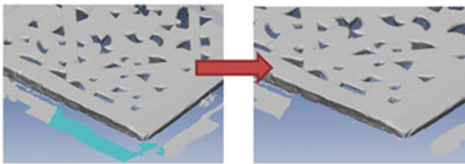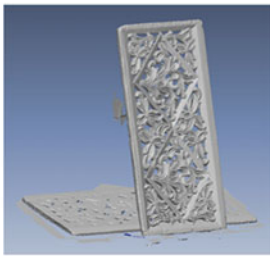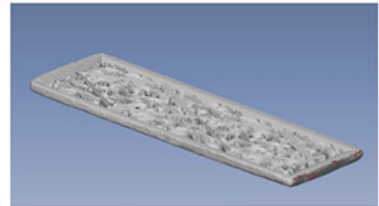
Fig. 13.2 Step-by-step digital data editing on Malay woodcarving samples
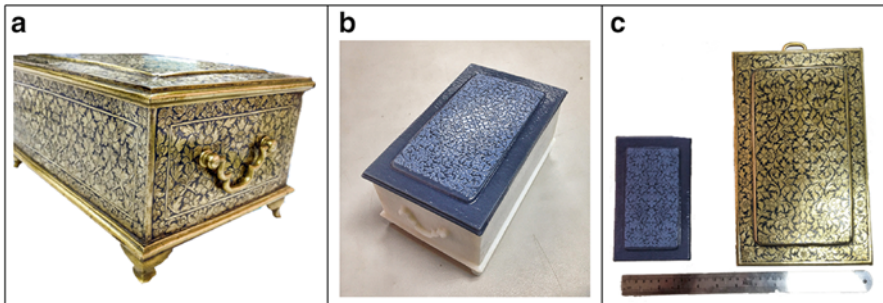
Fig. 13.3 Rapid prototyping resampling on the original artefact sample. (**a**) Sample on Malay art artefact. (**b**) Rapid prototype printing sample. (**c**) Accurate rescaling 1:1 to 1:2 between original artefact and RP samples

themes, motif composition and basic panel shapes and sizes (refer to Fig. 13.4, analysis; 5a root rectangles analysis on carving sample; and 5b, root rectangles analysis on Malay house sample).

a

Generating center based on the geometric grid

Geometric grid based on combination of 1 Root 4 & 4 Golden rectangle

The underlying geometric principles on the panel

Root 2 rectangle

Sample 11

4 x Golden Rectangle

b Geometric grid on plan based on combination of 4 x Root 3 & 7 x Root 5 Rectangle

4 x Root 3

Root 5

Golden Section

7 x Root 5

The underlying geometric grid on side elevation

The underlying geometric grid on front elevation

Fig. 13.4 Analyses. (**a**) Root rectangles analysis on carving sample. (**b**) Root rectangles analysis on Malay house sample. (**c**) Geometric analysis on Malay house (*right*) and its woodcarving (*left*)
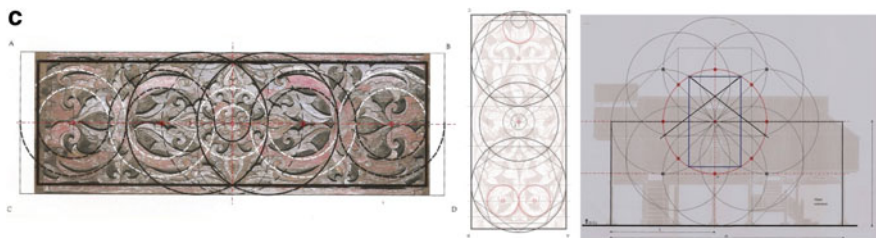
Fig. 13.4 (continued)

(b) The analysis on the Malay house emphasises on the archetypal form of the overall house design based on to the house's roof types and regional design typology. A general observation was then conducted to establish any design application on the house samples that may indicate the geometric construction of the house form, timber structure and dimensioning. Based on samples taken from the digital database, potential study samples were identified for further investigation followed by final detailed analysis (refer to Fig. 13.4, analysis; 5c, geometric analysis on Malay house and its woodcarving).

Findings

The study on 20 carving samples and 11 house samples revealed the basic form of the traditional house and all its architectural elements, e.g. doors, windows and wood panels relate to each other in comprehensive proportional composition. It demonstrated that the Malay craftsmen have understood and applied the universal principles within their architecture. Although it is hard to ascertain if they were conscious of the design principles or how they prescribed the knowledge, the survey proves that each woodcarving panel was prefabricated, proportioned and positioned in harmony to its context, which resulted in the production of breathtaking and intricately unique art and architecture.

Conclusion

Contradictory to widely held presumptions that the existence of dynamic geometry proportional system and its application in the Malay house is a mere coincidence, the study reveals that the Malay house was built with rather sophisticated knowledge incorporating the geometric construction in design stages of the house, from conception to construction. Prior to this study, due to scarcity in information and empirical study pertaining to the technical aspects of the Malay architecture, such proposition was considered as speculative [6]. Whether or not the Malay craftsmen employed the dynamic geometries in their design and construction consciously, or if they were indeed imbued with the knowledge of geometries, is an area that deserves further research. Nevertheless, the study reveals the consistent presence of
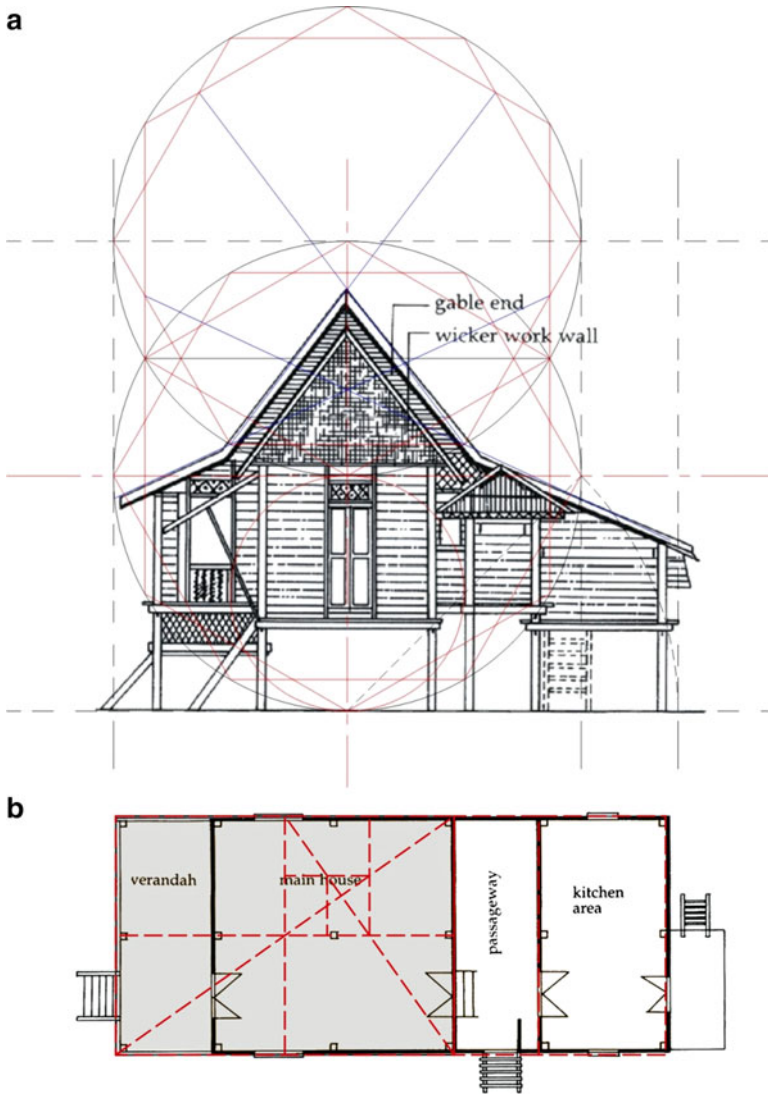
Fig. 13.5 Malay house proportional design. (**a**) Malay house proportion according to its geometric mean. (**b**) Malay house plan dimensioning according to its root two rectangles proportion and dimensioning

dynamic geometry application in all the samples documented. This paper argues that the analyses were made more efficient through the use of digital documentation of primary and secondary sources, which contributed to a new innovative approach on the studies of Malay architecture and art.

The main objective of the research is to uncover the underlying Malay traditional house design principles, method and technique in order to impart lost knowledge and wisdom to the present generation. By uncovering the design principles that gave rise to such unique architectural and design qualities, the study hopes to be able to revive

No.	Sample Code	Square	√2	√3	Double - square	Golden Section	√5
1	WP 1					(2 x *)	
2	WP 3			*	*		
3	WP 4			*			
4	WP 5		*				
5	WP 6		*	*			
6	WP 10				*		
7	WP 11						*
8	WP 13				*		
9	WP 14			*	*		
10	WP 15			*	*		
11	WP 16				*		
12	WP 17			*			
13	WP 18			*	*		
14	WP 19						*
15	WP 20						*
16	WP 21						*
17	WP 22						*
18	WP 23	*		*		*	
19	WP 24			*	*		
20	WP 25						*
21	WP 29				*		
22	WP 30				*	*	
23	WP 31				*	*	
24	WP 34	*			*		
25	WP 36						(2 x *)
26	WP 44	*	*	*			
27	WP 47			*			
28	WP 48			(2 x *)			
29	WP 51				*		
30	WP 55			*			
31	WP 56				*		
32	WP 57						*
33	WP 58			*			
34	WP 59	*		*			
35	WP 60			*			
36	WP 61						*
37	WP 62		(2 x *)				
38	WP 63			*			
39	WP 64		*				
40	WP 65				*		
41	WP 66		*				
42	WP 67			*			
43	WP 68			*			
44	WP 69			*			
45	WP 70			*			
46	WP 71	*					
47	WP 72	*					
48	WP 73			*			
49	WP 74				*		

Fig. 13.6 The results of preliminary analysis conducted on 49 shortlisted woodcarving panels. The analysis concluded that all 49 panels analysed demonstrated the use of one or a combination of overlapping root rectangles or a double-square rectangle or a golden rectangle as their governing design principle, indicative of the formal cause for the panels' shapes, dimensioning and design compositions

the traditional arts and its didactic values by means of education. This study perceives that providing the evidence of advanced building sciences in Malay building tradition, as shown in Figs. 13.6 and 13.7, the traditional knowledge is not only an important part in the effort of recognising the Malay traditional heritage but also a vital tool in
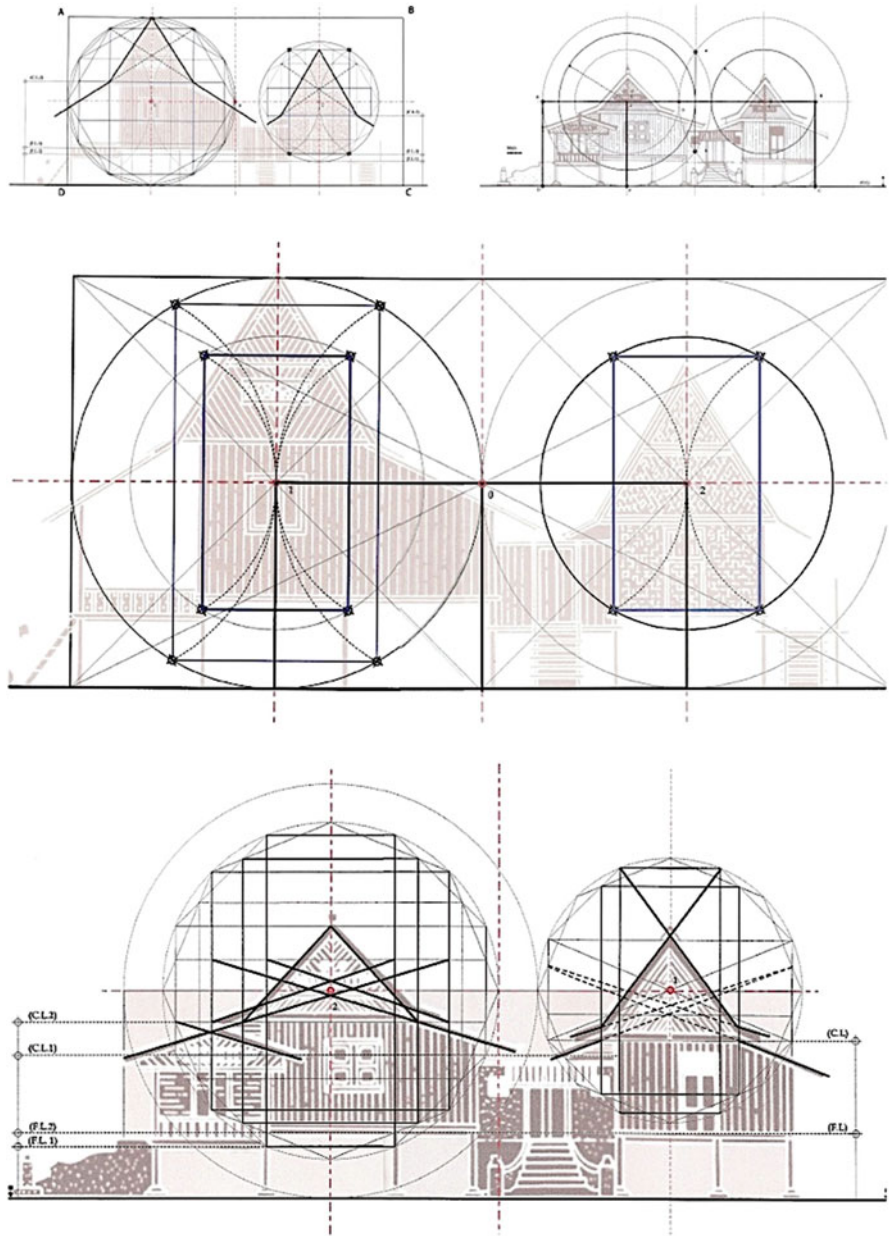
Fig. 13.7 Findings on Malay traditional houses' geometric analysis, completing the analyses that provide crucial evidence of advanced building sciences in Malay building tradition. Findings on Melaka 12 pillared house (H36) (*top middle*) and Melaka 16 pillared house (H42) (*bottom*) geometric analysis

addressing the lost wisdom that does however indicate and reveal the sophistication of the traditional Malay society and the imbued knowledge that they possessed in design and ornamentation, which was highly comparable to the knowledge of all the great civilisations.

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Chapter 14
Customer Satisfaction in Event Management Organized by District Islamic Religious Office (PAID) in Pahang

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Introduction

Event management activities serve to bridge the gap between organizations and customers. An event management is closely related to the management of the event, which includes managing the occasion as well as other functions related to the occasion. An event means a program that requires systematic planning and implementation through the establishment of committee members that will be beneficial to the customers [1]. In line with the increasing number of competition between private companies and the government, maintaining customer satisfaction is one of the top priorities to sustain goodwill with existing customers and attracting new ones [2]. As such, event management conducted by organizations needs to meet not only customers' satisfaction but also other areas such as communication and environment. Customer satisfaction is the benchmark that will determine the achievement of a company. It is a major criterion in determining the quality of services provided to the customers. It is also important to ensure the survival of an organization and to gain the trust of all parties. Drucker (1973) in Ksenia Novikova [3] mentioned that customer satisfaction has always been the goal of any activity organized by any organization or department. Meeting the needs of the customers and providing the appropriate environment for such event are a few mechanisms that can help to create customer satisfaction [4]. The problem usually occurs when the employees were unable to apply all those knowledge, especially while communicating with their customers.

This study would be beneficial to employees who worked with District Religious Office in increasing their customers' services skills while organizing events. Moreover, the result also would be beneficial to the senior management, especially

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a company that focuses on customer services to determine the suitable training for their employees. Besides that, this study should be beneficial to all managers, particularly those in the human resources department in choosing the right candidate to work in customer services department. Lastly, this study also would benefit academicians who are interested to broaden their knowledge in customer services. The theoretical framework and the operational definition of the variable used in this study were described further in the next section.

Literature Review

Quality service is regarded as one of the important elements for a service provider to survive and compete in the global environment. As such, it is pertinent for service providers to understand customers' expectations as well as perceptions. In addition, a good service provider must also comprehend the factors that will influence customers' evaluation and satisfaction of the service provided. This will lead to the retention of existing customers as well as attraction of new ones. The practice of excellent service quality has been proven to lead to increase the level of customers' satisfaction [5].

Delivering a quality of service to the customer requires both tangible and intangible aspects in a business transaction. Hence, service providers such as Jabatan Agama Islam Pahang (JAIP) have to understand customers' perception and expectation regarding the quality of services and how it can affect customers' satisfaction. Customers will make evaluation toward the quality of services based on their own expectation. Their subjective perceptions have a great impact on whether a service is a success or a failure. Service quality is conceptualized and measured by a different number of models.

Among these methods, the "SERVQUAL" model is widely accepted by many researchers [5]. Based on the study carried out by Ladhari [6], the "SERVQUAL" model is a good scale to use when measuring service quality in various industries. However, it is pertinent to choose the most important dimensions of this model to fit the particular service being measured. This is to ensure reliable and valid results. This model is chosen because it takes into account customers' expectation of a service as well as the perceptions of the service rendered. This is the best way to measure service quality in service sector [7]. The "SERVQUAL" model was proposed by Parasuraman, Berry, and Zeithmal in 1995 and comprised of five dimensions— tangibles, responsiveness, assurance, reliability, and empathy. Information gathered from the model would allow service providers such as JAIP to evaluate and reflect upon the services that they have provided. This would in turn ensure that these service providers would be able to realize if they had met or exceeded the service quality required of them.

According to Iwaarden et al. [8], tangibles can be defined as physical facilities, equipment, and appearance of personnel. In this study, tangibles refer to all the physical facilities and equipment provided by JAIP when they are in the process of
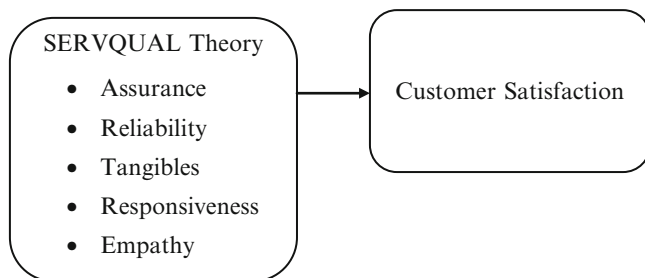
Fig. 14.1 Framework the relationship between SERVQUAL theory and customer satisfaction

providing a good service to customers. Appearance of personnel can be referred to appearance and characteristics of the customer service personnel when they entertain or treat the customers.

Reliability can be classified as the ability to perform all the promised services dependably and accurately [8]. When a service provider is able to produce and deliver prompt services according to customers' needs and wants, it demonstrates the service provider's reliability to the customers. Customer tends to shy away from a service provider who is unable to provide accurate and timely service as their level of satisfaction starts to decrease. Therefore, it is essential for a service provider to display good reliability in conducting their business with customers.

Iwaarden et al. [8] define responsiveness as the willingness to help customers and provide prompt service. From customers' point of view, when they experience any difficulties, the service provider should be able to handle, manage, and provide the final solution. It means that service personnel must always be available when the customers need their assistance. This will provide a good experience for customers, thus increasing the level of trust and confidence toward the particular service provider.

Assurance is a term that can be identified as the knowledge and courtesy of employees and their ability to inspire trust and confidence. This factor is related to the characteristics of the employees when they perform their task, duties, and responsibilities to the customers. This includes employees' competency, courtesy, credibility, and security [8].

The last factor in SERVQUAL is empathy which can be categorized as caring and individualized attention that the service providers give to their customers [8]. Empathy includes access, communication, and understanding the customers. Customer service personnel are advised to practice empathy when dealing and communicating with customers such as putting himself/herself in the customers' shoes [9]. The researchers have already discussed about the theory used to conduct this study, and therefore the research framework for this study is illustrated in Fig. 14.1.

The objectives of conducting this study were: (1) to measure and evaluate the quality of service provided by Jabatan Agama Islam Pahang (JAIP) based on the "SERVQUAL" model and (2) to evaluate the relationship of customer emotional

readiness to attend a program organized by religious offices and the level of satisfaction in the program. This study focused on the level of customer satisfaction with premarriage courses, which include the procedures and processes in the program, conducted by the religious offices.

Methodology of Research

This study was conducted among 300 participants who receive services from the offices of the District Religious Offices (PAID) in the state of Pahang. The study used a self-administered, Likert scale questionnaire and consists of two parts: demographic (part A) and the level of customer satisfaction (part B). Part B contains five elements: the effectiveness of the speakers (assurance), program content (reliability), quality equipment (tangibles), environment (responsiveness), and communication satisfaction (empathy).

Sampling

Two-level cluster sampling procedure was used to select the sample population for this study [10]. Three hundred sets of questionnaires were distributed to participants of the premarriage course conducted by the District Religious Office (PAID) in Pahang. There are 12 districts in Pahang and these districts have been further segregated into six zones. Based on random selection process, zones 2, 3, and 4 were selected for this study. The zones are Muadzam Shah, Kuantan, Maran, Temerloh, Jerantut, and Bentong. The number of participants who attend the premarriage course of each zone is different; hence, the researchers had randomly selected 100 participants for each zone. However, only 157 questionnaires were returned and the analysis was based on the returned questionnaires.

Instruments Reliability

Reliability, which describes the internal consistency of a set of items, was measured by Cronbach's alpha and item-total correlations. According to Sekaran [11], reliability score of less than .60 is considered to be poor, while those in the range of .70 are acceptable and those over .80 are considered good. The questionnaire used in this study scored an average of .80 and can be considered as good. The factor and reliability analysis results are summarized in Fig. 14.1.

Table 14.1 Sampling and return rate

No.	District	Sampling	Return rate
1.	Muadzam	50	24
2.	Kuantan	50	25
3.	Maran	50	27
4.	Temerloh	50	29
5.	Jerantut	50	25
6.	Bentong	50	27
	Total		157

Findings

Internal consistencies of constructs for each underlying variables were found to be good as indicated by the Cronbach's alpha value. Descriptive statistics about customers' demographic profiles, correlation, and regression analysis on the five factors toward customers' satisfaction in the service quality provided by JAIP was carried out.

One hundred and fifty-seven customers participated in the study in which 90 (57.3 %) were females and 67 (42.7 %) were males. The number of customers who are of Malaysian nationality was 151 (96.2 %), while 6 (3.8 %) customers are non-Malaysian. Majority of the customers are working in the private sector (83 or 52.9 %), 21 (13.4 %) are students, and 41 (26.1 %) are government employees. 95 (60.5 %) customers are in the 15–25 years age bracket, followed by 58 (36.9 %) in 26–35 years, 3 (1.9 %) within the age range of 36–45 years, and 1 (0.6 %) more than 45 years old. 71 (45.2 %) of them have SPM/STPM/Sijil or equivalent for the highest education, while 47 (29.9 %) are diploma holders and 39 (24.8 %) with Bachelor's/Master's/PhD degree. In order to examine the relationship between SERVQUAL and customers' satisfaction, Pearson Product Moment Correlation Coefficient was used. Correlation table among all measures was produced as shown in Table 14.1.

The correlation analysis showed that customers' satisfaction is significantly related to all of the five dimensions of service quality. In the table above, it shows that the correlation coefficient is positive (.715), indicating a positive correlation between service quality and customers' satisfaction. The table above also proved that there is a strong correlation between the two variables (.715), suggesting a strong relationship between service quality and customers' satisfaction. It indicates that if JAIP provides an increased quality of services, the customers will be more satisfied. Therefore, the researchers concluded that there was a positive and strong correlation between the two variables ($r = .715$, $n = 157$, $p < .0005$), with high levels of service quality associated with high levels of customers satisfaction.

Multiple regression analyses were performed to predict the highest relationship between SERVQUAL factor and customers' satisfaction. Table 14.2 shows that R-squared of 0.502 implies that the five factor variables explain about 50.2 % of the variance in the SERVQUAL.

Table 14.2 Factor and reliability analysis results

Factor	Name	Cronbach's alpha
1.	Tangibles	.838
2.	Responsiveness	.866
3.	Assurance	.765
4.	Reliability	.849
5.	Empathy	.812

Table 14.3 Customers' satisfaction on service quality

		Customers' satisfaction
	Pearson correlation	Sig. (2 tailed)
Service quality	0.715**	0.000

Note: **Correlation is significant at the 0.01 level (2 tailed)

Table 14.4 Multiple regression

Model summary[a]

				Std. error of	Change statistics					Durbin-
Model	R	R square	Adjusted R square	the estimate	R square change	F change	df1	df2	Sig. F change	Watson
1	.720[b]	.518	.502	.38463	.518	32.487	5	151	.000	1.656

[a]Dependent variable: compute_satisfaction2
[b]Predictors: (constant), mean_empathy, mean_reliability, mean_assurance, mean_responsiveness, mean_tangible

Table 14.5 Factors of customers' satisfaction

Coefficients[a]

		Unstandardized coefficients		Standardized coefficients		
Model		B	Std. error	Beta	t	Sig.
1	(Constant)	.601	.277		2.168	.032
	Mean_tangible	.178	.133	.163	1.345	.181
	Mean_responsiveness	.278	.127	.262	2.187	.030
	Mean_assurance	.165	.107	.161	1.541	.125
	Mean_reliability	.051	.091	.055	.557	.578
	Mean_empathy	.138	.108	.149	1.279	.203

[a]Dependent variable: compute_satisfaction2

As can be seen in Table 14.3, the responsiveness scale has a significant positive regression weight, indicating the participant agreed that the event's organizer is willing to help and provide a quick service to the customer with the highest beta of 0.262. It means that the variable makes the strongest unique contribution in explaining the dependent variable (Tables 14.4 and 14.5).

Conclusion

The findings from the survey revealed that there is significant and positive correlation between service quality and customers' satisfaction. It can be concluded that all five elements in SERVQUAL were very important in order to ensure the success of any event management at Jabatan Agama Islam Pahang. The result of this study also indicates responsiveness as the most important element in order to improve service quality. Therefore, employees at JAIP should improve their service by enhancing their willingness to help others and provide prompt services to the customers.

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Chapter 15
Client's Business Risk Assessment and Auditor's Test

Wan Mardyatul Miza Wan Tahir, Halil Paino, and Saharani Abdul Rashid

Introduction

Business risk is generally defined as the risk that an entity's business objective will not be attained as a result of the external and internal factors, pressures, and forces brought to bear on the entity and, ultimately, the risk associated with the entity's survival and profitability [1]. Business risk ultimately translates into the risk of financial statement error. Therefore, an approach which focuses on understanding a business, its environment, and business processes provides the best means by which an auditor will recognize risks with management fraud and business failure and thus reduce the room for any dysfunctional behavior by auditors [2]. Prior research has considered the impact of account-specific audit risk on evidential audit planning. There is some evidence that auditors adjust evidential planning for inherent and control risks [3, 4].

Research Objective

This study embarks on the main objective which is to examine the auditor's reaction in changing the audit procedures when a given business risk is accompanied by enhanced environmental factors.

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Literature Review

In an effort to improve the effectiveness of the audit by better understanding client business risk, audit firms need to reengineer their audit methodologies to focus the auditor's attention on the business risks in the organization whose financial statements are being audited [2, 5]. The audit methodology has been associated with changes in the scope of the audit planning and risk assessment process and in the related evidence gathering procedures. Thus, the proposed study is aimed to examine the influence of business risk on the auditor's identification of significant financial statement assertions and planned audit procedures. This is to be done by having further examination on the influence of business risk on the auditor's assessment of the likelihood of a material error in the financial statements.

Prior literature [6] suggests that the holistic perspective that auditors acquire in making business risk assessments influences their judgments by altering the auditor's tolerance for changes in accounts that are inconsistent with information about client operations. This suggests that auditors utilizing a business risk audit methodology may lead auditor to view business risk as an indication of possible misstatement in the financial statements. Reference [4] corroborated and extended the archival study of [3] by considering additional audit risk factors and expanding the study to include a sample of engagements and to include audits in a more recent time period. The results of both studies indicate a lack of strong relationship between account-specific client risks and audit program.

The shift from a financial statement risk approach to a business risk approach is predicted on auditors changing audit procedures with respect to identified business risks. However, given the prior evidence regarding a weak linkage between account-specific risk factors and audit program plans [3, 4], the maintained hypothesis that auditors change plans in response to business risks needs to be empirically validated. While prior research has focused on risks associated with receivables, payables, and similar accounts, this study focuses on the risks associated with achievements of business objectives that are generally classed as business risk.
Therefore, the hypothesis of this study is listed as:

H1: Auditors change audit procedures when a given business risk is accompanied by enhanced environmental factors compared to the same risk when it is not accompanied by such factors.

Research Methodology

To test the hypothesis that auditors change audit procedures in response to business risk, questionnaires have been distributed to 200 audit firms in Malaysia. From 200 questionnaires that have been distributed in January 2012 to August 2012, only 32 responses were received from the audit firms. Though, 23 are partners of the firm, 8 managers, and 2 supervisors. 28 out of 33 respondents have more than 10 years of

experience in auditing. 56 % of the respondents are above 40, and 44 % of them are not less than 30 years old. Thus, the participants are in a position to reflect seniority and experience in auditing field. 85 % respondents are male and the remaining 15 % are female. The survey provided with a statement of risk paired with the same risk accompanied by a statement of risk with additional issue that enhanced the business risk. The four statements of risks are (1) complex financial instruments, (2) ineffective tax planning, (3) management policies and procedures to protect against legal exposure, and (4) inadequacy of cash flow to meet current expenditure. Four planned audit procedures are provided to the risk. The auditors were required to rank 1 as the most important to 4 as the least important for the planned audit procedures regarding their importance to the given risks. Cross tab analysis and Wilcoxon signed-ranked test were utilized for the data analysis.

Result and Findings

The hypothesis of this study is to test whether auditors will change audit procedures according to client's business risk. Below are the summaries of the results on the auditors' level of importance (for the purpose of analysis, only the level of importance 1 and 2 by the auditors' rank were presented) in the audit procedures for each of the four risks, and they were paired with enhanced risks from the base risk.

Statement Risk 1

In the complex financial instruments, 15 auditors chose confirm balances with the counterparties and followed by 14 auditors that chose assessed valuation of the instruments by the specialist as the most important procedure (Table 15.1). However, in a situation where the clients were in the complex financial instruments added with the risk of volatility and poor performance in the equity market, 13 auditors chose test transactions as the most important procedure in the audit procedure. Next, eight auditors ranked assessed valuation of the instruments as the second important audit procedure. As can be seen, auditors changed the planned audit procedures according to clients' business risk as shown in Table 15.2, except for the assess valuations procedure.

Statement Risk 2

In the scenario of ineffective tax planning, 24 auditors believed that audit calculation of income tax provision was the most important audit procedure followed by 8 auditors who chose the test validity of amounts (Table 15.3). When the ineffective tax planning was added with significant changes in tax laws, the auditors still

Table 15.1 Number of auditors ranked the planned audit procedures in order of importance

| Procedures ranked | Planned audit procedures | | | |
	Confirm balances	Vouch journal entries and adjustments	Assess valuation	Test transactions
Statement of base risk				
Complex financial instruments				
1	15	0	14	1
2	16	5	3	2
Statement of base risk and enhanced by business risk				
Complex financial instruments with volatility and poor of performance of the equity market				
1	1	7	8	13
2	8	9	16	1

Table 15.2 The Wilcoxon signed-rank test for risk of complex financial instruments and its pair

| Wilcoxon signed-rank test | Planned audit procedures | | | |
	Confirm balances	Vouch journal entries and adjustments	Assess valuation	Test transactions
z	−0.5090	−4.000	−0.417	−4.000
Asymp. Sig (2-tailed)	0.000	0.000	0.677	0.000

Table 15.3 Number of auditors ranked the planned audit procedures in order of importance

| Procedures ranked | Planned audit procedures | | | |
	Audit calculation of the income tax provision	Test validity of amounts	Test recoverability of recorded deferred tax	Credit memo testing
Statement of base risk				
Ineffective tax planning				
1	24	8	1	1
2	8	24	3	1
Statement of base risk and enhanced by business risk				
Ineffective tax planning and significant changes in tax laws				
1	17	16	1	0
2	15	1	16	1

Table 15.4 The Wilcoxon signed-rank test for risk of ineffective tax planning and its pair

| Wilcoxon signed-rank test | Planned audit procedures | | | |
	Audit calculation of the income tax provision	Test validity of amounts	Test recoverability of recorded deferred tax	Credit memo testing
z	−1.633	−1.264	−4.463	−4.000
Asymp. Sig (2-tailed)	0.102	0.206	0.000	0.000

believed that audit calculations of income tax provision was the most important procedure by 17, auditors followed by 16 auditors in the test validity of the amount. As such, Table 15.4 showed that these two procedures were not significant and explained that the auditors did not change the procedures in this scenario.

Statement Risk 3

Majority of auditors will obtain attorney confirmation when their client's policies and procedures do not protect against legal exposure (Table 15.5). In this case, 21 auditors obtained attorney confirmation when the company's policies and procedures did not protect them against legal exposure, followed by 8 auditors on the sales cut-off testing. However, when client's policies and procedures do not protect against legal exposure arising in high sales return, 28 auditors ranked test on the sales cutoff as the most important procedure. On the other hand, only two of the auditors assess recorded balance representing probable losses as their main procedures. The Wilcoxon test shown in Table 15.6 clearly indicated that these three procedures were found to be significant, which explain why the auditors changed their audit procedure in this scenario.

Table 15.5 Number of auditors ranked the planned audit procedures in order of importance

	Planned audit procedures			
Procedures ranked	Obtain attorney confirmation	Assess recorded balance represent probable losses	Sales cut-off testing	Review capitalized cost
Statement of base risk				
Company's policies and procedures do not protect against legal exposure				
1	21	1	8	0
2	10	24	2	2
Statement of base risk and enhanced by business risk				
Company's policies and procedures do not protect against legal exposure arising in high sales return				
1	1	2	28	1
2	14	14	4	1

Table 15.6 Wilcoxon signed-rank test for risk of company's policies and procedures to protect against legal exposure and its pair

	Planned audit procedures			
Wilcoxon signed-rank test	Obtain attorney confirmation	Assess recorded balance represent probable losses	Sales cutoff testing	Review capitalized cost
z	−4.212	−3.345	−5.245	−1.667
Asymp. Sig (2-tailed)	0.000	0.001	0.000	0.096

Statement Risk 4

In the situation when client's cash flow is inadequate to meet its current expenditures, 24 auditors chose to obtain and review client's debt agreement, followed by 8 auditors that chose the assess going concern consideration as the most important procedure (Table 15.7). However, when client's had financial difficulty due to inadequacy of cash flows to meet the current expenditures as a result of expansion of operation, 15 auditors chose review capitalized cost as their main audit procedure. Another 14 auditors chose to assess the going concern as their most important procedure. Table 15.8 shows that all procedures were found to be significant, which explained the auditors would shift their audit procedure in relation to risks.

As conclusions, these findings support the hypothesis that auditors change audit procedures in accordance to risk factors, in this paper the clients' business risks.

Conclusion

This paper examines auditor's reaction toward business risk. Therefore, to test the hypothesis that auditors change audit procedures in response to business risk, questionnaires have been developed and distributed throughout Malaysia. The survey stated

Table 15.7 Number of auditors ranked the planned audit procedures in order of importance

Procedures ranked	Planned audit procedures			
	Obtain and review client's debt agreement	Assess going concern considerations	Impairment testing	Review capitalized cost
Statement of base risk				
Inadequacy of cash flows to meet current expenditures				
1	24	8	1	1
2	8	21	1	0
Statement of base risk and enhanced by business risk				
Inadequacy of cash flows to meet current expenditures due to expansion of operation				
1	0	14	1	15
2	15	3	2	16

Table 15.8 Wilcoxon signed-rank test for risk of inadequacy of cash flows to meet current expenditures and its pair

Wilcoxon signed-rank test	Planned audit procedures			
	Obtain and review client's debt agreement	Assess going concern considerations	Impairment testing	Review capitalized cost
z	−5.216	−2.828	−4.146	−5.138
Asymp. Sig (2-tailed)	0.000	0.005	0.000	0.000

a statement of risk paired with a statement of risk with additional environmental issues that will enhance business risk. The respondents, who are auditors, were required to rank the audit procedure based on the level of importance. The results show significant shift of audit procedures by the auditors in response to the clients' business risk. Therefore, this finding provides valuable information to the current literature evidence on business risk audit. However, this study conducted under a few limitations such as low respondents of survey only represents 16 % from 200 surveys distributed. Other research methods such as auditor interviews and laboratory experiments such as case study review would contribute more meaningful results.

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Chapter 16
Childcare Service Quality: Measuring Expectations of Working Parents Using SERVPERF Dimensions

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Introduction

The participation of both mother and father in the work force has become a common scenario in Malaysia nowadays. Due to the increasing cost of living, mothers need to work as well to financially assist the family. Working parents will normally spend around 8–9 h at work. During the working hours, it is impossible for the parents to look after their young children, thus creating the need for childcare service. The stress and worrisome about a child's well-being will definitely affect parents' focus and concentration at work. But high-quality services for young children which ensure that children have the opportunity to experience a stable and caring environment while the parents are away at work will give confidence to the parents to leave the kids in the care of the center.

However, over the years there has been a rise in reported cases of child abuse, negligence, and misconduct of behavior of the childminders in Malaysia.

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Yusof et al. [1] in [2] stated that the quality of childcare services in Malaysia has been far from satisfactory. Based on statistics released by Malaysian Department of Social Welfare, it was reported that in 2008, an average of seven children have become victims of child abuse each day [3], while between 2006 and 2008, there were 700 reported cases of child abuse in Malaysia [3].

The issues and incidents of child abuse have alarmed and become of concern to the working parents and the public as a whole. This has led to certain expectations among the parents on the quality of the childcare centers. Service quality is often measured based on customers' satisfaction. If the working parents' expectations on childcare service quality were met, then it would reflect the good service quality of childcare centers. Therefore, this study is conducted in order to measure the expectations of working parents towards the childcare service quality in Bandar Tun Abdul Razak, Jengka, and to determine whether there is relationship between service quality dimensions and working parents' satisfaction.

The Childcare

Family childcare, in most cases, is defined as a program in which a provider takes care of unrelated children in her own home [4]. The family childcare provider may be a neighbor, a friend, the woman down the street who cares for other people's children while raising her own, and/or someone who has chosen this as a career and business. Hernandez [5] as cited in [4] mentioned that the growing number of children being taken care of in a childcare or early education program is driven by increases in the number of women in the workforce, changes in family structure, and parents' desire to provide children with educational experiences to prepare them for school.

A trusted childcare center is prominent to ensure parents to balance work and family life, thus encouraging a good relationship between the caregivers and the children. Within this context, more mothers have entered the paid labor force and their children increasingly spend part of their time in non-parental care [6]. Here, childcare policies support enhanced practices for childcare and the outcomes for families and children in a number of ways.

In the Ninth Malaysia Plan, the provision of childcare centers merely focus on service as a measure to empower women to participate in the labor force while investment in preschool education is seen as human capital development [2]. Locally, a majority of working parents in Malaysia prefer to send their children to childcare center rather than employing domestic maids although public debate on the issues and incidents of the centers is indefinitely discussed [7]. Some of the incidents that took the lives of infants and toddlers in childcare centers in Malaysia are listed below:

- Seven babies were abused by the caretakers of a childcare service center in Taman Kota Masai where the babies were wrapped tightly in cloth and their mouths were taped [8].
- Two male infants died on the same day in Taman Permata, Ulu Klang, suspected to be suffocated due to choking on milk [9].

- Infant found in coma in Shah Alam suspected of having a fall [10].
- Two infants died in September [11].

Looking at the cases reported in the media, it appears that there were many anecdotes about poor quality of the childcare centers in Malaysia. An interesting quote on quality by [2] highlighted that:

> Quality childcare service is impossible without quality childcare providers.

This is supported by previous literature on childcare that reiterated on the notion of quality [12]. It is gathered in the survey that the quality of childcare centers is dependent on the locations and simultaneously affects the monthly fees [12]. Generally, higher quality of care is found at higher cost of living location. It is proven from this survey that the traditional triads of quality that consist of teacher and child ratios, teacher training, and group size are the most uniformly powerful associations with the observed quality of classroom processes.

Early researches on childcare quality have been widely discussed since the 1970s [7]. Researchers were interested to study the effects of childcare on children particularly on infant-maternal attachment and how variations in childcare affected children's development. In addition, new questions were asked about what constituted quality in childcare and how quality influenced children's development, especially in the areas of cognitive and social development. Then, discussions have changed to other areas of interest such as classroom composition, curriculum and program philosophy, physical environment, staff characteristics, adult-children interactions, and parent-staff communication.

Research in this area is greatly needed due to high demand for quality and affordable childcare center [13]. They argued on the difficulty of parents to select their childcare arrangements, and reasons to that are caused by limited economic resources and low availability of quality care arrangements in their area. Again, quality is heavily discussed in childcare centers.

SERVPERF Scales as the Quality Measurement Tool

Defining and measuring service quality is of importance to service providers. A firm cannot achieve success in today's business environment without delivering superior service quality, as it is the most powerful competitive trend shaping marketing and business strategy [14]. Thus, in order to examine the expectation of working parents towards the childcare service quality, the researchers have chosen to use Cronin and Taylor's [18] SERVPERF scales as the measuring instrument. SERVPERF scales basically measure the overall service quality performance of the childcare service provider in comparison to the Parasuraman et al. [15] SERVQUAL scales which were based on a difference score between customers' expectations of service and their perceptions after receiving the service [16]. The foundation of the quality measurement was initially introduced by Parasuraman et al. [15] using a tool called SERVQUAL. They believed that service quality should be represented as the difference or gap between service expectations and the actual service performance. If perception is equal to or more than the expectations, then the quality is sufficient [17].

The new five quality dimensions of SERVPERF scales which consist of 22 perception items on performance, thus excluding any consideration of expectations, have provided a more focus and more manageable framework or yardstick on service quality for the childcare center providers [18]. The dimensions of SERVPERF include tangibles, reliability, responsiveness, assurance, and empathy. Tangibles are referred to the physical evidence of the service. This would include physical facilities, appearance of personnel, tools or requirements, and physical presentation of the service center [19]. Reliability is the ability of the service provider to perform the promised services dependably and accurately [20]. Responsiveness would refer to the willingness to help customers and provide prompt service [20]. Assurance on the other hand refers to the employees knowledge and courtesy and their ability to inspire or instill trust and confidence in customers [20], while the last SERVPERF scale or dimension which is empathy is the caring, easy access, good communication, understanding, and individualized attention given to customers [20]. Knowing how customers make quality judgments can aid the service providers to provide better service operations and delivery in the future [21].

Cronin and Taylor found that unweighted SERVPERF measure performs better than any other measure of service quality and that it has greater predictive power than SERVQUAL [22]. They argue that current performance best reflects a customer's perception of service quality and that expectations are not part of this concept.

Methodology

The population for the study consisted of working parents who send their children to the childcare centers in Bandar Tun Abdul Razak, Jengka. Eight childcare centers, having the same facilities and providing the same type of services, were identified and selected in order to maintain generalizability of the childcare centers as the sampling frame for the whole population of working parents. These childcare centers are registered with the Social Welfare Services Department in Maran. Convenient sampling technique was used in selecting the samples. This is due to the unavailability of list of customers from some childcare centers (where the issue of confidentiality was raised up). Based on the sampling frame, the researchers then conducted a quantitative descriptive survey where 92 sets of structured questionnaires adapted from Cronin and Taylor [18] SERVPERF questionnaire were distributed. The questionnaires were collected back a week later with the help from owners of the childcare centers. A high response rate of 80 % was received for the study.

The questionnaire was designed to capture some information on demographic, and also the five dimensions of SERVPERF consisted of tangibles, reliability, responsiveness, assurance, and empathy. Respondents were required to rate the dimensions based on a five-point Likert scale items with 1, "strongly disagree," to 5, "strongly agree." In the last section, respondents were asked to rate the childcare service quality's importance based on SERVPERF dimensions with 100-point indicator.

The data was analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. Procedures used include the descriptive statistics for mean, frequency, and percentage and followed by reliability test, normality test, and correlation test.

Results and Findings

Reliability and Normality Analysis

Table 16.1 depicts the Cronbach's alpha scores for the five SERVPERF dimensions. The reliability analysis used the Cronbach's alpha as the reliability coefficient. The reliability scores obtained range from 0.815 to 0.927. According to [23], the closer the Cronbach's alpha to 1, the higher the internal consistency reliability. Therefore, the reliability for all dimensions studied is considered as high as it was above .70. Hence, the data suggested that the questionnaire was a good and reliable instrument for testing the working parents' perception towards the service quality of the childcare centers in Bandar Tun Abdul Razak, Jengka.

The result for the test of normality is shown in Table 16.2. The scores obtained on each variable in the study should be normally distributed [24]. This can be tested by inspecting the values of skewness and kurtosis. Whether or not the normality of a distribution is rejected will depend on the ratio of skewness to its standard error and the ratio of kurtosis to its standard error [25]. Based from the values of skewness and kurtosis, the data was found to be reasonably normally distributed which is between ± 2.0.

Table 16.1 Cronbach's alpha scores for SERVPERF scale

Scales (dimensions)	Number of items	Reliability coefficient (alpha)
Tangibles	5	.815
Reliability	5	.900
Responsiveness	4	.832
Assurance	4	.902
Empathy	3	.927

Table 16.2 Normality test result

Scales (dimensions)	Skewness
Tangibles	−.661
Reliability	−.191
Responsiveness	−.046
Assurance	−.910
Empathy	−.422

Table 16.3 Demographic profile of respondents

Personal variables	Frequency	Percentage
Number of children sent to childcare center for each parents		
1	51	64.6
2	22	27.8
3	4	5.1
4	2	2.5
Total	**79**	**100**
Status		
Parents	79	100
Custodians	0	0
Total	**79**	**100**
Title/position held		
Government staff	66	83.5
Private sector staff	7	8.9
Others	6	7.6
Total	**79**	**100**

Demographic Profile of Respondents

The profile of respondents participated in the study is shown in Table 16.3. Frequency distributions were obtained for all the personal data. The profiles of the respondents include number of children sent to the childcare center by each parents, parental status, and the parents' position. The majority of 64.6 % of respondents have only one child staying in the childcare center, while the remaining 35.4 % have more than one child staying in the childcare center. All of the respondents (100 %) were the parents of the children. The data shows 83.5 % of the respondents held positions in the government sector, while the remaining 16.5 % either work with the private sector or doing miscellaneous work.

The Five SERVPERF Dimensions

The following tables illustrate the results from the analysis of data on the respondents' expectations on the service quality performance of the childcare center. The analysis involved the use of descriptive statistics of mean and standard deviation.

Table 16.4 shows the mean score for the overall satisfaction and also the overall mean score for each dimension of the SERVPERF service performance among the respondents based on Likert scale ratings. The mean of 4.11 for overall satisfaction reflected the agreement of satisfaction by working parents towards childcare service quality in Bandar Tun Abdul Razak, Jengka. The result also ranked responsiveness as the utmost important in terms of performance expectations of respondents

Table 16.4 Overall mean scores for five SERVPERF dimensions

Dimensions	Mean	Std deviation
Overall satisfaction	4.11	.480
Responsiveness	4.25	.498
Assurance	4.19	.608
Reliability	4.16	.515
Empathy	4.07	.668
Tangibles	3.87	.584

towards the childcare center providers. The result indicates a high agreement among respondents with the mean score of 4.25 and the standard deviation of .49.

The dimension of assurance has been ranked second in the expectation list of the respondents with the mean score of 4.19 and the standard deviation of .60. Though it has been rated second after responsiveness, the researchers believe that it is still very important for the childcare center to provide enough assurance to the parents in order to ensure they could focus on their work while the children are at the care of the centers. Reliability and empathy ranked four and five, respectively, while tangibles have been ranked as the least important dimension among the respondents' expectation list of quality performance of the childcare centers.

Further results of descriptive statistics for the dimensions of SERVPERF which consist of tangibles, reliability, responsiveness, assurance, and empathy are shown in Table 16.5. The findings recorded that the respondents placed convenient hours of operations as the main important element of expectation under the dimension of tangibles with the mean score of 4.22, while modern equipment ranked last in the list of service quality expectation with the mean score of 3.58.

The findings show that respondents expected the service providers to be reliable as the items of providing service at the promised time and keeping parents informed about when services will be performed were ranked first and second with the mean score of 4.30 and 4.27, respectively. Providing service right the first time is also highly expected by the respondents as shown through the mean score of 4.06. The respondents also expected the childcare center staff to be courteous while rendering the service to them as the mean score shows the highest agreement of 4.38 among other items in responsiveness dimension of SERVPERF. Though ranked last, the item of prompt service to parents still shows quite a high agreement among respondents with the mean score of 4.19.

Staffs that instill confidence in parents and making parents feel secure in their transaction with the center are the two main items of assurance dimension that respondents expected from the childcare center. Both items have the same high mean scores of 4.27. The results show that parents really need the childcare center staffs to convince them that their children are well taken care of and are safe in the care of the center throughout the children's stay there. Though the item is ranked last in the dimension, the finding shows quite a high agreement among the respondents in getting individual attention when dealing with the childcare center with the mean score of 4.10.

Table 16.5 Descriptive statistics of SERVPERF dimensions

Items	N	Mean	Std deviation
Tangibles			
Modern equipment	79	3.58	.810
Visually appealing facilities	79	3.77	.750
Neat and professionally appearing staff	79	4.09	.683
Visually appealing documentation	79	3.73	.729
Convenient hours of operation	79	4.22	.872
Reliability			
Providing service as promised	79	4.13	.607
Dependability in handling parents' problems	79	4.08	.764
Performing service right the first time	79	4.06	.585
Providing service at the promised time	79	4.30	.563
Keeping parents informed about when services will be performed	79	4.27	.499
Responsiveness			
Prompt service to parents	79	4.19	.601
Willingness to help parents	79	4.22	.613
Readiness to response to parent's request	79	4.24	.604
Courteous staff	79	4.38	.626
Assurance			
Staffs who instill confidence in parents	79	4.27	.635
Making parents feel secure in their transaction with the center	79	4.27	.674
Staffs who have the knowledge to answer parents questions	79	4.14	.729
Giving parents individual attention	79	4.10	.727
Empathy			
Staffs who have the parents best interest at heart	79	4.04	.724
Staffs who deal with parents in a caring fashion	79	4.08	.694
Staffs who understand the need of parents	79	4.10	.727
Valid N (listwise)	**79**		

The last dimension of empathy of the SERVPERF instrument shows the respondents expected the staff of the childcare center to understand the needs of the parents which in a way also represent the need of the children. The high mean score of 4.10 for the item as well as the other two items shows how high the expectation of the parents is in getting the empathy of the childcare center when dealing with the needs of both the parents and children.

Table 16.6 below shows the ranking of five SERVPERF dimensions based on 100-point indicator allocated by respondents. The points reflect how important each of the features is to them pertaining to the childcare service. The higher the points, the more important a feature is to the respondents. Thus, on average, we can see that respondents assigned most points to reliability, followed by assurance, responsiveness, empathy, and lastly tangibility.

The correlation analysis was carried out in order to find out whether there is any relationship between service quality perceived by working parents (which represented by SERVPERF dimensions) and their satisfaction in childcare services.

Table 16.6 Ranking of five SERVPERF dimensions according to respondents' important points allocation

Dimension points	Mean	Std deviation
Reliability points	21.66	6.712
Assurance points	21.13	4.532
Responsiveness points	20.49	5.834
Empathy points	18.71	5.188
Tangibility points	17.41	5.291

Table 16.7 shows the result of the correlation matrix. The table basically summarizes the correlation among the variables.

From the table we can see that all variables have strong positive relationship and significantly correlated with customers' overall satisfaction. All values are extremely high at 0.700 and above. The correlation between assurance that is employees' knowledge and their ability to instill confidence in customers and the overall satisfaction shows the strongest relationship that is 0.878 with $p < 0.001$.

Conclusion and Recommendations

The first 5 years of a child's life has long been acknowledged by psychologists as important for their formative years [2]. The problem of choosing the right caregiver, a good substitute for the parents, is very hard, and the consequences of a wrong decision can be very detrimental to the child's personality development. Therefore, it is of utmost importance for the parents to seek for quality childcare center to ensure the proper upbringing of their children in their early years.

The study managed to determine the childcare service quality in Bandar Tun Abdul Razak, Jengka, based on working parents' expectations using quality measurement tool of five SERVPERF dimensions. The customers which referred to the working parents sending their children to the childcare centers were found to be highly satisfied with the childcare services provided by the childcare centers in Bandar Tun Abdul Razak, Jengka.

Based on the findings, the researchers could conclude that the childcare centers had provided up to expectation services which are synonymous with the culture of the mostly Malay residents in Bandar Tun Abdul Razak, Jengka. A community with lower individualistic culture is closely knit and highly interdependent among themselves [26]. Therefore, the findings of the research show that the service providers gave their best in not disappointing the customers by giving the due service as expected. Childcare centers play a major supporting role as it does not only support working parents but also a promising entrepreneurial business for providers. The tasks of nurturing the young ones with love, care, and safety should not be taken for granted.

Table 16.7 Correlation matrix between overall satisfaction and SERVPERF dimensions

		Overall satisfaction	Tangibles	Reliability	Responsiveness	Assurance	Empathy
Pearson correlation	Overall satisfaction	1.00	.721	.861	.862	.878	.855
	Tangibles	.721	1.00	.566	.445	.497	.493
	Reliability	.861	.566	1.00	.749	.733	.600
	Responsiveness	.860	.445	.749	1.00	.723	.717
	Assurance	.878	.497	.733	.723	1.00	.704
	Empathy	.855	.493	.600	.717	.704	1.00
Sig. (1 tailed)	Overall satisfaction	.	.000	.000	.000	.000	.000
	Tangibles	.000	.	.000	.000	.000	.000
	Reliability	.000	.000	.	.000	.000	.000
	Responsiveness	.000	.000	.000	.	.000	.000
	Assurance	.000	.000	.000	.000	.	.000
	Empathy	.000	.000	.000	.000	.000	.

$N = 79$

In order to ensure a high childcare service quality in Bandar Tun Abdul Razak, Jengka, the researchers suggested that continuous training or in-service training in the field of child development be provided to the childminders as they need to have new knowledge and better understanding of the aspects of children's psychology. This would help them to cope with the children's demanding attitude and needs, thus providing the service as expected. It is also suggested that the owners of the childcare centers should be very selective in hiring childminders. The staffs selected should be someone who is really keen in child development as the persons who care for the children represent the single most important factor in establishing quality services. Staffs who enjoy and feel confidence in their work, who are warm and caring towards children, and who provide a stimulating environment ensure quality. On the part of the government and the employers, it is recommended that they gear more efforts to provide nurseries in their organizations. Therefore, the researchers suggested that in-depth research on the fees and affordability of the parents should be conducted in the future.

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Chapter 17
Certified *Halal* Logo: The Importance Towards Muslim Customers in Bandar Pusat Jengka, Pahang

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Introduction

There is no doubt that demand on *halal* products has become very important and powerful economic value in today's world. It is not constrained to Muslims only but also to non-Muslim consumers which are from varied races, culture, and beliefs. To be a good Muslim, it is a person's responsibility to search and consume only *halal* food and beverages. *Halal* food is very healthy and hygienic because it is approved for doing good things. According to Shafie and Othman [13], taking *halal* food is connected to having a peace of mind. Malaysia as a multiracial and multicultural as well as *halal* hub country has great potential in attracting the local and international tourists in exploring its unique gastronomy particularly *halal* food and Islamic dietary law. Today, Malaysians enjoy and are grateful for the enormous choice of foods and drinks. Shaari and Mohd Arifin [12] stated that Muslims accumulating 60.4 % of the population in the country have to be selective in accordance to the Islamic law:

> One of the verses in the *Quran* keep reiterated on eating nourishing food like Surah Al-Baqara.

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O ye who believe! Eat of the good things that We have provided for you, and be grateful to Allah, if it is Him ye worship. (*Surah Al-Baqara* [The Cow], verse 172)

The display of *halal* logo in an eating establishment plays a significant role in convincing the customers mainly the Muslims to visit and dine without having any suspicions on the purity of the food. In Malaysia, the activities of controlling, monitoring, and regulating *halal* food products sold in Malaysia and export market are under the supervision of Jabatan Kemajuan Islam Malaysia/Department of Islamic Development Malaysia (JAKIM) [9].

The Demand for *Halal* Food

Halal product is widely recognized for their quality assurance. Meanwhile, the *halal* logo has become a symbol of good quality product. The global demand for *halal* food in accordance to Shariah compliant will continue to rise with a huge global demand. Islam is the basis of public and private life in Muslim nations [18]. This indicates that Islam has inspired the way of life of a Muslim and food consumption is one of them. With the growing number of Muslim population worldwide, the demand for *halal* food is simultaneously at an increasing rate. Zailani et al. [17] highlighted that the world Muslim population has been growing rapidly from 1.84 billion in 2007 to approximately 3 billion in 2010. Al-Nahdi et al. [2] on their survey found that majority of Malaysian Muslim considers the concept of *halal* as vital before consumption on patronizing *halal* restaurants.

As claimed by Muhammad [11], *halal* has now become a universal concept due to the increasing demand by both the Muslims and non-Muslims worldwide that seek clean, healthy, and safe food. Due to the number of foodborne illnesses such as mad cow disease and bird flu virus, there was an increase in sales throughout Moscow, the Philippines, and the United Kingdom. Within this context, the 4.5 million Muslims in France, 7.5 % of the total population, consume 300,000 t of meat products every year through 3,000 independent butcheries and chain supermarkets for a total sale of 3 billion Euros [3].

Halal Attributes

According to Essoussi and Zahaf [5], trust is the main factor raised when consumer deals with certification and relationship with the farmers. Certification may result consumer to feel a great deal better and safer. Nevertheless, trust plays a crucial point in relation to patronizing a restaurant and remains a public debate. Muslims in Malaysia are in worries about the issues of halalan toyyiban (wholesome) of food quality in the food supply chain as reported by Abdul Talib et al. [1]. As a result, majority of the Muslim consumers feel relief on the existence of the certification.

The other factor is on cleanliness. In the Holy *Quran*, the importance of cleanliness has been highlighted in many verses:

> Truly, Allah loves those who turn to Him constantly and He loves those who keep themselves pure and clean. (*Surah Al Baqara 2:222*)

> In it (mosque) are men who love to clean and to purify themselves. And Allah loves those who make themselves clean and pure. (*Surah Al Baqara 9:108*)

The concept of *halal* and *haram* (prohibited) cannot be separated from Islam as a way of life. Besides *halal*, we must strongly emphasize on cleanliness, especially in the context of foods and drinks. Wan Hassan and Hall [16] mentioned that Muslims are sensitive with the food they eat which must be clean and prepared in a right manner and they must avoid any forbidden items. Again, *Quran* had stressed that it will keep them faithfully clean and pure when a Muslim is eating only *halal* food.

Food quality seems to be important as Islam has set two essential criteria for food consumption, namely, *halal* that is permissible by Islamic *Shariah* and *toyyib* which refers to good quality food as explained by Shaikh Mohd Salleh [14]. In essence, food purity is knotted with food quality and creates the healthfulness (*halalan toyyiban*) of the *halal* food that complied with the Islamic dietary rules. According to Golnaz et al. [7], food purity aspects concern on ways the food is handled with a high level of hygiene, safety, nutrition, and meeting certain standard of cleanliness. It is unquestionable that food purity has become part of human necessity in ensuring healthy lifestyles to all races and religions.

Another important attribute of *halal* logo is it represents food safety. It means that to have food in good quality, it needs to ensure that it is safe and no side effects to a person's health. Food safety as known as risk perceptions or concerns about the properties of unfamiliar foods, as claimed by Grunert [8]. It is also supported by Giusti et al. [6] that food safety is focused on the presence of toxic compounds normally contained in foods, contaminants, mycotoxins, pathogens, and toxigenic microorganisms.

Food traceability has been identified as another important attribute to *halal* logo. It is the duty of a Muslim to recognize the resources and ingredients contained in the *halal* food and drink that goes into their mouth. This is supported by Zailani et al. [17] that traceability represents the ability to identify what is exactly happening to the products at any stage in the supply chain cycle starting from the farm where it is grown until transmitting it to the end phase of the finish products. Food traceability has its tracking system which is able to spot, if there is, any sign of contaminations and to remove products that are hazardous to customers' health [10].

Methodology

A convenience sampling method in this survey has adopted using personal approach on 200 respondents and only 165 valid questionnaires were completed and returned and further analyzed. Data were then entered into the Statistical Package for Social Science (SPSS) version 18. Most of the respondents were

Muslim customers as Bandar Pusat Jengka is a remote town in the state of Pahang, Malaysia, where it is predominantly inhabited by Malay settlers. However, there are also government and private sector employees including schoolteachers and university staffs as well as business owners and other individuals that represent the general demographic profiles.

Findings and Analysis

The importance of *halal* logo is measured in this section and respondents are given questions on the importance of *halal* logo, religious knowledge, confidence level, the display of *halal* logo, private *halal* certifiers, and their intention to visit a *halal-certified* restaurant if operated by a non-Muslim.

Table 17.1 indicates that respondents agreed that *halal* logo is important before patronizing a restaurant with a high mean of 4.79. Al-Nahdi et al. [2] supported this as Muslim customers always seek for *halal* logo as a prevalent factor before consumption. The religious knowledge of the Muslim customers has also guided them in making the decisions before eating. It is shown that the mean value is 4.79 and highlights that spiritual value is relevant in knowing the source of food. This is in line with what has been mentioned by Dahalan [4].

Trust is also prevalent as the respondents agreed that *halal* logo can increase their confidence level with mean value of 4.07. Shafie and Othman [13] have reiterated that trust and confidence would develop peace of mind. However, the Muslim customers had neutral opinions if all restaurants that display *halal* logo serve *halal* food and *halal* logo is the same despite of several private *halal* certifiers apart from JAKIM that showed mean values of 3.33 and 3.06, respectively. Due to the fact that noncertified *halal* issuers are still in operation despite the enforcement of the *Halal* Act, respondents were quite cautious. The results also demonstrate that the majority of the respondents will not visit a *halal*-certified restaurant although it is operated by a non-Muslim with a mean value of 2.79.

Table 17.1 Descriptive statistics for the importance of *halal* logo

Item	N Statistic	Mean Statistic
Halal logo is important before patronizing a restaurant	165	4.79
My religious knowledge has guided me in choosing the food that I want to eat	165	4.79
My confidence level increases when I see the *halal* logo	165	4.07
All restaurants that display *halal* logo serve *halal* food	165	3.33
Halal logo is the same despite of several private *halal* certifiers apart from JAKIM	165	3.06
I will patronize a *halal*-certified restaurant although it is operated by a non-Muslim	165	2.79
Valid N (listwise)	165	

Conclusion

Halal has always been a marking for the majority of Muslim followers before patronizing restaurants. *Halal* concept also had its own regulations as stated in the *Quran* [15]. The result from the survey discussed in this paper has identified that Muslim customers in Bandar Pusat Jengka, Pahang, have particular concern on the *halal* logo displayed at an eating establishment. Their religious knowledge has guided them in selecting food in restaurants. Thus, this belief intended to protect the politeness of individual life as to encourage the best dietary habit granted by Allah SWT. Based on the findings it showed that the trusted *halal* logo from JAKIM displayed at the eating establishments would gain confidence to the respondents. Besides that, respondents are willing to patronize *halal*-certified restaurants even though it is operated by non-Muslims.

This study is very significant in terms of its contribution to hospitality industry particularly the restaurant sector. A *halal*-certified restaurant needs to realize that the importance of *halal* logo may not only attract Muslim customers but also their non-Muslim relatives and friends. It also contributed benefits and knowledge to the local authorities in preparing the government's project to become the greater *halal* hub and *halal* market in the coming decades. This study grants the evidence that almost all of the respondents of *halal*-certified restaurants seek the *halal* logo before patronizing an eating establishment. It is gathered that *halal* logo certified by JAKIM is a trusted mark in building the confidence level among the Muslim customers. The demand on *halal* logo is growing inevitably and restaurant customers in Malaysia have high expectations towards the *halal* logo.

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Chapter 18
Awareness on Legal Rights and Data Protection in SNS: The Case of Facebook in Countryside Campus

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Introduction

Nowadays, social networking site (hereinafter as SNS) has become the most popular website that is surfed by people, especially the youth. SNS also becomes a new information and communications technology (ICT) tool for people to communicate with each other at different geographical areas. The present research will focus on Facebook as it has the most users recently, gaining rapid popularity [1] nowadays, yet we also have other famous SNS such as Twitter, LinkedIn, Foursquare, MySpace and Friendster. Statistics until December 2011 show that Facebook has 800 million users worldwide [2], and only 12, 159, 260 among them are Malaysian users who have Facebook account [3].

Facebook is a social communication tool designed to allow users to contact and communicate with other users [2]. They are connected together to communicate, collaborate, share ideas and keep updating with the Entire friends matter without boundaries. Facebook allows their users to send messages, upload photos, update status and locations and describe the personal interests such as favourite movies, books and dramas. In addition, Facebook provides a "wall" where users can post any messages to user's profile and attach any linkages, photos and videos. Facebook also provides a function where users can create a group for any invited users based on their same schools, same interest, same class or anything. Many people utilized

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Facebook as communication tools such as uploading of photos, setting different languages in Facebook, the use of games or useful applications, using Facebook platform in other websites and linking users' phone and other third-party companies' to Facebook.

Background and Motivation

As SNS is a type of online community that has grown tremendously in popularity over the past years [4], privacy issues have become the major concern for users, especially the youth. The disclosed information may somehow expose them to various cybercrimes and cyberattacks, such as sexual harassment, unauthorized use of data, suicide, production of obscene material and infringement of copyright [5]. People seem to forget that they are revealing their personal information to those who are not in their circle of friends as Facebook has become a part of daily life for many people because of easy and convenient communication. They tend to do that by exposing and revealing personal information such as status and uploading inappropriate pictures which make them famous among friends and attract friends to view their profile.

There are several legal provisions dealing with the usage of SNS. Facebook users will find that their identity or data might be stolen by others and they are exposed to cyberporn, sexual harassment and copyright infringement involving videos and pictures which lead to breach of the terms used. The Computer Crimes Act 1997, Communication and Multimedia Act 1998 and Penal Code are dealing with the issues involving cybercrime in Malaysia. However, the focus of this paper will be on data protection and privacy which is the main concern among young generation when using SNS. On the part of protection of personal data and privacy when using SNS, the law has become an important mechanism looking for either statutory obligation or case decided by judges. Currently Malaysia has passed the Personal Data Protection Act 2010 (hereinafter known as PDPA 2010) which was gazetted in June 2010. The act covers personal data used for commercial purpose under Section 4 and must fulfil three requirements: (a) being processed wholly or partly by means of equipment operating automatically in response to instructions given for that purpose; (b) being recorded with the intention that it should wholly or partly be processed by means of such equipment; or (c) being recorded as part of a relevant filing system or with the intention that it should form part of a relevant filing system that relates directly or indirectly to a data subject, who is identified or identifiable from that information [6]. Below are the seven (7) data protection principles that form the basis of PDPA 2010:

- *The General Principle*: Personal data can only be processed once the data subject has given his consent.
- *The Notice and Choice Principle*: Data users must inform the data subject about the purpose of the personal data being collected and processed.

- *The Disclosure Principle*: Subject to consent of the data subject; personal data shall not be disclosed for any other purposes other than the purpose for which it was disclosed.
- *The Security Principle*: A data user must take practical steps to protect the personal data from loss, misuse, modification, unauthorized or accidental access or disclosure, alteration or destruction or being given to unauthorized parties.
- *The Retention Principle*: The personal data processed shall not be kept longer than necessary for the fulfilment of the purpose.
- *The Data Integrity Principle*: The data user must take all reasonable steps to ensure that the personal data is accurate, complete, not misleading and kept up to date, having regard to the purpose for which the personal data was collected and processed.
- *The Access Principle*: A data subject must be provided access to his personal data held by the data user and be able to correct his personal data.

A person will face a fine not exceeding RM300,000 and/or imprisonment for a term not exceeding 2 years if convicted with breach of the above seven data protection principles under Section 5(2) PDPA 2010. Furthermore, Section 2(1) of PDPA 2010, however, stated that the processing of the data is only applicable for commercial activities. These activities might include commercial nature like exchange of goods or services, agency, investment, financing, banking and insurance. However, there has been argued that the act itself does not include data protection over non-commercial activities. It seems difficult to draw a line between the personal data that had been used for commercial and non-commercial purpose [6]. The act itself has two types of exemption: total and partial. Any personal data processing from personal, family/household affairs and recreational purpose are exempted from the application in the act. Partial exemption is applicable when data processing involves crime and taxation, physical and mental health, research, statistics, journalism, literature and arts [6, 7]. The act may cover personal data used for commercial activities such as online shopping and promotion of goods or services, but not personal data used for other non-commercial area. The question here is that did this non-covering of non-commercial activities affect the usage of SNS especially by young generation? Would their personal information or pictures stored in the SNS be open to abuse and misuse by other parties?

Secondly, privacy becomes another issue when using SNS. Tagging pictures and videos are another example of the privacy concern within Facebook. Even if the user has the opportunity to restrict their privacy, there is no legal framework addressing this concern [8]. In Malaysia, the Federal Constitution did not mention specifically on the right of privacy. However the case of Sivarasa Rasiah v. Badan Peguam Malaysia & Anor. [2010] 2 MLJ 333 recognized the right of privacy as including rights of life protected under Article 5 of the Federal Constitution. In statutory laws and regulations, several statutes dealing with privacy are as follows: the Birth and Death Registration Act 1957, the Child Act 2001, the Law Reform (Marriage and Divorce) Act 1976, the Penal Code, the Private Healthcare Facilities and Services Act 1998, the Communication and Multimedia (Licensing) regulations 1999, Private Hospitals Regulations 1973and the Bank Negara Guidelines on Data

Management and MIS Framework [6]. Recently, there has been a controversial issue regarding the amendment to Section 114A of the Evidence Act 1950 which means a person who is depicted in a publication as the owner or administrator is presumed to have published the contents [9]. It raised the concern of manipulation by others that concern with privacy. Unfortunately, the right of privacy has not been considered actionable per se by court in the case of Ultra Dimension v Kook Wei Kuan [2004] 5 CLJ 285 that involved infringement of photo to a group of kindergarten pupils for the purpose of advertisement. However, the breach of privacy was being considered in the case of Maslinda bt Ishak v Mohd Tahir bin Osman & Ors [2009] 6 MLJ 826. In this case the court allowed damages to be given to the appellant when her picture squatting and urinating in the truck had been taken without permission by an enforcement officer in a raid. Even though this case allowed the expansion of rights of privacy towards woman's photograph, there is much concern on the possibility of the picture being posted on SNS. Malaysian court should take positive approach in determining the concept of privacy pertaining to the cyberspace. Thus, the law of privacy in Malaysia needed to address within specific legislation and extend the rights of privacy to the use of SNS [7, 8, 10].

Thus, the present research will investigate the awareness of UiTM Pahang students towards their legal rights and protection especially on personal data and privacy when surfing on SNS. Through education and awareness, users will more willingly and effectively utilize privacy and security settings available on SNS [11].

Related Work

The present research focuses on the youth, as the majority of Facebook users are between 18 and 24 years old [12]. Similarly, other statistics (www.socialbakers.com) show the same result as 34 % of Facebook users in Malaysia are aged 18–24. Young adulthood is the time where individuals often learn new skills, experience new things and experiment with changes [13]. It has led to the issue on the protection on their personal data and privacy within cyberspace. Data protection law has emerged as the new area and many countries have enacted the legislative mechanism [5–7]. Previous studies have been done and have engaged on privacy concerns and risk taking related to disclosed personal information in SNS, especially Facebook [4, 12–18]. Mostly users are aware of the risks on disclosing too much information [15], but somehow they do not have much time to change the privacy settings [4, 11, 17] and feel comfortable to disclose the personal information. General privacy and identity information disclosure are of greater concern to women than men [13]. The more the data exposed to the public, the less awareness of users towards the personal data, and only few users change their privacy settings [12]. Therefore, individuals with SNS account have greater risk taking attitude than those who do not have an account, and mostly women have the concerns on privacy and identity information than men [14]. Individuals who have the self-disclosed

intentions exposed themselves to a negative impact on their social life and personal life [18]. Age and relationship statuses in Facebook account were important to determine the disclosure of information. As age increased, the disclosures also decreased [14]. These shows contradicted by a research finding [16] where most of university students are concerned about their privacy.

Research Methodology

The preliminary step involved is library-based research which analyses the legal position on data protection and privacy through legislations, books, journal articles and websites. In order to look into the response from students, a survey has been conducted. The survey is adapted from [4, 12, 13, 15–17] researches and modified by the author to make it suitable for Malaysian students in UiTM Pahang and strengthen the information available in the survey. The questionnaires consisted of five main parts: (1) background information, (2) information disclosure, (3) student awareness on risks which could occur once information was disclosed, (4) Facebook terms and use and privacy policy, and (5) students' awareness on the legal rights and data protection. Participants consist of 274 students aged 18–24 from various fields of study. Participants were approached and asked to complete a survey form.

Findings and Analysis

This study aims at finding the awareness of UiTM Pahang students towards the legal rights and data protection. Samples of 300 students were selected randomly from different fields of studies in UiTM Pahang. A net of 274 questionnaires were filled correctly and returned. 43.1 % of the respondents were males and 56.9 % of them were females. On the other hand, approximately 51.8 % of the respondents were in the age of 20 years old. Regarding the field of study of the respondents, most of them were from Science and Technology field (66.8 %), while from Social Science and Humanities field and Management and Business field were only 9.1 % and 24.1 % respectively.

Table 18.1 shows the percentage of respondents who share their information in Facebook. 87.2 % of the respondents include the picture of themselves on profile. Furthermore, almost 57.7 % include their e-mail address on their profile. Approximately 35.4 % include their instant messaging address. 67.5 % use their real name on their profile. Interestingly, a small percentage of the respondents include their phone number and home address with 5.8 % and 8.4 %, respectively.

Overall, 68.6 % of respondents were aware of the risks occurring once they disclose their private information in Facebook. See Table 18.2. Table 18.3 shows that 110 female respondents are more concerned with the risks of exposing personal information than male respondents. This study suggested that male respondents are comfortable

Table 18.1 Percentage
of respondents who share
personal information in
Facebook

Category	Frequency	Percentage (%)
Picture of themselves	239	87.2
E-mail address	158	57.7
Instant messaging	97	35.4
Phone number	16	5.8
Home address	23	8.4
Real name	185	67.5

Table 18.2 Percentage of respondents who were aware of the risks which could occur once information was disclosed

Category	Frequency	Percentage (%)
Yes	188	68.6
No	86	31.4

Table 18.3 Number of respondents who were aware of the risks which could occur once information was disclosed (categorized by gender)

		Gender		
	Category	Male	Female	Total
Are you aware of the risks that could occur once you disclose your personal information on Facebook?	Yes	78	110	188
	No	40	46	86

Table 18.4 Percentage
of respondents who read the
Facebook privacy policy

Category	Frequency	Percentage (%)
Yes	123	44.9
No	151	55.1

with how much information they revealed in online social networking site. This study finding is supported by the research conducted by Campbell et al. (2001), which concludes that even though individuals express concerns and awareness about Internet privacy, they are still willing to engage in risky online activities.

Table 18.4 shows the percentage of respondents who read the Facebook privacy policy and those who did not read before. To begin with, 44.9 % of respondents read the Facebook privacy policy, while 55.1 % did not read it. There are several reasons identified why respondents did not read the Facebook privacy policy. See Table 18.5. 43.4 % of respondents agreed that it takes too much effort to read the Facebook terms of use and privacy policy, and 33.6 % of them expressed to choose that the Facebook privacy policy was difficult to understand. The other respondents stated that they were not aware of the policy and they trust Facebook so much so that they did not have to read the policy. About 0.4 % of the respondents were missing. This finding was supported by the research done by Ofcom [19] where the lack of the awareness, too much effort, too much trust on online social networking site and low level of confidence in manipulating privacy settings are the factors why people are unconcerned about the risks that could occur.

Table 18.5 Reasons why respondents did not read the Facebook privacy policy

Category	Frequency	Percentage (%)
Take too much effort	119	43.4
Lack of awareness	54	19.7
Trust Facebook so much	8	2.9
Difficult to understand	92	33.6

Table 18.6 The percentage of respondents who were aware they have the rights of data under a law and awareness towards PDPA 2010 in Malaysia

Category	Frequency	Percentage (%)
Aware have the rights of data under a law	189	69
Aware Malaysia has PDPA 2010	85	31

Table 18.6 shows that 69 % of respondents were aware that they have the rights to have their personal information protected from being manipulated and misused by a third party under the law, especially in the Internet or social networking site. Unfortunately, only 31 % of respondents were aware that Malaysia has PDPA 2010, the act that protects personal data processing by others in commercial transactions either stored or recorded or managed automatically or as a file system to avoid them from being misused.

At the end of the survey, respondents were asked to change the privacy settings in Facebook. Fortunately, 83.2 % agreed to change the privacy setting especially on the personal information in Facebook. This indicates that increasing awareness of privacy might result in a more careful behaviour in online social networking.

Conclusion and Recommendations

Online social networking offers new opportunities for interaction, collaboration and communication in an easy and inexpensive way to maintain the existing relationship. In this study, we have reviewed earlier research on privacy issues related to social networking sites and presented the results of our empirical study among UiTM Pahang students. Therefore, this study found that majority of the UiTM Pahang students were aware of the issues on legal rights and were concerned about their data protection. In addition, these students still continue to use Facebook but have changed the privacy settings in their profile after completing the survey. This might be due to the publicity and education given on privacy concerns about online social networking though the previous cases happened in Malaysia and from the online and offline discussion by people in the surroundings.

Furthermore, the privacy policy of Facebook largely took a lot of efforts to be understood by the respondents and the language used is difficult to understand. However, many of the respondents were awakened by the survey and decided to pay more attention to their privacy settings in the future.

Overall, this study is important because it provides the evidence on the awareness of users towards the PDPA 2010 and laws pertaining to privacy in Malaysia, which is a new field to be explored as there are only a few research done in relation to SNS.

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Chapter 19
Change of Age-Specific Fertility Curves in Peninsular Malaysia: An Approach of Functional Data Analysis

Hazlenah Hanafiah and Abdul Aziz Jemain

Introduction

Speaking on global issue that most contributed to national development which has indirectly participated to the low fertility rate has to be treated seriously. Study by Y. Kinfu [1] revealed that though Addis Ababa was well known as a high-fertility nation, however, there are some cities in Africa experiencing obvious transition towards the fertility level of below 2. The dramatic increase in number of singles and delayed marriage and declination in marital fertility are crucial factors that lead to below-replacement fertility. Nevertheless, P. E. Lam [2] addressed that the continuous deterioration in fertility had caused the emerging of age crisis in Japan. The national development may be affected mainly in the aspect of sufficient workforce supplies which cause the massive and noncontrollable influx of illegal immigrants. In Peninsular Malaysia, there is a similar indication on the existence of intergenerational fertility behavior phenomenon among Malays (Puzziawati) [3]. On the contrary, changes in the pattern of delayed childbearing are more prominent among the Chinese and Indians.

Even though several researches have been carried out on fertility, they were concentrated more on discrete data. Therefore, this study attempts to introduce functional approach that has been vastly used in many researches recently (Ramsay and Silverman [4]). Nonparametric smoothing and functional principal component that has been proposed by Hyndman and Ullah [5] is mainly represented in this paper. Of late, the fertility issues have experienced some improvement due to the utilization of functional paradigm. Hyndman had played a main role in consistently highlighting functional approach at most recent research, especially in the

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demographic aspect. One of the advantages of functional analysis is that it allows simplifying of the nonparametric smoothing procedure. Meanwhile, findings in Shaista Alam et al. [6] showed that a complex dynamic interaction between family planning and socioeconomic changes may cause to sufficient fertility decline. The information obtained mainly acts as an important resource in boosting up the fiscal development, especially in controlling family planning program, pensions, and health and welfare services.

Data Sources and Methodology

Data was sourced from the vital statistics report which is prepared by the Department of Statistics, Malaysia. It covered age-specific fertility rate and midyear female population estimates in Peninsular Malaysia for the period of 38 years, from 1968 to 2005. Age-specific fertility rate is defined as the number of births by mothers within a specific age group during a given year, per thousand females in that age group, while midyear female population estimates by age group are prepared by taking into account the annual natural increase without the migration component based on the given age group.

Initially, the fertility rate will be transformed to logarithm form for the purpose of shrinking. The data is written as $\{x_i, y_t(x_i)\}$ where x_i denotes the centre of age group $i = 1, \ldots., p$ and $y_t(x)$ represents log fertility rates at age x in year t. The basic idea of functional data analysis is to convert the discrete data to continuous form by adopting a set of basis functions whereby all the information obtained will be based on the given functional data. The underlying smooth function, $f_t(x)$, which was obtained through the nonparametric smoothing process using weighted B-splines is shown in Eq. 19.1:

$$y_t\left(x_i\right) = f_t\left(x_i\right) + \sigma_t\left(x_i\right)\varepsilon_{t,i} \qquad (19.1)$$

where

$\sigma_t(x_i)$ allows the amount of noise to vary with x and
$\varepsilon_{t,i}$ is an iid standard normal random variable.

Basically, the loadings of functional principal component are in the form of functions where the extracted principal components are also known as harmonics. In the case of fertility data, a suggested set of basis functions with order $K = 3$ should be used to obtain the minimal mean integrated squared error (MISE). The decomposition of fitted curves by basis functions expansion can be expressed by the following model:

$$f_t\left(x\right) = \mu\left(x\right) + \sum_{k=1}^{K}\beta_{t,k}\varnothing_k\left(x\right) + e_t\left(x\right) \qquad (19.2)$$

where

$\mu(x)$ = central tendency of $f_t(x)$
$\varnothing_k(x)$ = set of orthonormal basis functions
$e_t(x)$ = model error which normally distributed with zero mean

Results and Discussion

Since 1968, the fertility rate shows a downward trend as indicated in Fig. 19.1a. In line with the national development, the level of awareness on the importance of education among the Malaysian citizen has increased particularly towards female children. The increased number of school enrolment among female students affects the fertility pattern for mothers within the age range of 15–20 years. Over the past few decades, the number of birth by mothers of all age group has explicitly dropped. Table 19.1 shows that mothers aged 25–29 years had the highest fertility rate with averagely 208 babies per 1,000 women. A huge change can be observed for the age range of 15–20 and 40–50. This could be related to the phenomenon of delayed marriage or remaining single among women in Peninsular Malaysia. The increased
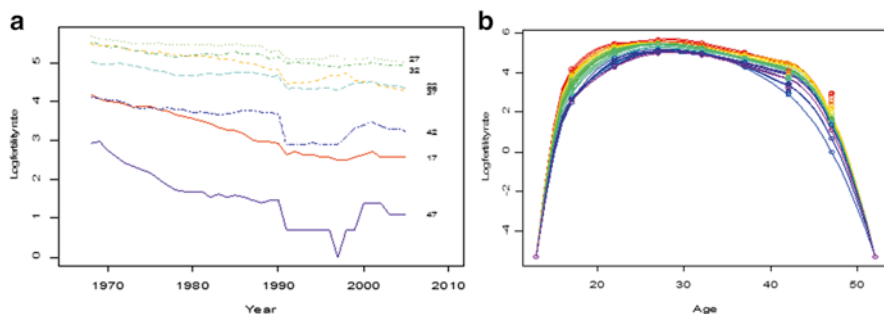
Fig. 19.1 Time series trend of log fertility rates (**a**) and smoothed log age-specific fertility rates (**b**)

Table 19.1 Descriptive information on age-specific fertility rate

Mothers' age group	Mean	Standard deviation
15–20	28.2	16.16
20–24	144.4	51.78
25–29	207.6	41.82
30–34	171.3	30.52
35–39	104.4	23.49
40–44	36.8	12.78
45–49	5.8	4.55
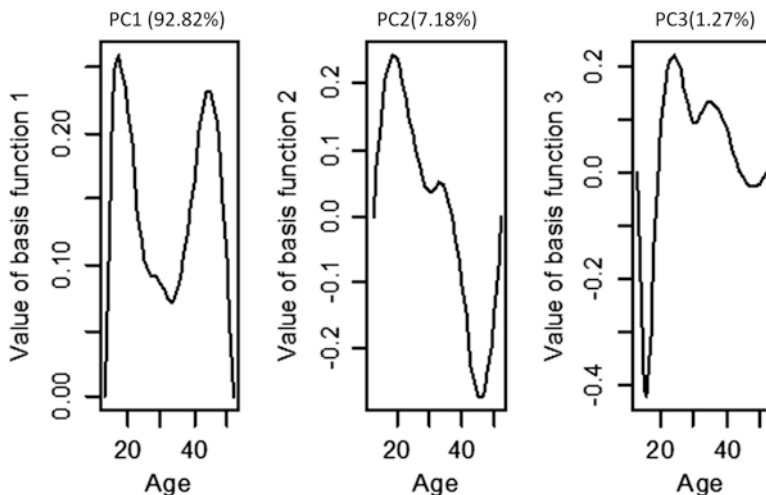
Fig. 19.2 Decomposition of fitted fertility curves

number of female students in higher learning institutions and inclination towards modern lifestyle that emphasizes more on career development rather than on family matters has contributed to the drastic decline of fertility among mothers within the age range of 40s. Smoothing process using *weighted B-spline* as indicated in Fig. 19.1b shows a clear visual presentation on fertility changes for each age group mother in Peninsular Malaysia. Even though there is an emergence of decline pattern on log fertility rate for the past 38 years, the changes are not apparent towards mothers at aged 25–35 years.

By means of functional principal component analysis, the graphical presentation in Fig. 19.2 illustrated that fertility function is decomposed into three principal curve components according to the large variation. The form curve model can be explained as follows:

(a) ϕ_1 = Mothers towards ages 20s and 40s
(b) ϕ_2 = Mothers at early 20s
(c) ϕ_3 = Mothers towards age 30s

The study reveals that the three underlying fertility curve components explained 90.82 %, 7.18 %, and 1.27 % of the total variation, respectively, with the remaining of 0.73 %. One can observe that the first curve component described that there is a large variability of fertility rate for mothers towards 20s and 40s. These two segments are highly correlated. Further, it is in line with the existence of awareness on the importance of education for both male and female children which may benefit to the aspect of quality life. Therefore, log fertility rate contributed by these groups shows a drastic and consistent falling especially after the 1970s. The deficiency of parents in emphasizing the importance of education onto their respective daughter

experienced a kind of paradigm shift that caused the increment of female students in primary and secondary schools after the independence period. This phenomenon is associated with the functional model in which the second curve component is describing fertility variation changes among mothers at early 20s. Finally, when considering the third curve component which was monopolized by fertility rate among mothers towards age 30s, marriage and family issues are only taken into account after enhancing their career prospect. There is a gradually downward change on fertility among these age group mothers.

Conclusion

This paper proved that the rapid development on the national modernization had revealed a direct impact towards a sharp fall in fertility in Peninsular Malaysia. Besides, mothers at age group 20s and 40s contributed to the large variations on fertility changes. Therefore, we believe that at this moment, parents had created awareness by providing better education background to their female children, whereas before, they were more focused on facilitating only male children with formal education. Generally, the fertility rate persistently signified a downward trend over the past few decades. This would lead to alarming a bad signal towards realizing population growth which may help spurring the economics advancement. In line with this, a prompt action should be taken particularly on implementing policy that is in relation to family planning, pensions, and expenditure on health and welfare services.

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Chapter 20
Intention to Whistle Blow Among Accountancy Students in Malaysia

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Introduction

Whistle blowing is defined as a process of disclosing ill practices in the business world. It supports the desires of integrity in the code of conduct. According to [1], whistle blowing activity on organisational wrongdoing has the potential for many positive outcomes for the organisation. The researchers are interested with this topic as they realise the imperative of providing whistle blowing protection in the corporate world. The objective of this study is to determine the factors that influence accountancy students' intentions to whistle blow.

Literature Review and Hypotheses Development

Perceptions on Ethics and Morals

Perceptions are commonly seen as the ability of human mind to guide morals and ethics. Morals are the differentiation between good and wrong instilled by standards, while ethics are the rule of conduct in a particular group [2]. Perceptions are easily influenced by institutional, personal and organisational factors [3]. A research by [4] found that there is a positive relationship between personal perceptions. [17] who conducted a study towards auditing students found that perceptions on ethics will affect students' intention to whistle blow.

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H1: There is a significant relationship between accountancy students' perceptions on ethics and moral with intentions to whistle blow.

Organisational Relationships

Emotion in a relationship involves individual mood and personality. A study by [5] indicated that emotions in a relationship had significant relationship with the action of consumer and play a vital role in organisational climate. Meanwhile [6, 7] concluded that positive emotions lead to supportive behaviours, greater mutual achievement and a more preferable future relationship and encouraged superior flexibility and creativity in problem solving. A study by [8] also indicated that whistle blowers are more satisfied with their job and have higher level of job commitment.

H2: There is a significant relationship between accountancy students' organisational relationship with intentions to whistle blow.

Consequences

According to [8], whistle blowing activities involve self-sacrifice. This is because whistle blowing may result in swift punishment. These harmful consequences of whistle blowing activity, suffered by some whistleblowers, are labelled as retaliation. In their study towards 2,188 federal government servants in the USA, [8] found that a whistle blower is less concerned with consequences compared to inactive observer. This is also consistent with [9, 10] who concluded that retaliation by management will affect the intention to whistle blow. Examples of retaliation in a workplace can be in terms of termination, downgrading and disagreement of promotion, loss of income and unfriendly working environment.

H3: There is a significant relationship between blowing the whistle consequences and intentions to whistle blow.

Research Method

Population chosen by the authors was the accountancy students that already learnt corporate governance. Most of the students are final year accountancy students. This is supported by [11, 12] who conducted studies on whistle blowing towards final year accountancy students. In this study, the respondents are from two public universities and three private universities in Malaysia. The data of the study were collected using questionnaire which was adapted from [13, 14]. Three hundred questionnaires were distributed which resulted to 87 % response rate.

Table 20.1 Relationship between research variables

		Intent	Consequence	Perceptions	Emotions
Intent	Correlation coefficient	1.000	.097	.165[**]	.220[**]
	Sig. (2 tailed)	–	.117	.007	.000
	N	261	261	261	261
Consequences	Correlation coefficient	.097	1.000	.306[**]	.258[**]
	Sig. (2 tailed)	.117	–	.000	.000
	N	261	261	261	261
Perceptions	Correlation coefficient	.165[**]	.306[**]	1.000	.335[**]
	Sig. (2 tailed)	.007	.000	–	.000
	N	261	261	261	261
Emotions	Correlation coefficient	.220[**]	.258[**]	.335[**]	1.000
	Sig. (2 tailed)	.000	.000	.000	–
	N	261	261	261	261

**Correlation is significant at the 0.01 level (2 tailed)

Out of this number, 67 % are female respondents. The study is conducted on students with varied academic performance which are measured based on their CGPA; 60.5 % of the respondents have CGPA of 3.00 and above. Previous researches [12, 15–17] showed that gender and academic performance affect the intention and judgement on ethics.

Findings and Analysis

Reliability and Normality Analysis

The authors have conducted reliability and normally tests towards all 23 items in the questionnaire. For the reliability test, Cronbach's alpha achieved 71.1 % which shows that there is a high level of internal consistency. In terms of normality test, normality cannot be assumed as the Kolmogorov-Smirnov test indicated the p-value of less than 0.05 for all items.

Correlation Analysis

Spearman rho correlation coefficients (*rs*) presented in Table 20.1 are used to assess the relationship between the variables investigated in this study.

The results indicated that there is a positive significant correlation between accountancy students' perceptions towards ethics and moral with the intention to whistle blow (p-value < 0.05). It shows that the accountancy students' perceptions do affect their intention to whistle blow. This result is supported by [17]. There is

also significant positive relationship between emotion and relationships with the intention to whistle blow (p-value < 0.05). This indicates that accountancy students are more willingly to whistle blow if they are influenced by their emotions and their relationships among colleagues. A study by [18] also showed that the observers of deviant behaviour are more likely to speak up to authorities when they feel angry or offensive towards an offender. However, the study did not find any significant relationship between consequences of whistle blowing with the intention to whistle blow. This is also consistent with [9] which concluded that retaliation does not deter whistle blowing. Hence, only H1 and H2 are accepted in this study.

Conclusion

The intentions of blowing the whistle among accountancy students are affected by perceptions and emotions and relationships. It shows that accountancy students today are concerned with the issues of ethics. Hence, accountability among accounting profession can be improved in the future. However, accountancy students' intention is not influenced by consequences such as media attentions and retaliations.

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Chapter 21
Family-Controlled Companies and the Issuance of Going-Concern Opinion in Malaysia

Mohammad Noor Hisham bin Osman and Siti Zaidah binti Turmin

Background

Incidents of major corporate collapses particularly the Enron and WorldCom cases demonstrated the importance of appropriate issuance of GC opinion. When Enron faced serious financial problems, Arthur Anderson, the accounting firm, did not issue any GC opinion, causing the stakeholders to lose billions of dollars after the company suddenly collapsed. In Malaysia, however, it is a common practice of not issuing GC opinion to appropriate situation. The Financial Statement Review Committee (FRSC) of Malaysian Institute of Accountants highlighted that the most common flaw in financial statements under their review was in the assessment of the appropriateness of GC assumption [1, 2]. Earlier, Zarinah Anwar, the Chairman of Securities Commission (SC) of Malaysia, was at least in two occasions questioned about the practice of Malaysian auditors in issuing GC opinion to selected distressed companies only (see [3, 4]).

This study attempted to examine the association between Malaysian family-controlled companies and the issuance of GC opinion. Malaysia is a worthy context for such study for at least three reasons. Firstly, Malaysia is going towards improving corporate governance practice particularly in terms of transparency, as it has been highlighted in the government's New Economic Model and Economic Transformation Programme initiatives. Secondly, family-controlled companies form a significant proportion of total Malaysian PLCs, and the inappropriate issuance of GC opinion is a critical issue among this group of companies (see [1, 2]). Thirdly, the Malaysian literature on GC opinion issuance is underdeveloped

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(see [5, 6]). Therefore, the findings of this study are relevant not only for Malaysian context but also for other countries of less litigious such as the Eastern European and Asian countries.

Problem Statement

Due to the importance of corporate governance factors in influencing auditors' judgements in issuing a GC opinion as well as the lack of studies on the area (see [5–8]), this research attempted to examine the relationship between family-controlled companies as one of the corporate governance factors and the issuance of GC opinion by the auditors. The examination of family-controlled companies was due to the significant existence of this type of business in Malaysia [9]. Specifically, more than two thirds of the Malaysian companies (i.e. 67.2 %) surveyed by [10] were family-owned companies [11]. Therefore, it is believed that the effect of family control on the propensity of GC opinion issuance deserves an empirical assessment.

Objectives

The general objective of this proposed study was to examine the association between family-controlled companies and the issuance of GC opinion. Given that a family-controlled company is operated in two ways (i.e. proportion of founding family board directors and family shareholding), the specific objectives were outlined as follows:

1. To determine the association between the proportion of founding family directors in the corporate board and GC opinion
2. To examine the association between family shareholding and GC opinion

Going-Concern Opinion

International Standard on Auditing (ISA) 570 defines the GC concept as a business that its operation is continuing for a predictable period in the future. GC is an accounting assumption that should be applied in a financial statement preparation unless there is an intention of the management to liquidate the business entity, to cease the business operation or in the condition that there is no realistic alternative but to do so [12]. Pertinent to this concept, ISA 570 in Paragraph 6 and Paragraph 7 mentioned that it is auditors' responsibility to obtain sufficient audit evidence on the

appropriateness of management's use of GC assumption in the preparation and presentation of financial statements of businesses and to conclude whether there is an uncertainty about the businesses' ability to continue as a GC entity.

Literature Review

According to Clinger III and Morin [13], a family-owned company can be seen as a business entity that is owned or managed by more than one member of the same family. A family-owned business is claimed to have low cost of corporate governance (i.e. cost of special accounting system, security system, policy manual, legal documents, and other mechanism to reduce theft and monitor employees' work habit). This might due to relationship and trust between employees and managers in a family-owned business. The business and economic landscape throughout the world are dominated by closely held and family-controlled companies [13]. Global companies like Samsung, LG Group, Carrefour, Fiat Group, Cargill, Mars, Ford, Walmart, and Peugeot Group are some examples of closely held and family-controlled firms with USD$250 billion revenues [13]. Family-controlled companies form two thirds of all private enterprise in Australia, 70 % companies in Brazil, 90 % in Chile and the United States of America, 80 % in Finland, and 75 % in the United Kingdom [13]. In Malaysia, 67.2 % of companies are family-owned companies [11].

Agency theory argues that the presence of family as company board members will increase the possibility to obtain a qualified audit report. Based on agency theory, the family dominance in family-controlled companies is expected to be associated with lower level of board independence, higher agency cost, and lower level of corporate transparency. Also, the tendency of board members to pressure the auditors in issuing a clean report decreases due to lower cost of receiving adverse opinions. Furthermore, as family influence increases, the probability of shareholders taking punitive action decreases [7].

Previous studies on predictors of GC opinion are plenty (e.g. [6, 14, 15]). However, only Ballesta and Garcia-Meca [7] assessed the association between family control and the issuance of such opinion. The study was conducted upon the population of all Spanish non-financial companies listed in the Madrid Stock Exchange during 1999–2002. The study investigated the effect of ownership concentration, board ownership, board size, and family members' influence on audit report. Results of the multivariate logistic regression indicated that, among others, the more family members in the board, the more likely the companies to receive a qualified audit opinion [7]. This paper is an extension of Ballesta's work as it focuses on the effect of family control on the GC opinion decision in the Malaysian context. There are two measures for the family control: (1) the proportion of founding family directors and (2) family shareholdings.

Table 21.1 Descriptive statistics 1

| | Financial year | | | | | | | |
| | 2010 | | 2009 | | 2008 | | Total | |
Types of opinion	No.	%	No.	%	No.	%	No.	%
Non-GC opinion	6	35	1	17	4	36	11	32
GC opinion								
Unqualified (EOM)	4	24	1	17	3	28	8	24
Disclaimer	6	35	4	66	4	36	14	41
Qualified	1	6	–	–	–	–	1	3
Total	**17**	**100**	**6**	**100**	**11**	**100**	**34**	**100**

Research Method

Study sample consisted of Bursa Malaysia's PN17 companies for the year 2008–2011. PN17 companies are companies that fall under Bursa Malaysia definition of listed companies having financial and operational distress. Distress companies were taken as sample because ISA 570 mentioned that GC opinion is appropriate for companies facing financial problems. This sampling strategy is consistent with prior studies on antecedents of GC opinion [16, 17]. Data were collected through electronic sources, mainly via company's annual reports retrieved from Bursa Malaysia websites.

Results and Discussion

Descriptive

A total of 50 companies were listed as PN17 by Bursa Malaysia between 2008 and 2011. However, only 34 companies published annual reports in a financial year after they were listed as PN17 companies. The remaining 16—four PN17 companies did not release their latest annual report yet during data collection and 12 others were already delisted from the bursa.

Table 21.1 shows that from 2008 to 2010, there is around 68 % of PN17 companies which received GC opinion. In most cases, auditor issued disclaimers to these companies (61 % of GC opinion recipients), even though this is opposed to ISA 570 [12] which prescribed that more appropriate opinion for distressed companies is qualified with emphasis of matter on GC issues. Additional details about the data are provided in Table 21.2.

Table 21.2 Descriptive statistics II

	Min.	Max.	Mean	S. dev.	Skewness	Kurtosis
FMDIR	0	0.80	0.17	25.342	1.363	.727
FMOWN	0	0.43	0.03	9.164	3.463	12.182
AUDSIZE	0	1.00	0.38	0.4933	0.507	−1.856
CLSIZE	0	346.7 mil.	90.2 mil.	89.4 mil.	1.264	1.302
FINDIST	0.007	747.52	22.82	128.052	5.831	33.999

Multivariate Analysis

Direct logistic regression was performed to assess the factors influencing GC status among PN17 companies. The regression model is as follows:

$$GCOPIN = b_0 + b_1 FMDIR + b_2 FMOWN + b_3 AUDSIZE - b_4 CLSIZE + b_5 FINDIST + e$$

where

GCOPIN = GC opinion equal to 1, else equal to 0 [5, 6]
FMDIR = Percentage of family directors on board
FMOWN = Percentage of family ownership
AUDSIZE = Big 5 audit firms = 1, else = 0
CLSIZE = Natural log of sales revenue [5, 6]
FINDIST = Total liabilities/total assets

The model contained two independent variables (percentage of family director on the board and percentage of family ownership) and three control variables (audit firm size, client size, and financial distress). The full model containing all predictors was statistically significant [x^2 (5, $N=34$) $=18.31$, $p<0.05$], indicating that the model was able to distinguish between GC companies and non-GC companies. The model as a whole explained between 41.6 % (Cox and Snell R square) and 58.1 % (Nagelkerke R square) of the variance in GC status and correctly classified 82.4 % of cases.

Table 21.3 shows that family control variables did not possess any significant effect on GC opinion decision, which is inconsistent with Ballesta and Garcia-Meca [7] who reported the presence of high concentration of family members in board highly influenced auditors to issue GC opinions. In addition, this study also discovered that the size of audit firms and their clients has no impact on GC opinion decisions in Malaysia. The only variable that could predict GC opinion is the financial distress, i.e. debt ratio ($p=0.059$). Furthermore, the odd ratio of 81.94 indicated that the companies facing financial distress over 81 times were more likely to report GC status than those who did not have financial distress problem. The significance of debt ratio is predictable because ISA 570 prescribes that the main factor casting doubt to GC assumption is financial distress.

Table 21.3 Logistic regression predicting going-concern status among PN17 companies

	B	S.E.	Wald	df	*p*	Odds ratio	95 % C.I. for odds ratio	
							Lower	Upper
Percentage of family director	0.004	0.044	0.006	1	0.937	1.004	0.920	1.094
Percentage of family ownership	0.667	0.951	0.493	1	0.483	1.949	0.302	12.568
Audit firm size	1.308	1.272	1.057	1	0.304	3.700	0.306	44.799
Client size	0.000	0.000	1.358	1	0.244	1.000	1.000	1.000
Financial distress (debt ratio)	4.406	1.800	5.992	1	0.059	81.944	2.407	2,790.157

Conclusion

This study assessed the impact of family control on the possibility of auditors to issue GC opinion to distressed companies. Analysis produced no association between the two variables. The findings showed that Malaysian auditors do not differentiate whether a client company is a family business or not when they make GC opinion issuance decision. The findings did not support agency theory explanation which suggests that high degree of family control is associated with lower level of board independence, leading to GC opinion issuance by the auditors. This is also inconsistent with a report by Ballesta and Garcia-Meca [7] who found that in Spain, which is also a less litigious context like Malaysia, there was a positive impact of family ownership on GC opinion issuance. This is a strange development because Malaysian family-controlled businesses are known to be associated with lower level of transparency (e.g. more likely to manage earnings [18] and are expected to be more likely to receiving GC opinion. In conclusion, the findings of this study show that there is a big question mark on the audit quality provided by auditors in this country.

The main limitation of this study was that the sample size was relatively small and the year of coverage was not very recent but only up to 2010. This project, however, opens door to several potential future studies. The association between family control and GC opinion issuance by adopting other measures for the family control concept can be further studied. A method developed by Amran and Che Ahmad [19] should be considered. The authors suggested that a company is rated as family controlled if (1) the CEO is the founder of the company or is related by blood or married to the founder, (2) at least two family members involve in managing the company, and (3) with family ownership of 20 % or more [19]. Furthermore, future studies should also explore the effect of control by management, institutions, and government on the issuance of GC opinion.

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Chapter 22
Counselling Students' Perceptions Toward Integrating Spirituality into Counselling Among Children

Peter Wong Sin On

Introduction

A Viennese psychiatrist who survived the brutalities of World War II concentration camps, Victor Frankl [1], says that the spiritual dimension cannot be ignored, for it is what makes us human [1]. While there has been an emerging number of literature on spirituality within the last two decades, the recent trend in research on spirituality also increasingly involved children and adolescents [2].

Despite the large quantity of literature, there has been no commonly accepted definition on spirituality so far. Spirituality could denote different connotations to people of different backgrounds, and even people of similar profession may not share the same meaning. For the purpose of this paper, spirituality is defined as 'the motivational and emotional source of an individual's quest for a personally-defined relationship with people and the non-human environment; for some, it includes a connectedness with a higher being leading to enhanced feelings of well-being, inner peace, and life satisfaction' [3, p. 624]. Spirituality is differentiated from religion as everyone can have his/her sense of spirituality, including an atheist. However, not everyone adheres to religious beliefs [3]. This could be contrasted in the more institutionalised religion, which also comes with moral component, while spirituality does not necessarily have a moral component [4].

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Spirituality and Children

Although the integration of spirituality into the helping professions was initially recognised in medicine and nursing, spirituality is today incorporated in other helping professions which include counselling and psychotherapy. Similarly, the integration of spirituality across varying disciplines has been examining its significance in the lives of not only adults but well-being of the young people as well [2].

Children have been often referred to as the 'future generation', as they are portrayed as growing beings who are not yet mature particularly in the developmental models such as those proposed by Piaget, Fowler, Goldman, Kohlberg, and Erikson. Dillen [5], an academic in the field of pastoral theology, considers children to be intrinsically valuable and that there is room for mutual learning between adults and children. In fact, various writers have noted that children have a specific spirituality even at a very young age, although their spirituality may be different from the spirituality of adults and may not necessarily be expressed in words and cognitive categories like the way adults do [5].

In many countries like Malaysia, anyone who is under 18 years of age would be legally a child, which includes an adolescent in the 13–17 age group. However, a child in the context of this paper refers to a primary school-going age boy or girl, spanning around 7–12 years old.

Method

Participants

Four undergraduates from a professional counselling programme of Universiti Malaysia Terengganu, a medium-size public university on the east coast of Peninsular Malaysia, participated in this study through in-depth interviews. Participants were briefed about the purpose of the study and that they were not obliged to participate in the study in any way and they could leave the study project anytime without any penalty. They were informed that their identity would be protected and only pseudonyms would be used instead. Except for one participant whose gender was male, the three others were female; all the participants were third year students, their ethnicity was Malay, and their religious affiliation was Islam (see Table 22.1).

Interview Protocol

The researcher is the primary instrument of this study which involved developing interview questions, the collection and analysis of the data [6]. The language used in the interviews was essentially English although the participants also expressed themselves in Bahasa Malaysia alongside.

Table 22.1 Demographic descriptions of the participants

Pseudonyms	Year of study	Gender	Ethnicity	Religious affiliation
Amin	3	Male	Malay	Islam
Azizah	3	Female	Malay	Islam
Hayati	3	Female	Malay	Islam
Noraini	3	Female	Malay	Islam

Interview Questions

Among the pertinent questions asked on the participants were the following: What does spirituality mean to you? While children are legally defined as those under 18 years of age, do you think some of them are too young to deal with their spiritual issues? Do you honestly think the current code of ethics for counsellors in this country is sufficient to address the spiritual dimension of a client who is a minor? and, by the end of the 4-year counselling programme, would you feel you are adequately equipped to help clients who are minors to address their spiritual issues in counselling? Other questions relevant to the objectives of the study such as what experience they had on working with children and how they would integrate spirituality into counselling were asked.

Procedure

The study was conducted in the first half of 2012 and the participants were interviewed for about an hour each with their permission granted for the recording. After the transcripts have been written, the participants were asked to do member check to ensure their accuracy based on the original recording before the second interviews were conducted. Similarly, they asked to do a similar member check on their second verbatim subsequent to the second interviews.

Data Analysis

The data collected were analysed according to the standards procedure of Interpretive Phenomenological Analysis as summarised by Biggerstaff and Thompson [7] in the following stages [7]:

Stage 1. The initial encounter with the text, i.e. transcripts from the interviews.
Stage 2. Preliminary themes are identified based on the recurring materials.
Stage 3. Themes are grouped as clusters which share similar characteristics.
Stage 4. Themes are tabulated in a summary table.

Results

Altogether four themes and three sub-themes were identified from the transcripts. The themes were as follows:

1. *Spirituality is significant in counselling to children as much as to adults.* Spirituality is a significant component in counselling among children, even prior to their puberty.
2. *Counsellors need to use techniques such as play therapy, drawing, and so on to work with children in counselling.* Children are not able to express themselves verbally like adults, and they do not usually have the patience and concentration of the adults.
3. *Counsellors need to understand the children's background as well as their perspectives in order to help them effectively.* Counselling young children can be challenging when a counsellor needs to make extra efforts to explore their stories and feelings, compared to working with adult clients.
4. *Student counsellors need to be adequately prepared to work with children.* Student counsellors would benefit from at least one course in counselling children as a way of getting prepared to work with children, especially in handling their spiritual issues.

   The three sub-themes identified were as follows:

1. *The autonomy of the child as a client must be respected.* Even though parental consent is essential in the counselling process, the dignity of the child is to be maintained at all times.
2. *Spirituality helps to connect people, including children.* They need to connect with other people and the environment and learn how to relate in the course of growing up.
3. *Children enjoy the fun of play.* As Noraini (participant) says, 'Play leads to joyous moments in children'.

Discussion

One of the participants, Hayati, said, 'Spirituality is very significant to children, even at a young age'. Azizah, another participant, said that children may not fully understand what spirituality is about, but a counsellor could certainly guide them. Participant Amin too agreed that the children's spiritual life need to be taken care of in order to grow up as a healthy human being. Only a person who has a healthy spiritual life could lead to a balanced life which consists of social, psychological, somatic, and moral dimensions [3].

Unlike counselling adults, counsellors working with children could pose numerous challenges such as the way children express themselves. Children who are 10 or 11 years of age usually have not acquired feeling words such as 'frustrated' or

'disappointed', not to mention the 7- or 8-year-old children who are unlikely to fully express themselves. Children have feelings too and they need to be given opportunities to express their feelings in a healthy manner.

As the proverb says, all work and no play makes Jack a dull boy. Play is part and parcel of growing up. In fact, it would be incomplete for a child to grow up without adequate amount of play. It is in play that children learn about themselves and the world around them, while enjoying the fun of it. Play therapy is widely practised among counselling with children whereby a trained play therapist could work effectively with children who not only will enjoy the session but get the therapeutic benefits as well. In the midst of toys, drawing, sandplay, and so on, a play therapy session lasting half an hour or so goes by quickly as a child is invited to share his or her feelings, thoughts, and imagination in a safe, well-defined, and conducive environment.

On the other hand, a skilful play therapist requires specialised professional training in addition to the general requirements of a counsellor. At least for a start, one course at the introductory level on counselling with children can be a source of help. While some universities offer play therapy programmes at the master's and doctoral level, several play therapists' associations also offer training to qualified counsellors and therapists who wish to focus on working with children.

Finally, the dignity of the person needs to be respected, including that of a child. A minor requires informed consent from that of a parent or the guardian of the child, since the child is not in a position to do that until he/she becomes an adult legally. Obviously, such an ethical issue demands the prudence on the part of the counsellor as well as the party who grants informed consent so that the child's right too is protected fully as a client.

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Chapter 23
Assessment Literacy: A Catalyst to the Success of School-Based Assessment in Malaysian Schools

Rohaya Talib, Mohd Najib Abd Ghafar, and Hamimah Abu Naim

Introduction

Malaysia will become a developed nation by 2020 and has risen to the challenge of globalization to transform education. It involves the improvement of the evaluation through school-based assessment (SBA). SBA is a form of holistic assessment that includes an assessment of cognitive, affective, and psychomotor skills. The assessment is undertaken by the subject teachers during the teaching and learning process in accordance with procedures set by the Malaysian Examination Syndicate. The SBA component consists of School Assessment; Centralized Assessment; Physical Activity, Sports, and Cocurricular Assessment; and Psychometric Assessment. This new SBA system is an improvement to the earlier one with the introduction of the standard assessment and application program. That refers to the SBA Management System (SBAMS) to help teachers in recording students' performance. The move is very much consistent with the National Education Philosophy to create harmonious and balanced human capital.

As SBA is a fairly new innovation in the Malaysian education system, the role of the teachers in the assessment system is vital. As claimed by Tan Sri Murad Mohammad Nor, the former Education Director General, the most important part in the implementation of policy is the teachers. However good the policy is, it will be no use if the teachers do not implement it well [6]. Additionally, the education policy should be implemented with a sense of responsibility, competence, and honesty to leave a positive impact on the development of knowledge, skills, and personality of the student. In schools, teachers are multitasking; not only are they involved in teaching but also in assessment that refers to the process of gathering information systematically for the purpose of diagnosing, monitoring progress, and evaluating the effectiveness of teaching [14]. As a matter of fact, the transformation of the

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assessment policy which emphasized holistic assessment is demanding teacher assessment literacy (AL) to be enhanced and strengthened. AL refers to the knowledge-based competency in the field [17] which includes declarative knowledge (facts, concepts, principles) and procedural knowledge (knowledge application to practice) [4]. Reference [19] describes AL as literates who know the difference between sound and unsound assessment. They know what they are assessing, why they are doing it, and how best to assess the knowledge or skill of interest and are also aware of the potential negative consequences of poor and inaccurate assessment. He further stressed that the lack of knowledge among teachers in understanding the concept and good practices of assessment will hinder the process of educational excellence. Furthermore, the importance of teachers' AL has been stated by [2] who said that there was a positive correlation between the constructs of knowledge and practice; a high-degree knowledge of assessment will result in more effective practices in the classroom. This finding is further supported by [17], who said teachers who have high AL will be able to manage the learning process more effectively and to interpret students' performance accurately and fairly.

In the context of Malaysia, first class human capital could be materialized through teachers who are really committed to the profession and skillful in assessment practices because they are capable of tapping the students' potential from various dimensions of intelligence. This task is harder than producing straight "A" students. Nonetheless, it is quite alarming to note that as reported by [6], the oral school-based assessment was not implemented according to guidelines and objectives provided by the Malaysian Examination Syndicate. This indirectly provides evidence that teacher AL issues are crucial because the purpose of assessment is to make fair decisions related to students, curriculum, and programs. Because of the huge impact assessments have on the future of students and nation, there should be an effort to investigate it further [5]. Thus, this preliminary study is seen as timely as it could provide information about the levels of AL among teachers in Malaysian public schools. The findings will be used to recommend improvements to enhance teachers' professionalism.

Methodology

This study used the quantitative descriptive design to measure teachers' AL. A total of 465 secondary school teachers were selected by random cluster sampling method from 10 districts in Johor as respondents. Data were collected using Assessment Literacy Test (ALT) that has Kuder-Richardson$_{20}$ reliability estimates of 0.85. ALT was developed based on the Malaysian Teacher Training Syllabus, the Standards for Teacher Competence in Educational Assessment of Students (1990), and Stiggins Competency Assessment Model (1999). ALT consists of 45 multiple choice items measuring 5 assessment dimensions: Assessment Concepts (ASC), Measurement Methods (MEM), Testing (TET), Scoring and Grading (SCG), and Statistics and Reporting (STR). The administration of ALT was carried out in collaboration with

Table 23.1 Mean matrix

Factors/dimensions	ASC	MEM	TET	SCG	STR
Gender					
Male [M]	52.13	50.38	51.80	46.73	50.23
Female [F]	49.87	52.92	50.00	50.38	48.40
Position					
Subject teacher [ST]	50.32	52.97	50.76	48.51	48.88
Subject panel [SP]	50.20	51.38	51.14	50.02	48.87
Examination secretary [ES]	51.26	51.89	49.91	49.02	49.24
Teaching experience					
1–5 yrs [TE1]	54.92	52.46	51.55	47.63	45.03
6–10 yrs [TE2]	50.80	53.60	49.61	47.31	50.18
> 10 yrs [TE3]	48.65	51.20	50.54	50.63	50.29
Subject area					
Language [LA]	50.48	52.74	50.37	49.97	47.72
Science and mathematics [SM]	50.64	52.08	50.08	47.99	50.93
Tech and vocational [TV]	52.17	49.32	49.38	49.78	50.50
Humanities [HU]	49.95	51.41	52.65	50.46	46.66
Mean	50.63	52.13	50.59	49.16	48.98

the school administrators while ALT scoring process was done using Quest2 that generated observed scores for each respondent. Observed scores were then transformed to standard score (t-score: Mean = 50 and Standard Deviation = 10) while the literacy level is determined by Assessment Literacy Indicator (High, Score T > 60; Moderate, 40 < Score T ≤ 60; Low, 0 < Score T ≤ 40). ALI was designed based on the law of normal distribution curve for the total area of the normal sphere that reflects the amount of observation in a population [1]. Reference [12] also considered the categorization based on characteristics of the normal distribution provides a standard for comparison because the distribution of sample scores represents the characteristics of the population.

Findings

Findings from this study indicated that 13.33 % of teachers are at a high literacy level, 68.82 % are at the moderate literacy level, and 17.85 % at low literacy level. On the whole, the results identified mean differences on four demographic factors and five assessment dimensions with values between 46.66 and 50.97 as shown in Table 23.1.

Based on Table 23.1, obviously, the mean for three dimensions (ASC, MEM, and TEST) were above standard mean (T = 50) compared to the other two dimensions (SCG and STR). It is also a fact that three categories of position (ST, SP, ES) and two groups of subject area (LA and HU) scored below the means for STR (statistical and reporting knowledge) while groups TE1 and TE2 and HU for SCG

(scoring and grading procedures). Additionally, groups SE, TE2, and TV have proven to be lacking on TET (testing process). On the whole, the results shown that teachers AL based on four demographic factors and five dimensions of assessment were at a moderate level with the mean ranging between 46.66 and 50.97.

Discussion

Overall, this study was able to produce a one-dimensional profile of teacher knowledge assessment. Results showed that 86.67 % of the total number of teachers was in the middle and lower levels of literacy. These figures can be interpreted in two ways, namely, (i) reject the assumption that teachers have zero knowledge of assessment and (ii) teachers in Malaysian public schools need ongoing training to enhance current knowledge to remain relevant and competitive [10]. Hence, the Ministry of Education should plan for retraining courses to prepare teachers who are in-service to adapt to the transformation challenges. The concept of retraining is aimed to add value in the form of latest knowledge and skills to enhance professionalism, efficiency, and effectiveness of teachers who are currently serving [7]. It is also worth noting that [18] found that teachers spend 33–50 % of their time doing work-related assessment every day. Therefore, teachers' competence should be at a high level that is commensurate with the time used for that purpose. This finding is also expected to encourage teachers to be proactive to access information from various sources to increase assessment knowledge [3] either formal or through work-based learning [20]. As a consequence of a high level of awareness and reflective thinking, teachers will be able to develop themselves in terms of professional knowledge, skills, and expertise.

Implications and Recommendations

Reference [10] study found that assessment courses in teacher training programmers did not match the needs of teachers in assessing students in the classroom. His findings supported the studies of [11], [13], and [15] where knowledge factor is said to be one of the reasons teachers faced problems when assessing the students. Similarly, the results from the need analysis conducted at the beginning of this study indicated that 87.30 % (n = 465) had expressed their willingness to attend further training in the area of assessment. Their quest for such training indirectly confirmed that they require knowledge to perform better in assessment. Furthermore, the study of [8] also highlighted that there was a possibility of skilled trainers but not skilled in assessment content controlling most of the classrooms during training session. This situation will indirectly reduce the impact of assessment training to teachers. Sidin [16] pointed out that the quality of teachers produced is highly dependent on the relevance and effectiveness of the curriculum in teachers training programs.

Thus, this study recommended that (i) content knowledge of assessment should be relevant to the needs of policy change and (ii) high quality of teaching staff to teach at teacher training programs.

In addition, as a teacher who is responsible for planning, managing, and reporting on assessment activities at school, the examination secretary should be given extensive training in assessment because they manage all assessment activities at school. The schools needed most the assessment personnel who are established and knowledgeable in the job to ensure the assessment activities are implemented, monitored, and being judged by professionals [9]. Hence, this study suggests that the examination secretary post be promoted to "Guru Cemerlang Pentaksiran" as to improve the assessment quality and integrity at the school level. This is in line with the recommendations of the National Union of Teaching Profession (The Star, October 13, 2008). Furthermore, with the implementation of SBA, more workload is transferred to the schools. Therefore, this recommendation is made so that the examination secretary can focus on planning and conducting assessments in a transparent, orderly, and fair manner with due recognition from the Ministry of Education.

Conclusion

This study has achieved its purpose, describing the level of assessment literacy among secondary school teachers in Malaysian public schools. The findings not only describe the levels as it also provides the implications of necessary trainings relevant to the change of policy from examination-based to school-based assessment.

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Chapter 24
Discriminant Analysis: A Study on Corporate Distress

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and Siti Nurhafizah Mohd Shafie

Introduction

Financial distress of an organization is defined as a condition where obligations are not met or are met with difficulty. Such a condition will have detrimental effects on both the company's equity and debt holders [1]. In the middle of 2007 until 2008, it can be seen that the United States experienced one of the worst economic crises in two decades, disasters in its subprime market leading to housing foreclosures, and the complete breakdown of the banking and financial system. The global financial crisis has hit Malaysia hard but it has a little different from the Asian Financial Crisis. Khoon and Hui found that RM7 billion stimulus packages that include about 1 % of Malaysia's Gross Domestic Product (GDP) have been criticized as too small [2]. As the global financial conditions get worse into the fourth quarter of 2008 and early, the Malaysian economy faced a view of the great decline.

Looking at the above situation, it is important to develop a model to assess the financial health of firms in Malaysian context. Early warning systems developed from distress prediction model have proven to reduce the probability that a company gets into corporate distress or even goes bankrupt. This should in turn prevent the

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systematic collapse of a country's economy. The purposes of this paper are to identify which financial ratios are significantly important in predicting distressed companies and to construct distress prediction models. This paper attempts to identify financial features that differentiate firms heading for distress from healthy firms.

Methodology

Variables Involved

In this paper, the dependent variables are referring to status of firms, which are healthy firms and distressed firms. To identify distressed firms, the conditions set forth in Bursa Malaysia's Listing Requirement are used. The firms in financial distress are those that have been withheld from the listing in the Bursa Malaysia. The independent variables used can be classified according to different set of ratios. From the original list of ratios, eight variables were selected on the basis of their popularity in the literature review and potential relevancy to the study [3]. The sample consists of total 56 companies which include 28 financially distressed companies and 28 healthy companies as listed in Bursa Malaysia Berhad during the period from year 2004 to 2008. Distressed companies were matched with healthy companies if they belonged to the same industry classification and have the closest total assets. The criteria were set as control factors to ensure minimum bias in the selection of the control sample used in the development of the failure prediction model [4]. As mentioned by [5], companies were excluded from the sample if they were classified under financial and property industries. The reasons for these are that their ratios are highly volatile where their businesses rely heavily on the economy.

Discriminant Analysis

Discriminant analysis attempts to express one dependent variable as a linear combination of other features or measurements. It is used to identify the common characteristics of the groups, which allow determining the groups that are most similar to each other [6]. The characteristics used to distinguish between the groups are called the discriminant variables. The discriminant function in Eq. 24.1 is a linear combination of the independent variables [7]:

$$D = b_1 x_1 + b_2 x_2 + \ldots + b_n x_n + c \tag{24.1}$$

where D = discriminant function score, b_i = discriminant coefficients, x_i = discriminant variables, and c = constant with $i = 1, 2, \ldots, n$. In general, the discriminant functions are generated from a sample of individuals (or cases), for which group's membership is known (healthy and distressed firms).

Selection of the Variables

There are two stages in selection of the variables procedure. Firstly, check the overall significance of the discriminant function. Wilks' lambda is used to test if the discriminant function as a whole is significant. The second stage is to test the significance of each independent variable by using F test. The test is only to be performed if the overall model of the test is significant. In line with the previous study of [8], Wilks' lambda is useful in evaluating the overall adequacy of the analysis. Vuran found that the F test relates the differences between the average values of the ratios in each group to the variability of values within each group [9]. The test will confirm whether an independent variable is important in predicting the status of firms.

Classification for Two Populations

Fisher's discriminant functions are used to classify the dependent variable (distressed and healthy firm). The populations or groups that will be classified are labeled as π_1 and π_2, where π_1 is the population for distressed firms and π_2 is the population for healthy firms. These two populations can be described by Fisher's discriminant function, $\hat{d}_1(x)$ and $\hat{d}_2(x)$. The new observation, x_0 are separated or classified on the basis of measurements for p associated random variables $X' = [X_1, X_2, \ldots, X_p]$. x_0 with associated measurements X must be assigned to either π_1 or π_2. Let p_1 be the prior probability of π_1 and p_2 be the prior probability of π_2. In practice, the prior probability is assumed to be equal for all groups or based on the number of sample in each group [8]. The classification rule is to allocate x_0 into the group π_1 if the Fisher's discriminant function $\hat{d}_1(x)$ greater than $\hat{d}_2(x)$. Otherwise, x_0 will be assigned into group π_2 [10].

In prediction of corporate distress, some researchers make use of the complement of error rate which is the accuracy rate of classification in percentage to measure the performance of classification functions. The value of accuracy rate of classification will easily obtain by $(1 - \text{resubstitution error rate}) \times 100$ %. This approach used by [3–5, 8, 9].

Results and Discussions

Table 24.1 shows the results of variance inflation factor (VIF) for the independent variables. The VIF values range in between 1.002 and 1.146. Moreover, the values of VIF for all variables are below 10, which indicated that the multicollinearity problem does not exist means that the independent variables uncorrelated to each other [11].

Table 24.1 Variance inflating factors

Variables	$VIF = 1/(1-R^2)$
Current assets to total assets (CATA)	1.1062
Debt ratio (DR)	1.0471
Total liabilities to total equity (TLTE)	1.0020
Working capital to total assets (WCTA)	1.0331
Return on assets (ROA)	1.1455
Return on equity (ROE)	1.0482
Cash to current liabilities (CCL)	1.0811
Cash to total assets (CTA)	1.0030

Table 24.2 F test of independent variable for 1, 2, and 3 years prior to distress

Variables	1st year		2nd year		3rd year	
	F statistics	p value	F statistics	p value	F statistics	p value
CATA	5.739	0.020	5.332	0.025	3.462	0.068
DR	2.572	0.115	10.457	0.002	7.546	0.008
TLTE	0.081	0.777	1.131	0.292	0.821	0.369
WCTA	1.775	0.188	2.214	0.143	1.080	0.303
ROA	7.890	0.007	14.457	0.000	9.064	0.004
ROE	2.633	0.110	1.125	0.294	6.126	0.016
CCL	4.379	0.041	3.582	0.064	1.433	0.237
CTA	0.152	0.698	7.266	0.009	2.271	0.138

Based on the multivariate test results, the Wilks' lambda is 0.628 with a p value less than 0.05. Thus, the group means appear to differ. Hence, there is evidence to reject null hypothesis and conclude that at least one of the population mean vector for status of firms (healthy and distressed) is different from another.

As it is seen in Table 24.2 for 1 year prior to distress, CATA, ROA, and CCL are all significant since p value less than 0.05. The variables with 5 % level of significant for 2 years prior to distress are CATA, DR, ROA, and CTA. For 3 years prior to distress, the variables that have significantly discriminating ability with p value less than 0.05 are DR, ROA, and ROE. Therefore, those variables are considered important in predicting healthy and distressed firms.

In this paper, $\hat{d}_1(x)$ and $\hat{d}_2(x)$ are the Fisher's discriminant function for distressed and healthy firms, respectively. Both functions then will be used to classify the dependent variable (distressed and healthy firm). According to the result of Fisher's discriminant function coefficients, the Fisher's discriminant function for 1 year prior to distress can be written as:

$$\hat{d}_1(x) = -2.540 + 5.864CATA - 1.975ROA + 0.025CCL \tag{24.2}$$

$$\hat{d}_2(x) = -1.576 + 3.844CATA + 0.324ROA + 0.200CCL \tag{24.3}$$

Table 24.3 Classification results of discriminant function

Status	One year prior to distress (%)	Two years prior to distress (%)	Three years prior to distress (%)
Healthy	78.6	85.7	78.6
Distress	78.6	78.6	67.9
Classification accuracy	78.6	82.1	73.2

Fisher's discriminant function for 2 years prior to distress can be written as:

$$\hat{d}_1(x) = -3.374 + 6.778CATA + 3.043DR + 2.514ROA - 5.941CTA \quad (24.4)$$

$$\hat{d}_2(x) = -2.118 + 4.010CATA + 2.195DR + 4.850ROA + 7.878CTA \quad (24.5)$$

Fisher's discriminant function for 3 years prior to distress can be written as:

$$\hat{d}_1(x) = -2.640 + 7.290DR - 2.255ROA - 1.112ROE \quad (24.6)$$

$$\hat{d}_2(x) = -1.176 + 3.804DR + 0.100ROA - 0.117ROE \quad (24.7)$$

Table 24.3 reports the classification results of the functions for three consecutive years. It appears that an overall prediction accuracy of 78.6 % for the model in 1 year prior to distress. Moreover, the classification results for 2 years prior to distress demonstrate that the function has predictive accuracy of 82.1 %. The classification results for 3 years prior to distress indicate that the discriminant function classifies 73.2 % correctly.

Summary

According to [12], financial ratios can help us to identify the potential problem. By comparing the mean values of several ratios between the healthy firms and distressed firms, differences between the two do appear to exist. This study found that the prediction model of corporate failure for Malaysian firms was successfully developed. The model illustrates exceptional performance with correct classification accuracy rate more than 70 % as far as 3 years before the distress event. The significant variables that can be used to discriminate between distressed and healthy companies as far as 3 years before actual distress are summarized in Table 24.4.

According to the finding analysis (refer to Table 24.4), profitability ratios are the ratios that are consistently significant as early as 3 years prior to distress. The most important ratio found to differentiate between healthy and potentially distressed firms is Return on Assets. The reason for this is that firms with better profitability are often seen as being better managed. By productively utilizing a firm's assets and

Table 24.4 Summary of the significant variables

Ratio	Variables	Years prior to distress		
		One	Two	Three
Liquidity	Current assets to total assets	X	X	
	Cash to current liabilities	X		
	Cash to total assets		X	
Profitability	Return on assets	X	X	X
	Return on equity			X
Solvency	Debt ratio		X	X

resources, the profits generated by these efforts are often seen as indication of the firm performance.

In this study, by focusing on the Malaysian situation, it was found that the ratios that significantly can predict the corporate failure are in line with the findings presented by [4, 5, 12]. There are three variables that are significantly similar in predicting distress condition which are Return on Assets, Cash to Total Assets, and Debt Ratio. The results show that the models can be used by the managers of the firms to predict potential business failure as early as possible and provide sufficient warning to the interested parties about the company.

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Chapter 25
Waterfront Development in Malaysia: Best Practices in the Future

Azlina Md. Yassin, Sandy Bond, and John McDonagh

Introduction

Rivers and water are valuable natural resources for human life, the environment and national development. Water plays an essential role in people's lives and has long been recognised as one of humanity's most important natural resources. Despite the importance of rivers for settlement and public space and their biodiversity and traditional importance as sources of primary and secondary production, the contribution of rivers to energy cycles is now becoming better appreciated [1–3].

The waterfront redevelopment phenomenon began in the early 1960s. Hoyle [4] explains that the emergence of waterfront redevelopment is mainly but not exclusively associated with maritime activity. The phenomenon grew in the 1970s, accelerated in the 1980s [5] and continues to the present day.

In Malaysia, rapid development and urbanisation over decades caused the Malaysian government to start including many waterfront areas in future development with the focus on more recreational use, while private property developers concentrated more on mixed-use development. However, in many cases, the implementation of waterfront development projects is driven more by investment needs rather than by community and environmental needs. In addition, inadequate regulations and guidelines relating to waterfront development at every level of government is having a negative impact environmentally and socially such as water pollution and crime [6, 7].

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Therefore, this paper aims to identify the attributes which are desirable to be taken into consideration when undertaking waterfront development in Malaysia in the future, from the property development companies' point of views. The findings were then recommended in assisting property development companies when undertaking waterfront development in the future.

Review of the Literature

Definition of Waterfront and Waterfront Development

In general, the waterfront refers to land fronting on to water [8]. Even though the word waterfront itself is clear, some researchers prefer to use different words to replace the term waterfront, for example, city port, harbour front, riverside, river edge, water edge and riverfront [9–13].

The waterfront is a zone of interaction between urban development and the water and a waterfront area is considered to be a unique and irreplaceable resource where it interfaces between land, water, air, sun and productive plants [14]. Moreover, Ryckbost [15] sees waterfronts as any property that has a strong visual or physical connection to water with the water itself being any type of water body such as a lake, the ocean, a river or a stream of all sizes [5].

In the development context, waterfront developments have various interpretations depending on the characteristics of the sites and the cities [8]. And, Butuner [16] sees waterfronts as land to be reclaimed from water in order to create an extension of existing city centres.

Principles for Successful Waterfront Development

The success of a waterfront development is only achieved once it can function on all levels and benefit all stakeholders [17]. Therefore, in order to achieve the specific aims of a successful waterfront development, 10 elements recommended to be taken into consideration while planning a waterfront development were identified, as presented in Fig. 25.1.

Principles for Sustainable Waterfront

Bruttomesso [18] recommended 10 principles for securing long-term growth for waterfront areas. The sustainable principles are presented in Table 25.1.
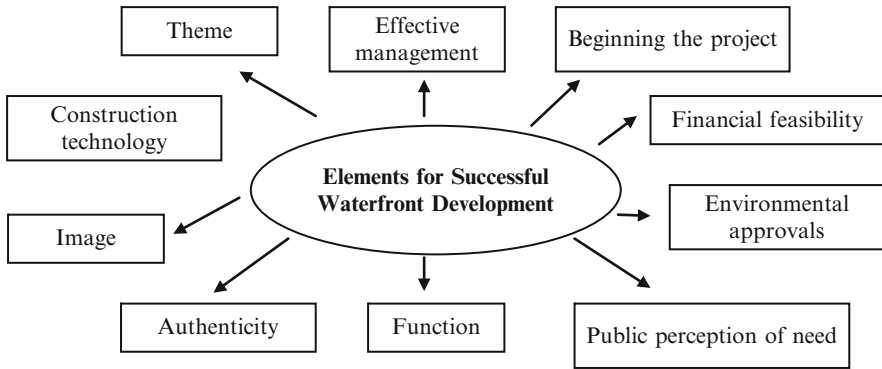
Fig. 25.1 Elements for successful waterfront development (Source: [17])

Table 25.1 Principles for sustainable waterfront development

Ten principles for a sustainable waterfront development	Secure the quality of water and the environment
	Waterfronts are part of the existing urban fabric
	The historic identity gives character
	Mixed-use is a priority
	Public access is a prerequisite
	Planning in public-private partnerships speeds the process
	Public participation is an element of sustainability
	Waterfronts are long-term projects
	Revitalisations is an ongoing process
	Waterfronts profit from international networking

Source: [18]

Research Methodology

In this study, a quantitative research strategy was adopted as a strategy for the data collection. The questionnaire survey was carried out within Malaysia and the respondents were property development companies listed under Bursa Malaysia.

Findings and Discussion

Respondents' Profile

The sample data comprises property development companies listed under Bursa Malaysia during 2009. Only 91 property development companies were listed in 2009 [19]. Of the 91 questionnaires mailed and e-mailed to the respondents, 61

Table 25.2 Principles for best practice of waterfront development practice in Malaysia in future

Environment	(1)	Environmental impact assessment (EIA) is compulsory	.703
	(2)	Maintenance and rehabilitation costs are shared between stakeholders	.697
	(3)	Upgrading and maintaining established settlements along waterfront areas	.674
	(4)	Provision of sufficient public facilities and amenities (such as pedestrian, landscaping, access ways, recreation areas, etc.)	.670
	(5)	Provide flood mitigation (e.g. by planting more trees)	.636
	(6)	Continuous river rehabilitation	.586
	(7)	Integrate both modern and heritage aspects into development	.574
Waterfront benefits	(1)	Sharing waterfront benefits (such as view, financial rewards, etc.) among stakeholders (e.g. waterfront community, government, developers)	.827
	(2)	Encourage economic activity	.691
	(3)	Upgrading and maintaining sewage systems	.656
	(4)	Participation among stakeholders should be compulsory at every stage of the development	.551
Mitigation	(1)	Mitigate property speculation	.799
	(2)	Continuously educate public about environmental concerns	.718
Beautification	(1)	River reserve beautification	.745
	(2)	Protection of natural resources (water and environment)	.600
Security	(1)	Personal security is maintained by means of policing, surveillance cameras, etc.	.737
	(2)	Should use environmentally friendly materials in construction	.548
Type of development	(1)	Restrict type of development	.821

Factor loadings in the range of ±.30 to ±.40 are considered to meet the minimal level for interpretation of structure. Loadings ±.50 or greater are considered practically significant, and loadings exceeding ±.70 are indicative of well-defined structures [20]

were returned within 3 months of the response period (the survey was conducted between April and July 2010). This resulted in a total of 67 % useable response rate.

Factor Analysis Results: Principles for Best Practice of Waterfront Development Practice in Malaysia in Future

A principal component factor analysis specifies six factors that are *IMPORTANT* to be considered when undertaking waterfront development in future for Malaysia. The six factors extracted by factor analysis explained 66.26 % of the variation in the data. Table 25.2 presents the principles for best practice of waterfront development practice in Malaysia in future.

Conclusion

The focus of this research was to recommend principles for best practice for waterfront development in Malaysia in future. This study confirmed that 18 principles loaded in 6 factors are important for taking into consideration when planning a waterfront development project. Instead of statement recommendations, enforcement of the statement by the responsible institutions was considered by respondents to be highly desirable in order to achieve successful waterfront development in Malaysia as is evidenced in other countries.

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Chapter 26
Human Resource Management from an Islamic Perspective: Experiences of GLCs

I. Osman, M.H. Mahphoth, and M.J. Hashim

Introduction

Muslims in developing nations have faced the greatest challenge where globalisation becomes a threat that must be executed with development [1]. The rise of globalisation influences local employees to adopt Western management, and this issue increasingly results in inconsistency of aspects, religion and business practices [2]. Religion plays a big role in gaining competitiveness. The past studies clearly stated the contributions of religion towards organisational effectiveness. Khan et al. [3], Haslinda [4], Hashim [5] and Yeganeh et al. (2008) agree that human resource becomes a source of competitive advantage in organisations. The interference of religion in managing human resource can maintain competitive advantages, thus promoting a good relationship between the employer and the employee in an organisation.

For Muslim countries, Islamic principles must be maintained by the *Quran* and *Sunnah* to treat employees fairly and justly. According to Khan et al. [3], Islam and work have a good relationship. Islam considers work as an essential element of man's success in his life and all people are equal in the sight of Allah; they differ only in their deeds. Islamic HRM means the implementation of human resource management activities with the guidance of the Qu'ran and Hadith. The key of Islamic prescriptions is the Al-Qur'an (Kamel Mellahi et al. 2010), and they said Islam and HRM are relevant to implement not just for organisations operating in major Islamic countries but also in countries where Muslims are a minority.

Islamic principles and HRM are significant. In their studies, Khan et al. [3] and Ab Rahman et al. (2009) found a positive relationship between Islamic principles and human resource management. However, the limited literatures in Islamic management have witnessed the increasing interest to explore its application. The gaps of understanding and applying the Islamic principles in managing

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human resource have caused the wide adoption of Western practices in daily business activities. Researchers have agreed, with the argument from Al-Husan et al. (2009) and Faten et al. (2009), that the importing of HRM from Western management practices has insufficient evidence to increase organisational performances. The lack of understanding and knowledge among Muslim employees regarding Islamic principles will lastly be difficult to change. Hashim [6] agrees that if these issues remained, Islamic organisations should start to institutionalise Islamic values and teachings.

Hashim [6], Branine et al. (2010), Budhwar et al. (2006) and Tayeb [7] agreed on the importance of managing human resource in Islamic management, but very limited empirical studies have examined this. Kamel Mellahi et al. (2010) recommended much more research is needed to gain understanding of the roles of Islam, especially related to HRM issues. In addition, limited studies on human resource management from Islamic practices provide a new potential research to government-linked companies (GLCs) to maintain excellent performance. Malaysia's GLCs have faced challenges to enhance national competitiveness where human resource issues become critical problems in enhancing the productivity of the organisations.

Islamic HRM concerns justice and fairness (Abulhassan 2006). According to Junaidah (2008), managing human resource in Islamic approaches does influence organisational justices. Verse 85 of the Surah Al-Hijr (15) in the Quran states: "*We created not the heavens, the earth and all between them, but for just ends*". Verses 38–39 in the Surah Ad-Dukhaan (44) state: "*We created not the heavens, the earth and all between them, merely in (idle) sport. We created them not except for just ends, but most of them do not understand*". Organisational justice is very important and it represents the employee's perception about fair treatment within organisations ([8]; Malik et al. 2011). According to Guest [9] and Purcell et al. [10], the employee's outcome creates a significant relationship between human resource management and performance. Thus, HRM practices must be conducted fairly and in an unbiased manner, and justice must be considered as a main factor influencing human resource effectiveness. This paper discusses the level of HRM from Islamic perspectives and its relationship to organisational justice. This paper also discusses the interference of Islamic principles on HRM activities which include recruitment and selection, training and development, career development, performance management and rewards among GLCs in Malaysia.

Literature Review

Human resource management (HRM) is the process of managing employees to achieve the organisation's objectives. It is a process of acquisition, development, motivation and maintenance of human resource. To achieve and sustain good performance, HRM activities should be implemented in an environment of employee's involvement. In short, HRM is an important process to manage human capital for organisation effectiveness.

Managing human resource meets various challenges. Yeganeh et al. (2008) have identified challenges that shaped HR practices which include culture, legal system, technology, organisational structure and size. Katou et al. [11] found that the policies affecting sex discrimination, selection of employees, distributions of profits and job advancement may be influenced by religious factors. An Islamic principle affects the management in organisations. The significant findings from past researches have proved that the Islamic principle does influence organisational effectiveness. Zangoueinezhed et al. (2011), Ab Ghani Azmi (2010), Ali and Al-Kazemi [12], Hashim [5, 13] have witnessed the significant relationships.

Government-Linked Companies (GLCs) in Malaysia

Government-linked companies (GLCs) are key drivers of the Malaysian economy. GLCs are defined as companies that have a primarily commercial objective despite the Malaysian government holding a direct controlling stake. They exist in most Malaysian industries, including manufacturing, plantation, finance, trading, transportation, shipbuilding and services. In Malaysia, GLCs are defined as companies in which the government has to control the stake. GLCs have to assume greater roles in Malaysia's economic development. Engaging in growth opportunities, GLCs have performed to create special advantages towards managing their employees which concerned recruitment and selection processes, effective compensation systems, extensive training and development activities, adequate job satisfaction and employment security all impact positively on the overall business and performance of a corporation.

HRM from an Islamic Perspective

In Malaysia's National Vision, government-linked companies (GLCs) are expected to successfully drive the national economy as one of the growth engines to increase the profitability of their domestic operations. As a Muslim nation, Islamic principles serve Malaysia with significant contributions to increase performance and to replace with Western management. Islamic knowledge and principles required all Muslim employees to adhere to the Qur'an and Hadith. According to Abulhasan (2006), human services cannot be separated from the whole human being who, according to Islam, is the best creation. Muslim employees have to follow Islamic principles implemented in HRM activities. Past researchers have witnessed that HRM activities significantly regarded Islamic principles for organisations to exercise. Previous researches below have proven the importance of Islamic principles to be applied in HRM activities within organisations.

Titles of research	Significant findings
Human resource management based on the index of Islamic human development: the Holy Qur'an approach (Abouzar et al. 2011)	Human development from an Islamic approach has increased the satisfaction of human needs and facilitates to solve internal and external conflicts to reach spiritual perfection
Human resource management with Islamic management principles: a dialect for a reverse diffusion in management (Mohd Branine [14])	Understanding of Islamic principles will help Western management to develop a blend of Islamic management for more HRM issues
Human resource management practices on organizational commitment: the Islamic perspective (Hashim [5])	Islamic organisations in Malaysia frequently practise Islamic HRM. Organisational commitment highly and significantly correlated with Islamic approach
Islamic human resource practices and organizational performance: a preliminary finding of Islamic organizations in Malaysia (Ab Ghani Azmi [15])	The impacts of Islamic HRM on organisational performance are high. Islamic HRM practices are better than the conventional system, and organisations are suggested to implement these practices regardless of their objectives and industries
Influence of ethical belief, national culture and institutions on preferences for HRM in Oman (Katou et al. [11])	The ethical belief and aspects of national culture and national institutions have impacts on HRM practices
Introduction: Islam and human resource management (Kamel Mellahi and Budhwar 2010)	More research is needed to gain a deeper understanding on Islamic HRM and its implication to organisational performance
Islamic challenges to HR in modern organizations (Abbas J. Ali [2])	Islamic prescriptions view the interest of employees and employers. Islamic teaching is a vital and rich source for designing HR policies. Future research should provide a framework for HR issues in an Islamic context
Islamic HRM practices and employee commitment?: a test among employees of Islamic banks in Bangladesh (Ab Rahman et al. 2009)	Islamic knowledge and understanding should be adopted as a core principle in all organisations under Islamic syariah. The application of Islamic principles should be common to all basic HR functions
Human resource management: an Islamic perspective (Khan et al. 2010)	Islam teaches to treat employees equally regardless of their position and task. Significant contributions of HRM activities are fair treatment of employees and decisions made in an unbiased manner
Islamic revival in human resource management practices among selected Islamic organisations in Malaysia (Hashim 2009)	Muslim HR managers in Islamic organisations are obliged to understand and apply Islamic approach in managing their employees
The Qu'ran-based human resource management and its effects on organizational justice, job satisfaction and turnover intention (Hashim 2008)	Organisational justice, job satisfaction and turnover have correlated to Qur'an-based HRM. More attention should be given to selection, performance appraisal and compensation to raise the good perception of employees on justice
Integrating religious principles and human resource management activities (Joys 2001)	The responsibilities and rights of employees in HRM must be integrated with religion

Recruitment and Selection

Recruitment is the process of selecting the potential candidates for organisations to leverage competitive advantage. In Islam, choosing the right person effects trust and loyalty to organisations. If employees have been chosen based on favouritism and not due to their capabilities, they will tend to feel mistrust and disloyalty. Al-Quran has provided a very simple but yet very relevant criteria to be used for the selection of the best applicants. In surah Al-Qasas, verse 26, the prophet Moses who met Syu'aib, whose daughter said to him: "*O my (dear) father! Engage him on wages truly the best of men for you to employ is the (man) is strong and trusty*". Al-Qur'an also refers to another set of criteria, that is, accountability and the required skills to handle a particular job. The verse in Surah Yusuf (12) states: "*Set me over the store-houses of the land, I will indeed guard them, as one that kno*ws".

According to Hashim, J. (2008), to ensure that the right person is selected, an Islamic approach should be considered to choose the best characteristics of a candidate. These are trust (*amanah*) and responsibility, motivation, seeking knowledge and training and seeking excellence. For trust, a candidate must be trustful and responsible. Allah said "*Every man is pledge for what which he hath earned*". For seeking someone excellent, Islam encourages a person working in a team to seek perfection and excellence. Allah in the verse of Al-Quran said "*…if ye good for your own souls, and if ye do evil, it is for them (in like manner)*" "*and ye (mankind) perform no act, but We are wirness of you when ye are engaged therein*". The prophet Muhammad (SWT) said "*Allah likes that when someone does anything, it must be done perfectly well*".

In Ab Ghani Azmi, I. (2010), selection and recruitment in Islamic principles were considerable. The Islamic selection and recruitment practices among Muslim organisations still under moderate. In a closed finding, Hashim, J. (2008) found a considerable mean of recruitment (4.914) and selection (5.237) in Islamic principles. It was clear to put more effort to adopt Islamic principles in recruiting and selecting employees. As underlined in Al-Quran and Hadith where choosing the right person to produce trust and loyalty and to avoid favouritism. This study has supported the findings of Hashim, J. (2008) to specify the characteristics of choosing candidates, which focus on trust (*amanah*) and responsibility, motivation, seeking knowledge and training and seeking excellence. On the other hand, HRM practitioners must concern on experience, competence, sincerity and other values. In Islam, discriminations and favouritisms must be avoided to ensure talent can be drawn from candidates of different backgrounds.

Training and Development

Training is a process of providing opportunity to an individual to acquire knowledge, develop skills and capabilities necessary to perform their job and to fulfil the organisation's needs. In Islam, all employees are required to acquire Islamic

knowledge and based on their profession to raise the quality. Professional skills will increase the employee's productivity suitable for their salary. Seeking knowledge and pursuing education are greatly emphasised in Islam.

The verse in Qur'an states: "*Those truly fear God among His servants who have knowledge*". The prophet Muhammad (SAW) also declared it compulsory for Muslims to acquire knowledge when he said "*Seeking knowledge is a duty on every Muslim man and woman*". Training and development also need to raise the motivation among employees. Religious teaching can play a great spiritual motivational role. There are ample Islamic teachings that encourage Muslims to be productive. The verse in Surah Al-Baqarah (2) states: "*And of them (also) is who saith: Our Lord! Give unto us in the world that which is good and in the hereafter that which is good and Guard us from the doom of fire*". Khalid Ahmad (2008) stresses the importance of training in building positive morale and maximising efficiency and productivity.

Nik Mutazim et al. (2011) found the highest influence of Islamic principles on training and development, this activity not fully implemented by most of the organisations in Malaysia. Compared to the findings from Hashim (2008), Ab Rahman et al. (2009) and Ab Ghani Azmi (2010), this activity shows lower mean. Researchers agreed with the recommendation from previous researchers to develop knowledge and pursue education through Islamic teachings. Previous studies have shown that the GLCs are not efficient in managing labour and capital productivities. The companies have to strategise the management and development of human capital, with the aim of increasing their knowledge and skills through trainings.

Career Development

According to Alhabshi et al. [16], career development is good where the organisation continues to make an investment to their employees. They added the development process leads to the employee's career path. This process is formal through seminars, workshops and short and long courses. The combination of personal and organisational career development must be continued to achieve an ideal human development for excellent results. According to Hashim (2008), career development is a continuing process for employees to plan and create their future to help them achieve their goals. She added the purpose of career development is to develop the employee's current performance, to take advantage of future job opportunities and to realise their employer's goals for a dynamic and effective workforce. The success of career development is identified from the individual employee's level, that is, assessing the individual's abilities, interest and career goals; assessing the individual's abilities and potentials by organisations; communicating career options and opportunity within organisations and career counselling.

Performance Management

Performance management is a process of ensuring that employees' activities and outputs contribute to the organisation's goals (Noe et al. 2009). In the research paper of Yeganeh et al. (2008), they found that little attention was paid to appraisal in Iranian public organisations and the top-down system was based on subjective judgment which concerned more on personal behaviour rather than on performance evaluation. Hashim (2008) said that measuring employee's performance must consider justice and fairness, accountability and responsibility. According to her, HR managers need to be just and perceived as just by employees. Allah has mentioned in Surah An-Nahl (16:90): "*Allah commands justice, the doing of good and liberty to kith and kin and He forbids all shameful deeds and injustice. He instructs you, that ye may receive admonition*". Abulhasan (2006) said that the sense of responsibility and accountability must be considered with Islamic teachings where work means to attain Allah's pleasure. HR managers need to be accountable in response to his/her decision and action. In the verse of Surah Al-Zalzalah (35:7–8), Allah said, "*Then shall everyone who has done an atom's weight of good, see it. And anyone who has done an atom's weight of evil, shall see it*".

Rewards

A reward is a desirable outcome resulting from a desirable behaviour, while punishment is the undesirable outcome that follows an unwanted behaviour. Hashim (2009) said that the purpose of compensation, whether direct or indirect, is to recognise the value of performance of employees and to establish the ways to motivate them. The reason for rewards is to recognise good performance to encourage employees to work hard. Allah said in the verse of Surah Al-Khaf (18:30), "*We never waste the reward of anyone who did good*". The prophet Muhammad (SWT) said, "*Whoever puts an effort and succeeds gets two newlands and whoever puts an effort and does not succeed gets one reward*". Ab Rahman et al. (2009) found a positive relationship between compensation and rewards on organisational outcomes. Reasonable, competitive and fair compensation system must be well developed to promote positive commitment. One of the aspects of fairness is the salary. In Islam, salary is not just on employee's contributions but more importantly on his basic needs. Employers are required to pay his/her employees with sufficient wage. The prophet Muhammad (SAW) said, "*It is most important for you to provide food and clothing to your assistants*".

Abulhasan (2006) said that the Islamic system requires a humanity (brotherhood) element in the fixation of compensation. He said organisations should arrange the compensation for its employees to meet their basic needs in a standard of living. He added compensation must be against the favouritism in pay and promotion to

protect the employee's rights and promote justice and fairness. The adoption of Western practices has influenced most of the reward activities in Muslim countries. From an Islamic perspective, a reward must be given based on good or poor performance. HR managers must recognise the good employees with promotion to improve morale and productivity.

Islamic Human Resource Management and Organisational Justice

Islam is against any practices of injustice and it has been clearly revealed by Allah. In verse 29, Surah Al-A'raf, Allah says, "*Say: My Lord hath commended justice and that ye set your whole selves (to Him) at every time and place of prayer and call upon Him making your devotion sincere as in His sight: such as He created you in the beginning so shall you*". Justice is required to be established in Islam and universally applies in all fields of human resource activities in organisations. It is a person's obligation to establish and uphold absolute justice as a part of *taqwa* (deed) and *iman* (faith). Organisational justice is the employee's perception of fairness in an organisation. Greenberg [17] defined organisational justice as the employee's perception on justice and equality in organisations. Greenberg and Baron (2003) found organisational justice consists of the employee's perception towards distribution of outcome and perceived fairness. Procedural justice refers to the perception of employees on fairness of decision-making in an organisation. According to Nabatchi et al. (2007), procedural justice is important to project the best satisfaction of employees from the official decision-making policies. Interactional justice refers to interpersonal treatment received by an individual employee [18].

Hashim (2008) exploring on "Quran-based human resource management and its effects on organisational justice, job satisfaction and turnover intention" suggested an Islamic human resource management must be practised by all Muslim organisations. She said more attention should be given to human resource management practices such as selection, performance appraisal and competition which contribute to injustice perception of employees. Dzansi and Dzansi (2010) explored the organisational justice approach on human resource management practices found significant. Less transparency in political interferences will increase the employee's perceptions on human resource management practices and directly improve their commitment. Murtaza et al. [8] and Ferndale et al. (2010) found promotions and increments of employees must be given to deserving employees without discrimination or bias. Distributive justice should be improved to allocate resources, performance rewards, pay and promotion.

Other research papers examined organisational justice and human resource management outcomes. Folger et al. (1998) suggest that justice must concentrate on the management of employee benefits, training and employee's development. Casas (2007) revealed organisational justice perceptions on human resource management related to fair policies and procedures. The implementation of organisational justice

will help organisations to select and train human resource professionals to enhance fairness. So as to build interactional justice, the roles of appraisers and appraisees must be separated. The appraisees must feel free to express their emotions and are encouraged to give inputs in an interview session. Correlations between interactional justice and supervisor supports will increase the employee's satisfaction.

Conclusions

Limited research on Islamic HRM and its relationship to organisational justice drives the less motivated researchers to deeply explore on these two variables. The obligations of an employer to stress on Islamic principles must be applied to HRM functions. Communicating about Islamic principles on HRM practices to employees will increase its understanding, making it easy to practise. On the other hand, positive acceptance of Islamic principles will avoid unbiased and unethical exercises where justice meets in every single of task. Islamic teachings cannot be just an option among Muslim employees for performing tasks; it must be the main direction to get blessed by the Creator. Organisational justices will respond in a good way for improving the organisational behaviour as a whole. Distributional and procedural justice confirmed efficiency and the effectiveness of human resource productivity.

Islamic principles allow employees to conform to the good way to become successful in their lives. Islamic practices guide employees to perform greater and always meet the expectation of their employer. Exploring HRM and organisational justice, this study has confirmed the significant relationship in the findings of Dzansi and Dzansi (2010), Mohd Nasurdin et al. (2011) and Siti Zuraini et al. (2010). In Muslim organisations, HR managers need to ensure employees understand the concept and practices of Islamic management. Verbal and nonverbal communication helps employees to understand the Islamic principles and its application to HRM functions. Previous findings found the limitation of Islamic HRM due to a weak understanding of Islamic concepts and benefits. Communication requires cooperation from all parties to produce a great Islamic-based performance. HR practitioners are responsible for investigating the effectiveness of current practices of managing human resource and slowly changing with Islamic principles. The greatest challenge they will have to face is to change the existing management system to a system guided by Islamic principles. This can be solved through explaining the reasonable evidence proved by other organisations that have been practising HRM functions with Islamic principles.

The GLCs aim to realise their own organisational objectives such as making a profit, producing quality products and excellent services and becoming the largest organisations. Good productivity comes from the effectiveness and efficiency of employers in managing their human resource. Realising the importance of employees as valuable assets, they must be managed accordingly. Islam has clearly emphasised justice and truth as stated in the Quran. The foundation of Islamic justice was

firmly established during the lifetime of the prophet Muhammad (SAW). The verse in Surah al-Nisa (5), Allah (SWT) ordains to the effects: "*Allah doth command you to render back your trusts to those to whom they are due, and when ye judge between people that ye judge with justice*". The establishing of justice in organisations, employees successfully manage the good performance, equity and human brotherhood. For Muslim employees, it is an obligation to obey the rules and regulations stated in the Al-Quran and *Sunnah*.

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Chapter 27
The Application of Consistent Minimum Vector Variance (MVV) Estimators on Hotelling T^2 Control Chart

Hazlina Ali, S.S. Syed-Yahaya, and Zurni omar

Introduction

Performance of traditional Hotelling T^2 control chart using classical estimators is usually marred by the masking and swamping effects. The traditional Hotelling T^2 control chart is only effective in eliminating extreme outliers in small sample sizes, but it fails to detect more moderate outliers particularly when the number of variables is large [1–3]. In order to alleviate the problem, robust location and scale estimators are recommended in place of the classical mean and covariance matrix. Robust estimators are known to be more effective in detecting the deviation of data or outliers as compared to the classical estimators [4]. A wide range of robust estimators of multivariate location and scatter is available; see [5, 6] for a review. Currently, the most popular and widely used robust estimator in the T^2 control chart is the minimum covariance determinant (MCD). Recently, a new robust estimator known as minimum vector variance (MVV) estimator was introduced by Herwindiati [7]. MVV estimators possess the nice properties of MCD such as in terms of breakdown point and affine equivariant properties, while achieving better computational efficiency [8, 9]. The study on the significant role of MCD estimators in the construction of robust Hotelling T^2 chart can be easily found in the literature; see [1–3, 10]. However, the performance of T^2_{MCD} chart shows a conflict between the percentage of outliers detection and the ability in controlling the overall false alarm rate under certain conditions. To alleviate this conflict, Yahaya et al. [11] introduced the MVV estimator in Hotelling T^2 chart (T^2_{MVV}) in Phase II. In general, the result showed that T^2_{MVV} charts were able to detect out-of-control signals and simultaneously control false alarm rates even with large number of quality characteristics. Despite the good performance of T^2_{MVV}, the estimated upper control limits (UCL) for Hotelling T^2 chart issued from MVV estimators were large if compared to the

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traditional and MCD charts. MVV estimators have the same characteristics as the MCD estimators with respect to breakdown point and affine equivariance property. Their algorithms also display the same structures, but differ in their objective function; MCD uses $|\Sigma|$ while MVV uses $Tr(\Sigma^2)$. This study attempts to improve the MVV estimators to achieve consistency and unbiased at normal model.

The organisation of the remaining parts of this paper is as follows. Section 27.2 discusses about the formal definition of the MVV estimator and the adjustment done on the MVV scatter estimator to ensure that it is consistent and unbiased. In Sect. 27.3, a real data analysis from aircraft industry is presented to illustrate the applicability of the improved chart. Finally, discussion and conclusion are given in the last section.

Minimum Vector Variance (MVV) Estimator

Herwindiati et al. [9] had proved that MVV estimators possess three major properties of a good robust estimator, i.e. high breakdown point, affine equivariance and computational efficiency. The main method used in the estimation of MVV is the Mahalanobis squared distances (MSD). Define a data set $X = \{x_1, x_2, \ldots, x_n\}$ of p-variate observations. Denote the MVV estimators for the location parameter and scatter by M_{MVV} and S_{MVV}, respectively. Now, let $H \subseteq X$; the M_{MVV} and S_{MVV} are determined based on the set H consisting of $h = \dfrac{n+p+1}{2}$ data which give S_{MVV} having minimum $Tr(S^2_{MVV})$ among all possible sets of h data. To compute the approximation of MVV estimators, we used the MVV algorithm proposed in Yahaya et al. [11]. The location and scatter estimators are defined as

$$M_{MVV} = \frac{1}{h} \sum_{i=1}^{h} x_i \tag{27.1}$$

$$S_{MVV} = \frac{1}{h} \sum_{i=1}^{h} \left(x_i - M_{MVV} \right) \left(x_i - M_{MVV} \right)^t \tag{27.2}$$

Scatter estimator is typically calibrated to be consistent for the normal distribution; thus, the consistency and correction factors are needed to guarantee Fisher consistency and improve its biasness for small sample behaviour. Fisher consistency is a standard concept in robust statistics and it means that the functionals evaluated at the model distribution F return the true parameter values, μ and Σ [12]. If $x_i \sim N(\mu, \Sigma)$, we take consistency factor, $c(h)$ defined as

$$c(h) = \frac{h/n}{P\left(\chi^2_{p+2} < \chi^2_{p, h/n}\right)} \tag{27.3}$$

Albeit this process guarantees consistency under normal distribution, this consistency factor is not sufficient to make the MVV estimator unbiased for small sample sizes. To overcome the insufficiency problem, we compute correction factor, $\vartheta^\alpha_{p,n}$, via simulation study for several sample sizes n and dimension p based on [13]. Next, we determine the MVV scatter as follows:

$$\vartheta^\alpha_{p,n} c\left(h\right) S_{MVV} = \frac{\vartheta^\alpha_{p,n} c\left(h\right)}{h} \sum_{i=1}^{h}\left(x_i - M_{MVV}\right)\left(x_i - M_{MVV}\right)^t \qquad (27.4)$$

A Real Data Analysis

The application of the improved method $T^2_{MVV(I)}$ on real data is illustrated using data furnished by Asian Composites Manufacturing Sdn. Bhd. (ACM) involved in the production of advanced composite panels for the aircraft industry. ACM produces flat and contoured primary (Aileron Skins, Spoilers and Spars) and secondary (Flat Panels, Leading Edges and MISC: Components) structure composite bond assemblies and sub-assemblies for aerospace industries. ACM provided us with data on spoilers. For the purpose of this study, a sample of 47 spoilers ($n=47$) which consists of several features, namely, trim edge (X_1), trim edge spar (X_2) and drill hole (X_3), was furnished to us by the company. Out of the total, 21 spoilers were collected from 2009, while the rest were from 2010. Hence, we decided to use the 2009 spoilers as Phase I historical data and considered the spoilers from 2010 as future data in this study. Estimates for the location vector ($\bar{X}$) and scatter matrix (S) are presented in Table 27.1. The values of the various versions of Hotelling's T^2 statistics used in this study appear in the last four columns of Table 27.2. As could be observed in Table 27.1, the upper control limit (UCL) for $T^2_{MVV(I)}$ is smaller than the rest of the values except T^2_O. There is only a small difference between the $T^2_{MVV(I)}$ (11.5513) and the original T^2_O (11.035). When compared with the original T^2_{MVV} ($T^2_{MVV(o)}$), we observe a large disparity between the two values ($T^2_{MVV(o)} = 41.298$ and $T^2_{MVV(I)} = 11.5513$). Table 27.2 identifies the out-of-control data (highlighted) using the different T^2 statistics. Four statistics, namely, $T^2_{MVV(o)}$, $T^2_{MVV(I)}$ T^2_{MCD} and T^2_S signal observations 20, 22 and 25 as out of control, but T^2_O only signals 20 and 25 as out-of-control observations and fails to signal observation 22. Even though with low UCL value, T^2_O is unable to detect the out-of-control data unlike $T^2_{MVV(I)}$ (refer to the results of observation 20).

Conclusion

The UCL value for the Hotelling T^2 control chart using consistent and unbiased MVV estimators seemed to improve significantly from the Hotelling T^2 control chart using the original MVV estimators. The improved method ($T^2_{MVV(I)}$) was put

Table 27.1 Estimates of location vector, covariance matrix and upper control limit (UCL)

Charts	$\bar{X}$			S			UCL
T_O^2	$\begin{bmatrix} 0.00504 & 0.00284 & 0.01579 \end{bmatrix}$			$\begin{bmatrix} 0.00004 & 0.00002 & 0.00003 \\ 0.00002 & 0.00009 & 0.00001 \\ 0.00003 & 0.00001 & 0.00011 \end{bmatrix}$			11.035
T_S^2	$\begin{bmatrix} 0.00365 & 0.00256 & 0.01209 \end{bmatrix}$			$\begin{bmatrix} 0.00001 & 0.00000 & 0.00000 \\ 0.00000 & 0.00003 & -0.00001 \\ 0.00000 & -0.00001 & 0.00003 \end{bmatrix}$			11.798
T_{MCD}^2	$\begin{bmatrix} 0.00414 & 0.00207 & 0.01096 \end{bmatrix}$			$\begin{bmatrix} 0.00002 & 0.00000 & 0.00000 \\ 0.00002 & 0.00009 & -0.00002 \\ 0.00000 & -0.00002 & 0.00003 \end{bmatrix}$			21.946
$T_{MVV(o)}^2$	$[0.00336 \quad 0.00354 \quad 0.00913]$			$\begin{bmatrix} 0.00001 & 0.00001 & 0.00000 \\ 0.00001 & 0.00003 & 0.00000 \\ 0.00000 & 0.00000 & 0.00001 \end{bmatrix}$			41.298
$T_{MVV(I)}^2$	$[0.00336 \quad 0.00354 \quad 0.00913]$			$\begin{bmatrix} 0.00003 & 0.00002 & -0.00001 \\ 0.00002 & 0.00007 & -0.00001 \\ -0.00001 & -0.00001 & 0.00002 \end{bmatrix}$			11.5513

Table 27.2 The Hotelling T^2 values for the future (Phase II)

No.	x1	x2	x3	T_O^2	T_S^2	T_{MCD}^2	$T_{MVV(o)}^2$	$T_{MVV(I)}^2$
1	0.0041	0.0087	0.0129	0.55822	1.42418	1.76591	4.39082	1.56608
2	0.0047	0.0109	0.0124	0.90026	2.54922	2.46944	5.16947	1.84380
3	0.0031	0.0057	0.0096	0.49916	0.49356	0.34367	0.29917	0.10671
4	0.0035	-0.0020	0.0101	0.54633	1.01572	0.54563	1.50640	0.53729
5	0.0040	-0.0028	0.0125	0.45922	0.95881	0.45797	3.78687	1.35067
6	0.0031	0.0008	0.0061	0.90130	1.74802	1.25274	2.24213	0.79971
7	-0.0019	0.0101	0.0112	3.09329	4.13719	4.44043	6.53612	2.33125
8	0.0009	0.0039	0.0082	0.80608	1.28839	0.68370	1.05554	0.37648
9	-0.0052	0.0090	0.0203	7.36021	9.68427	14.97663	26.04990	9.29127
10	-0.0008	0.0110	0.0184	3.61976	5.80349	9.74168	19.17603	6.83955
11	-0.0021	0.0139	0.0170	5.38392	8.08967	11.87166	19.63128	7.00193
12	-0.0017	0.0092	0.0061	2.73870	4.79492	2.97882	8.13879	2.90288
13	-0.0010	0.0133	0.0138	3.80577	5.68902	7.40398	11.38954	4.06233
14	-0.0030	0.0002	0.0053	2.05480	6.34679	3.30863	9.14983	3.26349
15	0.0016	0.0134	0.0151	2.50731	5.02274	6.80538	12.38812	4.41850
16	0.0027	0.0086	0.0070	1.19755	1.89797	1.06789	2.05633	0.73344
17	0.0004	0.0086	0.0087	1.57979	2.26296	1.75966	2.87650	1.02597
18	-0.0036	0.0136	0.0129	5.79103	7.96571	9.28168	13.92929	4.96819
19	-0.0028	0.0003	0.0078	1.83044	4.70032	2.41775	4.87909	1.74023
20	0.0120	0.0123	0.0768	**38.13972**	**190.29688**	**214.92329**	**894.51844**	**319.04971**
21	-0.0015	0.0004	0.0115	1.26507	2.33013	1.54862	2.06405	0.73619
22	0.0009	0.0232	0.0202	8.41812	**19.77199**	**24.65515**	**45.24620**	**16.13805**
23	-0.0035	0.0088	0.0107	3.75884	5.16445	4.87934	7.53275	2.68672
24	0.0016	0.0061	0.0066	1.06020	1.75635	0.93200	2.23575	0.79743
25	-0.0228	-0.0466	0.0231	**42.84468**	**134.62223**	**68.63065**	**116.02933**	**41.38442**
26	0.0037	-0.0038	0.0147	0.48316	1.39455	0.77959	7.32655	2.61318

to test on real data, and the finding showed that the method performed well in detecting out-of-control data with a more stringent UCL value as compared to the original T^2_{MVV} (unimproved, $T^2_{MVV(o)}$). With good properties and performance, this improved MVV estimators should be considered as alternative estimators to replace the usual mean and variance vector in the construction of the robust Hotelling T^2 control chart.

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Chapter 28
Ethical Sensitivity and Ethics Education: Case of Accounting Students

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Introduction

After the recent corporate scandals in the USA and Europe, there are calls from various professional bodies for a greater emphasis on ethics education. It is claimed that these scandals clearly indicate the need to instill the ethical values in the students on the importance of ethics and increased attention has also been directed toward the teaching of business ethics [1]. It is believed that if the ethics education is properly incorporated in the curriculum, it can make a difference to the attitudes and behavior of the students who are the future managers [2]. According to [3], ethical thinking is a generic competence and ideally should be part of every curriculum. However, there is also the consideration that, even if ethics education is effective in achieving such goals, this may only have a short-term impact [3]. Thus, it is a challenge for the educators and universities to ensure that the accounting curriculum adopted is able to prepare the students for their professional careers in accounting [4]. [5] support this view by stating that members of professional accounting bodies worldwide acknowledged that ethics should be part of the accounting curriculum just like any other accounting technical skills.

In addition, it is claimed that measuring students' ethical sensitivity on whether they are given a chance to make ethical decisions or whether they have encountered ethical dilemmas or ethical challenges is important to ensure that accounting students are properly developing adequate ethical reasoning skills within their undergraduate curriculum [6]. There are limited studies which focus on accounting students' ethical sensitivity. Hence, this study attempts to explore the ethical sensitivity of these accounting students. This study is further supported by [7] who argues that if socialization into the accounting profession actually begins during the collegiate

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years, it is important to the profession that undergraduate accounting students' ethical reasoning skills are properly measured and understood. In addition, [8] states that research on ethical attitudes of future accountants is critical for practitioners, as it may alert them to potential problems resulting from low levels of ethical development among potential employees.

Related Literature

Business ethics as a subject has received a great deal of attention in recent years. The issues have ranged from what constitutes ethics to possible methods of altering ethical beliefs. Perhaps, the most widely examined topic in business ethics, and ethical behavior in general, involves the factors contributing to individual differences in ethical beliefs [9]. It is claimed that taking a course in ethics appears to improve students' ethical sensitivity and belief that ethical behavior is associated with successful business outcomes [10]. This is important because according to [11], in today's legalistic society, what is morally correct is often confused with what is legally correct. In many instances, this may present a conflict between adhering to the code of ethics and doing what some may perceive as proper ethical behavior, that is, when the ethic course can provide the guidelines on what is ethically right and wrong. This is supported by an earlier study which claims that, even if individuals have a well-developed sense of "what is right," these personal ethical values may still come into conflict with each other or with organizational and professional codes or rules. The inclusion of ethics in accounting courses can give students guidance as to how to deal with these situations [3].

However, many students do not perceive business ethics curriculum as having a direct or obvious relationship or importance to business as might other business classes such as management or finance. Reasons for ethics education should be stressed from the start, and reinforced throughout the course, as to why business ethics is an important topic [12].[12] further elaborate that to motivate these students to learn about ethics and behave ethically, one approach is to "sell" them on the importance of ethics in business and its relevance to their success. This is supported by [13] who admit that ethics education is encouraged and valued at most institutions. In addition, it is claimed that while many facets of one's ethical personality are determined during adolescence, this ethical personality continues to change and develop well into adulthood; therefore, in order "to function ethically in professional situations, one requires special education and preparation" in conjunction with one's professional training [14].

[15] reports that the most important objective of ethics education is to disrupt students' perceptions about their profession, themselves, and the impact that their actions, as accountants, have on other individuals. In addition, [16] noted that an assessment on the effectiveness of ethics instruction could be made regarding the students' ability to (1) identify alternative responses to a moral situation, (2) identify the effects of various moral alternatives on various stakeholders, (3) evaluate the

ethical implications related to a particular accounting issue, or (4) rely on various ethical principles. Reviews have revealed that ethical conduct and education are critical to modern society, the business world, and the accounting profession. When lapses in ethical behavior by accountants occur, the profession's credibility is endangered [17].

[18] further revealed that while the absence of more broadly educated accountants has likely hurt the profession in a number of areas, they believe that inadequate ethics education is among the most critical failures. The statement is further supported by a study carried out by [19], which revealed that accounting students were more willing to engage in questionable activity (padding expense accounts, pressure from brokerage firms to recommend inferior investment products, price fixing within contract bids, inappropriate Christmas gifts to purchasing agents, and illegal copying of computer software) than were their business counterparts.

Discussing on the challenges, [15] claims that there are a number of different ways in which students' ethical awareness can be disrupted as students are encouraged to appreciate the impact of their routine practices on other people. He further expressed that one of the initial challenges of accounting education is to develop a broader appreciation of the function of accounting as a context against which the moral aspects of this practice can be explored. However, as real ethical situations are often more ambiguous than those scenarios used in ethics education programs, and thus mere recognition may not be the important variable in terms of effectiveness of ethics education, individuals might look to others in their environment to guide their behavior [20]. Regardless of at what stage ethics education takes place, the post-Enron era has presented an opportunity for critical advances in ethics education and one in which professional accounting bodies ought to have a role [5]. Furthermore, the importance of the work environment on ethical behavior raises the issue of the role of professional accounting bodies in not only providing professional accreditation courses for university graduates but also the provision of ongoing professional development activities in ethics education [5].

Research Method

Data used in this study was collected using primary source. Questionnaires were distributed and interviews were conducted to better understand the issue of the study. The questionnaire used in this research was adapted from [21, 5, 8, 7]. Questionnaires were distributed to the whole population of 120 final-year accounting students at a public university in Malaysia. About 114 questionnaires were returned and usable for the study. The questionnaire consists of three sections. The first section attempts to solicit information about the importance of ethical acts to the accounting students. Ethical scenarios are given in the second section of the questionnaire to measure the ethical sensitivity of accounting students. And the last section seeks information about the respondents' sociodemographic. The respondents were required to answer based on a five-point Likert scale (1, strongly disagree, to

Table 28.1 Students' perception on importance of ethics

	Min.	Max.	Mean	Std. dev
A company's first priority should be employee morale	1	5	3.82	.732
To remain competitive in a global environment, business company will have to maintain ethics and social responsibility	2	5	3.90	.638
A person should make certain that their actions never intentionally harm another even to a small degree	2	5	3.89	.738
Being ethical and socially responsible is the most important thing a person can do	1	5	3.93	.737
Questions of what is ethical for everyone can never be resolved since it is up to the individual	1	5	3.83	.901

5, strongly agree). In addition, interviews were conducted to get further insight on their ethical sensitivity. Twelve final-year accounting students were chosen randomly for in-depth interviews (these were selected among those who answered the questionnaires). The interview took about 20 min each.

Results and Discussions

Descriptive Statistics

The analysis of the profile indicates that more than majority (75 %) of the respondents are female and 25 % of the respondents are male. About 42 % of the respondents are Malays, 53 % are Chinese, and the balance is Indian. More than 38 % of the respondents have CGPA between 3.51 and 4.00. Another 44 % of the respondents have CGPA between 3.01 and 3.50, and the balance (18 %) has CGPA below 3.00.

Table 28.1 presents the students' perception on the importance of ethics to them. Generally, the mean score for the statements in this table is above 2.5 in the 5-point Likert scale. They appear to understand the importance of ethics, but this score of more than three but less than four indicates that they are taking a moderate approach. This result is similar to the findings of earlier studies by [22] and [23]. They find that the students would not prefer to indulge in unethical behavior, but majority of them opt to be on the safe side by neither act unethically nor blow the whistle. This highlights the importance of the educators and faculties in instilling the ethic values in the learning processes at the universities.

Table 28.2 presents the students' response to the scenarios to measure their ethical sensitivity. Overall, the results indicate that (in each scenario) more than majority of the students strongly disagreed and disagreed with the unethical conducts in the scenarios. However, there are about 17–30 % of the students who choose to take the neutral position, and about 6–20 % of the respondents agreed with the unethical act, but none decide to strongly support the unethical acts.

Table 28.2 Students' ethical sensitivity

	Mean	Std. dev	Strongly disagree and disagree (%)	Neutral (%)	Agreed (%)
An executive earning RM100, 000 a year exaggerated his expense account by about RM3,000 a year. Do you agree with the executive's action?	2.21	0.867	65	29	6
Because of pressure from his brokerage firm, a sharebroker recommended a type of share that he did not consider being a good investment. Do you agree with the sharebroker's action?	2.11	0.870	75	17	8
A small business received one-fourth of its gross revenue in the form of cash. The owner reported only one-half of the cash receipts for income tax purposes. Do you agree with the owner's action in reporting the revenue?	2.20	0.942	72	17	11
A company paid a RM100 000 "consulting" fee to an official of a foreign country. In return, the official promised assistance in obtaining a contract that will produce RM5 million profits for the contracting company. Do you agree with the company's action?	2.43	0.968	54	30	16
A company Chairman found that a competitor had made an important scientific discovery, which would sharply reduce the profits of his own company. He then hired a key employee of the competitor in an attempt to learn the details of the discovery	2.58	1.072	54	26	20

Interviews

Twelve students are selected randomly for interviews. Among others, they are asked about their opinion on the ethic course that they have attended during the semester. Eight of the students claim that classroom studies help them in giving the guidelines on what is ethical and what is unethical, but it is not adequate to prepare them to face the working life. This is due to the fact that sometimes students do not actually

get to see the importance of ethics, and most of the time they just want to score well in exams. Among others, they state that:

Ethic course provides us the guidelines as to what is ethical and what is unethical, but it may not adequately prepare students for suitable mindset to face the dilemmas …emm…we can't really prepare for the real world dilemmas because the real world is going to be different.

In the real world, things are complicated, and not easy to solve.

However, four other interviewees disagree, and two of them stress that it depends on how the class is conducted. If the students are exposed to real-world scenarios and related discussions, then it will be effective. The other two interviewees think that it depends on how ethical an individual wants to be.

In addition, they also share the impact of ethics course on them. Nine of them admit that it has created an impact on their ethical values. Some of them agreed that now they are able to determine whether a given issue is ethical or not ethical. They admitted that all this while they were doing things without thinking and most of the times they tend to follow others. They comment that:

I think I'm more ethical now because most of the time we don't actually realize we are facing ethical dilemmas; now I think I know what is ethical and what is not. It has created an impact.

I am more conscious now, as I know which one is right and wrong.

I think I am more ethical now, I think twice before I do anything.

Yes, there is an impact, not to say that I am more ethical, but now there is awareness.

However, the other three interviewees had different thoughts on this. They claim that:

I think ethical value comes from your own self, not based on the past ten weeks of classes.

Interviewees are also asked to compare the impact of their practical training and ethic course on their ethical sensitivity. Six of them agree that ethic education has a better impact, while five students think that practical training provides a better exposure and impact on ethics and one interviewee claims that it depends solely on a person's belief and ethical values. Those who feel ethic course gives a better impact commented that:

I think the classroom studies have better impact. As now we have done our practical training, we can relate what we are studying to what we have faced earlier. Before this, we did things without knowing the theory or relevance behind it. More inputs are given in class.

I think classes are more important. During practical training, I was unaware of some of my actions. But now in class I get a better exposure. I think ethics classes should be held first before we go for training.

However, the other five interviewees with different opinion have stated that practical training has given them a better impact. Among others, they claim that:

I think practical training is more effective because in classes we tend to assume when we face problems it is easy to react ethically but in fact when we really face the situation, it is different. So it is more about us. And it is important for classes to be conducted on discussion basis.

Practical training gives us the opportunity to apply the knowledge and face the real world, but the ethic class just give us the basic guidelines.

However, one of the interviewee, Mr. A, thinks that it depends solely on how the class is being conducted or how strong is the ethical values of a firm. If the classes are not giving enough exposure or if the firm fails to instill the ethical values, a positive impact cannot be created.

Besides the comparison, they are also asked whether their undergraduate studies, including the training and ethics classes, have prepared them to deal with ethical issues in working environment. Most of them agree that it has created a baseline but it is not adequate for them to face the working world. They feel that ethics is not about something to be learned in 4 years. It is more of experience; they can only face the challenge when they face the situation. They comment that:

> We have covered the theory part, but when it comes to the real working world so many things to be looked for. I think it also depends on the students themselves, if they know what it is to be ethical then they can face the working world.

Conclusion

This study explores the importance of ethical sensitivity and ethical exposure among accounting students. The statistical results appear to suggest that the final-year accounting students possess moderate ethical sensitivity. They claim that their ethics classes have created an impact on their ethic values. They also admit that their undergraduate studies have prepared them to a certain extent to deal with the issue of ethics. However, more exposure and experience will be needed to apply the theories, lessons, and knowledge learned in the 4 years of studies. In addition, some students point out that it also depends on individual ethic values and how ethical one wants to be.

There are some limitations in this study that may have implications in interpreting the results. The interviews were conducted with only 12 final-year students. Opinion and feedback from more interviewees may provide better findings. The perception of students and lecturers from both private and public universities may be obtained in future study. Further research may also be conducted by examining the pre and post effect of ethics education.

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Chapter 29
Visualisation Skills of Geometric Figures: Its Effect in Visualisation-Based Teaching

N. Nasir, M. Ghazali, and N.A. Razak

Introduction

Visualisation-based teaching (VBT) is introduced to assist teachers in addressing learners' difficulty in Geometric Construction. Usually, teaching and learning of topics related to geometry pose challenges to teachers and learners. This occurs because the teaching of geometry is different from the teaching of numericals or algebra [1]. Geometry requires learners to possess knowledge of the concept and image of figure simultaneously [2]. On the contrary, numericals or algebra requires learners to have knowledge of the concept as a procedure, while images strengthen that knowledge [3, 4]. Concept and image in geometry are linked to two processing systems that involve verbal and visual forms [5]. Thus, the abilities to mentally visualise either verbal or visual forms, to describe it verbally or visually, and to combine both forms are elements which are used in VBT.

Visualisation skills in VBT are applied in the topic of Geometric Constructions in three forms. The first form is the verbal and visual process: the sketching figures based on verbal instructions or describing the features of a given figure. The second form is the verbal-to-visual process: transforming the forms of a sentence or symbol to figures. The third is the visual-to-verbal process: transforming the forms of a figure to sentence or symbol. Visualisation skills need to be introduced before skills in constructing geometric figures are taught in Geometric Construction. The combination of visualisation skills and construction skills in Geometric Construction assists learners' cognitive process in geometric activities. This occurs because during geometric activities, the cognitive process of reasoning for the construction of geometric figures is dependent on the reasoning for visualisation [1]. Hence, the two

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types of VBT presented in this study are VBT1, where the teacher and learners use the activity module, and VBT2, where only the teacher uses the activity module.

Issues Related to This Study

Visualisation has been identified as a problem specifically in teaching and learning of mathematics [6–9]. Other research has found that visualisation is a process that is necessary to produce images which are shapes, shades, designs, patterns and so on [6, 8, 9]. Visualisation is also linked to image and cognitive processes to enhance an individual's understanding of mathematical concepts [1, 10]. However, there have been some researches on visualisation and image in the teaching and learning of mathematics [3, 4]. There have also been researches which used the term "creating visualisation". For example, learners' weakness in creating visualisation to solve mathematical problems is an issue which needs to be given attention [11].

Teachers' role in teaching has been questioned because effective teaching can assist learners in geometric-related topics of Geometric Construction. For instance, researches on computer-aided teaching (CAT) showed that CAT can assist learners in topics related to geometry. An example is the Geometer's Sketchpad software (GSS) [12–14]. Findings also showed that CAT has not been able to fully assist learners, particularly lower secondary learners, to master the topic of Geometric Construction. Findings also showed problems in CAT which uses GSS when the teaching time frame is limited and when the teacher has insufficient time and exposure to master skills in using GSS [12].

Apart from these, there are other issues such as producing images by using individual abilities in the field of geometry which need further study. Hence, the researcher has devised visualisation skills of geometric figures in an activity module to assist teachers and learners to master the topic of Geometric Construction.

Purpose of the Study

The purpose of this paper is to study the effect of visualisation-based teaching (VBT) on visualisation skills of geometric figures among form two learners with different abilities in space visualisation. Form two learners were chosen because the topic of Geometric Construction is learnt in form two.

Research Questions

This study has been carried out to answer the following questions:

1. Is there any significant effect of visualisation-based teaching (VBT1 and VBT2) on the posttest visualisation skills of geometric figures?

2. Is there any significant effect of learners' ability of space visualisation (high or low) on the posttest visualisation skills of geometric figures?
3. Is there any significant interaction effect between the types of visualisation-based teaching and learner's ability of space visualisation on the posttest visualisation skills of geometric figures?

Research Methodology

This study employed a quantitative research approach and adopted the Quasiexperiment-Nonequivalent Control Group Design methodology.

Population and Samples

The target research population was form two learners in two secondary schools in the Kuala Kangsar district of Malaysia. There are 25 secondary schools in this district. Kuala Kangsar district was selected because the researcher had obtained a lot of responses regarding this research from teachers and schools in this district. As this study requires research to be done on two schools with similar features and academic qualifications, the research technique used was purposive sampling. Research samples consist of 66 learners from the two schools.

Research Instrument

This study used the Differential Aptitude Tests for Space Relations (DAT:SR) and Visualisation of Geometric Figures Test as the study instruments. DAT:SR contains 50 multiple-choice questions (mentally folding objects), while the Visualisation of Geometric Figures Test consists of 24 subjective questions (three parts: A, B and C).

Research Findings

The effects of the types of VBT on the visualisation skills of geometric figures among the learners with high and low ability of space visualisation can be seen from Table 29.1.

Table 29.1 shows that there is a significant effect of VBT1 (teacher and learners using the activity module) and VBT2 (teacher using the activity module) on the posttest visualisation skills of geometric figures [$F (1, 60) = 6.039, p < .05$].

Table 29.1 Two-way ANCOVA analysis for the research hypothesis

Question	Null hypothesis	Result
No. 1.1	There is no significant effect of visualisation-based teaching (VBT1 and VBT2) on the posttest visualisation skills of geometric figures	Significant, Ho: 1 is rejected. F (1, 60) = 6.039 p < .05
No. 1.2	There is no significant effect of learners' ability of space visualisation (high or low) on the posttest visualisation skills of geometric figures	Significant, Ho: 2 failed to be rejected. F (1, 60) = 1.064 p > .05
No. 1.3	There is no significant interaction effect between types of teaching based on visualisation and the learners' ability of space visualisation on the posttest visualisation skills of geometric figures	Significant, Ho: 3 failed to be rejected. F (1, 60) = 3.977 p > .05

This finding revealed that VBT1 (teacher and learners using the activity module) and VBT2 (teacher using the activity module) affects visualisation skills of geometric figures.

Table 29.1 also provides evidence that the learners' ability of space visualisation, whether high or low, has no significant effect on the posttest visualisation skills of geometric figures [F (2, 60) = 1.064, $p > .05$].

Thus, the null hypothesis 1.2 failed to be rejected. This gives evidence that the learners' ability of space visualisation, whether high or low, does not have any effect on the visualisation skills of geometric figures which have been taught in VBT1 and VBT2.

The results of the two-way ANCOVA test analysis also indicated that the interaction effect between visualisation-based teaching and the learners' ability of space visualisation has no significant effect on the posttest visualisation skills of geometric figures [F (1. 60) = 3.977, $p > .05$].

From the statistical evidence, the null hypothesis 1.3 failed to be rejected. Findings showed no active correlation between VBT1 (teacher and learners using the activity module) and VBT2 (teacher using the activity module) and the learners' ability of space visualisation, whether high or low, on the visualisation skills of geometric figures.

Conclusion

Visualisation-based teaching (VBT) was created by the researcher to assist teachers and learners address problems in the teaching and learning of Geometric Construction. In this study, two types of VBT were used during the teaching of Geometric Construction. The study used the VBT1, where the teacher and learners

used the activity module, and the VBT2, where only the teacher used the activity module. The results of the two-way ANCOVA analysis showed that VBT has a significant effect on visualisation skills of geometric figures in the topic of Geometric Construction. This indicates that visualisation skills in VBT1 and VBT2 have positive effects on visualisation-based teaching.

The study found that the learners' ability of space visualisation, whether high or low, also affects learners' performance in tests on visualisation skills of geometric figures [8, 9]. Therefore, to obtain optimum result in this study, the researcher tests the learners' ability of space visualisation. The two-way ANCOVA analysis found that the learners' ability of space visualisation, whether high or low, does not have an effect on visualisation skills of geometric figures as taught in VBT. Findings showed that visualisation skills of geometric figures can enhance teaching by the teachers or learning by learners, regardless of learners' ability of space visualisation.

Finally, the two-way ANCOVA analytical statistics found no active correlation between the types of VBT and the learners' ability of space visualisation on visualisation skills of geometric figures. This indicates that regardless of whether VBT1 or VBT2 was used, and regardless of the learners' ability of space visualisation (whether high or low), visualisation skills of geometric figures in VBT can still be taught effectively.

From this study, it is evident that the visualisation skills of geometric figures used in the activity module are highly suitable for the teaching and learning of Geometric Construction. The visualisation skills of geometric figures can assist learners to explore something more creative. For example, learners can use their fingers, fold paper, look at rulers, but not using them, and so on to estimate the side length of geometric figures. The activity module also helps teachers who are too busy to prepare suitable teaching and learning materials for learners. However, it is not easy for teachers to teach this subject without the aid of suitable materials. Geometric Construction exercises in the textbooks are not sufficient if the cognitive process of the learners in the reasoning of geometric figures construction is not combined with the reasoning of visualisation of geometric figures [10]. Therefore, this research hopes to inspire other researchers to conduct studies on visualisation skills to see whether it can also be applied in other subjects.

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Chapter 30
Measuring Customer Needs and Want: Exploring SERVQUAL Dimensions in Cooperatives

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Introduction

A customer is considered satisfied when a product or service meets or exceeds the customer's expectation [18]. If a person gets a product or service performance that does not meet his or her expectation, he or she would not be satisfied.

A cooperative may be defined as a business owned and controlled equally by people who use its services or who work at it [19]. Cooperative enterprises are the focus of this study in the field of cooperative economics which has limited liability, an unlimited life span, an elected board of directors, and an administrative staff. All profits are distributed to the member owners in proportion to their contributions according to each member's level of participation in the cooperative, for instance, by dividend on sales or purchases, rather than divided according to capital invested.

Koperasi Universiti Islam Antarabangsa Malaysia Berhad main businesses are supplying tools and equipment, furniture, stationeries, and books. Koperasi UiTM Pahang Berhad main businesses are running retail shops, photocopying services, transportation services, member's loan, bookstore, internet service, insurance, and selling and breeding of fishes.

SERVQUAL was developed to measure service quality that affects customer satisfaction. Parasuraman et al. [13, 14, 16] identified five dimensions of service qual-

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ity, that is, reliability, assurance, tangibles, empathy, and responsiveness. They are defined as follows:

1. Reliability—the ability to perform the promised service dependably and accurately
2. Assurance—knowledge and courtesy of employees and their ability to inspire, trust, and confidence
3. Tangibles—appearance of physical facilities, equipment, personnel, and communication materials
4. Empathy—the caring, individualized attention, and appearance of personnel
5. Responsiveness—the willingness of staff to help customers and provide prompt service

All of the SERVQUAL dimensions may give impact to the competency of the cooperatives and thus affect their productivity. Therefore, the cooperatives need to improve their service and performance in order to meet customer needs and wants and thereby remain competitive in the industry.

Literature Review

Parasuraman et al. [16] proposed service quality to be a function of prepurchase customer expectations, perceived process quality, and perceived output quality. They defined service quality as the gap between customers' expectations of service and their perceptions of the service experience, ultimately deriving the now-standard SERVQUAL multiple-item survey instrument.

Customers bring their experiences and overall perceptions of a service firm to each encounter because customers often have continuous contacts with the same service firm [5]. Therefore, the cooperatives should be aware because the perception of staff in communicating with their customer will give impact toward the cooperatives' image; that can be viewed as a filter in terms of a consumer's perception of service quality [9].

Achieving customer satisfaction is the primary goal for most service firms today [8]. Zeithaml and Bitner [20] stated that satisfaction is the customer evaluation of a product or service in terms of whether that product or service has met their needs and expectations. Satisfaction or dissatisfaction is not inherent in the product or service but, instead, is the consumer's perceptions of the attributes of the product or service as they relate to that individual [3]. Satisfaction is a wide concept, whereas service quality assessment focuses specifically on dimensions of service. Service quality is a component of customer satisfaction [20].

Hassan and Dalal [6] assesses the service quality of central blood bank management and found that, for the blood donors, all of the five dimension scores are all positive implying that the blood donors' tend to be satisfied. A study conducted by El-Bassiouni et al. [4] revealed the customer satisfaction indices and scores of customers' trust were indicating high levels of satisfaction and client trust. Lee et al. [11] stated SERVQUAL translated to Singapore stockbroking customers with good reliability.

Based on study by Kumar et al. [12] that used modified SERVQUAL, the banking sector needs to improve on competence and convenience to reduce the gap. It is suggested that the banking sector needs to become credible and be more responsive to fulfilling the assurance of the customers and providing the banking facilities more conveniently. Angelos [1] reveals that the widely used SERVQUAL instrument fails to fully capture the role of "tangibles" in determining overall customer satisfaction. A study by Khodayar et al. [10] demonstrated the three of the five SERVQUAL dimensions, namely, tangibles, reliability, and empathy, are not satisfied by the customers.

Thus, improvements are needed across three abovementioned dimensions to increase the customer satisfaction. According to Seyed Mostafa Razavi et al. [17], there are significant and positive relationships between service quality and customer perceived value and customer satisfaction in these companies. Furthermore, service quality can predict customer satisfaction more than what customer perceived value does. Homburg et al. [7] revealed the existence of a strong, positive impact of customer satisfaction on willingness to pay for the service offered by the firm. Gupta and Chen [2] in their study of relationship between perceived service quality and five dimensions discovered a striking result in terms of service quality dimensions is the statistically significant relationship between perceived service quality and reliability dimensions.

Research Objectives

The main objective of this research is to determine the level of customer satisfaction at both cooperatives based on the five SERVQUAL dimensions. Furthermore, the relationship between the SERVQUAL dimensions and customer satisfaction was also investigated. Specifically, this study tries to answer the following research questions:

  (i) How satisfied are the cooperatives' customers toward the products and services offered?
 (ii) How do the customers rate the cooperatives' reliability, assurance, tangibles, empathy, and responsiveness?
(iii) Is there a significant correlation between the cooperatives' reliability, assurance, tangibles, empathy, and responsiveness with customer satisfaction?
(iv) Do reliability, assurance, tangibles, empathy, and responsiveness, taken together, significantly contribute to the prediction of customer satisfaction?

Methodology

The population of this study consists of 8,300 people (staff and students) from both universities. Stratified sampling method was used to obtain data from 400 respondents. A quantitative descriptive survey was conducted using an adaptation of the basic

format of Parasuraman et al. [15] using SERVQUAL instrument. The questionnaire consisted of closed-ended five-point Likert scale items which required the respondents to rate each statement as 1—"Strongly Disagree" to 5—"Strongly Agree." Reliability, assurance, tangibles, empathy, and responsiveness are considered the independent variables while customer satisfaction is the dependent variable. Data analysis procedures used include reliability test, descriptive statistics, and correlational analysis.

Result and Findings

Table 30.1 shows the demographic data of respondents which show that majority of the respondents were female. Most respondents are from 18 to 25 years old indicating that most of them are students. Most of UIA students were Bachelor Degree students while UiTM Pahang's students were mostly studying at the Diploma level.

Table 30.2 shows the mean and standard deviation of all the variables measured from the questionnaire. The mean score of 2.92 shows that customers are fairly satisfied with the overall service quality provided by the cooperatives. The mean value for reliability, assurance, tangibles, empathy, and responsiveness is lower than 3.5 and this shows the cooperatives need to improve on these SERVQUAL dimensions.

Correlational Analysis

The correlation analysis in Table 30.3 shows that the service quality provided by cooperatives is significantly related to all of the five dimensions of customer satisfaction. The magnitudes of the correlation coefficients indicate a relatively strong significant relationship between the five dimensions and customer satisfaction.

Table 30.1 Demographic data of respondents

		UIA		UiTM	
Profile respondents		F	%	F	%
Gender	Male	63	30.7	95	48.7
	Female	142	69.3	100	51.3
Education	SPM	26	12.7	62	31.8
	Diploma	16	7.8	71	36.4
	Bachelor	152	74.1	26	13.3
	Master	10	4.9	31	15.9
	Others	1	0.5	5	2.6
Occupation	Academic staffs	11	5.4	54	27.7
	Nonacademic staffs	39	19	23	11.8
	Students	155	75.6	118	60.5

Table 30.2 Mean value for all variables of SERVQUAL dimension

Variables	M	SD
Tangible	2.99	0.87
Reliability	3.02	0.96
Responsiveness	3.03	0.90
Assurance	3.13	0.92
Empathy	2.87	0.95
Customer satisfaction	2.92	0.90

Table 30.3 Correlation among factors

Variable	Satisfaction	Tangibles	Reliability	Responsiveness	Assurance	Empathy
Satisfaction	1	0.63**	0.68**	0.74**	0.78**	0.76**
Tangibles		1	0.62**	0.62**	0.63**	0.51**
Reliability			1	0.79**	0.76**	0.61**
Responsiveness				1	0.87**	0.73**
Assurance					1	0.76**
Empathy						1

**p<0.01 level (2 tailed)

Table 30.4 Multiple regression analysis

R	R^2	Adjusted R^2	Std. error of estimate	p value
0.84	0.71	0.71	0.44	0.000

Multiple Regression Analysis

A summary of the multiple regression analysis for all the independent variables toward the dependent variable is displayed in Table 30.4. It indicates that reliability, assurance, tangibles, empathy, and responsiveness, taken together, were able to explain the variance of customer satisfaction toward service quality provided by both cooperatives. The Adjusted R2 indicates that the five SERVQUAL dimensions, taken together, contribute 71 % to the prediction of customer satisfaction. This is further justified by the significant F value ($F = 191.55$, $p < 0.001$), which strongly supports the result could not have occurred by chance. In Table 30.5, it was found that empathy significantly predicted customer satisfaction ($\beta = 0.38$, $p < 0.001$), as did assurance ($\beta = 0.27$, $p < 0.001$) and tangibles ($\beta = 0.18$, $p < 0.001$).

Summary

The customers of these cooperatives are fairly satisfied with service and products offered such as stationery, photocopy services, and food and beverages which can fulfill staff and students daily needs. The finding is supported by empathy,

Table 30.5 Model summary of the investigated variables

Model	Unstandardized coefficients		Standardized coefficients		
	B	Std. error	Beta	t	P value
(Constant)	−0.294	0.118		−2.497	0.013
Tangibles	0.235	0.049	0.18	4.807	0.000
Reliability	0.112	0.049	0.10	2.107	0.036
Responsiveness	0.040	0.066	0.04	0.610	0.542
Assurance	0.286	0.065	0.27	4.418	0.000
Empathy	0.403	0.045	0.38	8.972	0.000

assurance, and tangibles dimension of SERVQUAL. Other than that, there could be other factors that can enhance the motivation of employees to serve customer, thus to enhance customer satisfaction such as reward, salary, training, leadership, and environment at the workplace. Implementation of the service quality must be driven from the top of the organization in which training program could be conducted to ensure that the program is beneficial to the cooperatives.

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Chapter 31
Model of Self-Esteem, Job-Search Intensity and Career Decision-Making Self-Efficacy for Undergraduate Students

A. Norida, N. Mohd Tajudin, H. Kalthom, Z. Jano, M. Sharif, and M. Shahrulanuar

Introduction

In the twenty-first century workplace, possessing a bachelor degree is no longer the passport to secure jobs [1]. Employers are increasingly looking for more than just content knowledge and hard skills; they want 'work-ready' graduates with desired soft skills. Employers worldwide have been critical about graduates and their readiness for the world of work [2]. Similarly, Malaysian employers are generally not happy with the level of soft skills possessed by graduates entering the workforce. According to Malaysian employers, Malaysian graduates normally were qualified in their area of studies, but they lacked self-confidence and skills in preparation for job search [3], and their main drawbacks are lack of positive attitude, confidence and preparation for job search [4]. In other words, there has been lack of soft skills and competency among newly graduating students (self-confidence, positive attitude, job-search preparation skills and communication skills) in relation to employability.

These drawbacks are closely related to self-esteem, job-search behaviour, and career decision-making self-efficacy as the variables involved in the present study. Self-esteem has a vast definition by different scholars. For example, self-esteem is referred to as an overall evaluation of oneself in either a positive or negative way and a belief that oneself is competent and worthy of living [5]. Self-esteem is also viewed as a global judgement of the worth or value of the self [6]. Job-search

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intensity is defined as the frequency whereby job seekers engage in job-search activities such as preparing a resume or contacting an employment agency [7]. Career decision-making self-efficacy specifically refers to individuals' feelings of competency in their abilities for self-appraisal, gathering occupational information, selecting career goals, engaging in career planning, and problem solving when difficulties are encountered [8].

Several studies had investigated certain variables related to self-esteem [9–13], job-search intensity [14–17] and career decision-making [18–23]. However, there has been little discussion about the relationship on these three variables. As such, this study aimed to examine the relationship between self-esteem (individual differences variable), job-search intensity (job-search behaviour) and career decision-making (outcome predictor) among undergraduate students and propose a model of self-action-outcome for the undergraduate students. The hypotheses tested for this study are as follows:

Self-esteem influences the career decision-making self-efficacy among undergraduate students.
Job-search intensity influences the career decision-making self-efficacy among undergraduate students.
Self-esteem influences the job-search intensity among undergraduate students.

Materials and Methods

The sample sizes for this research were 678 undergraduate students and adequate for structural equation modelling (SEM) techniques [24, 25]. This research used three instruments, namely, the Rosenberg Self-Esteem Scale, the Job-Search Intensity Scale and the Career Decision-Making Self-Efficacy Scale.

The Rosenberg Self-Esteem Scale is used to measure students' global self-esteem. This instrument is one of the most widely used instruments to measure self-esteem in research settings. The instrument focuses on people's general feelings towards themselves, without referring to any specific quality or attribute. The original SE has a 10-item scale. The items are scored by using a 4-point Likert type, ranging from 0 (strongly disagree) to 3 (strongly agree). Half of the items are worded in a positive direction and the other half are worded in a negative direction. The Job-Search Intensity Scale is a self-report scale assessing behaviours related to seeking employment. This scale measures the frequency of individual participation in several job-seeking behaviours each week with options ranging from 1 (never or zero times) to 5 (very often, at least ten times). The Career Decision-Making Self-Efficacy Scale is used to assess career decision-making self-efficacy among respondents. The CDMSE measures confidence in accomplishing career-related tasks. This instrument consists of 25 items rated on a 5-point scale, with responses ranging from 0 (no confidence at all) to 4 (complete confidence).

This research was a survey-based type, and participants were recruited using cluster sampling procedure. This research used the test-retest to determine the reliability of the instrument and then SEM to test the validity of the constructs. The study applied a six-stage structural equation modelling using the AMOS (version 18) model-fitting program to test the research hypotheses.

Results and Discussion

Figure 31.1 presents the empirical results of the hypothesised structural relationship model of self-esteem, job-search intensity and career decision-making self-efficacy. The overall fit of the model was adequate with CFI = .977, TLI = .971 and RMSEA = .048. The statistics indicate that the parameters were free from offending estimates, ranging from .52 to .90. The CFI (.977) and TLI (.971) fit indicators exceeded the threshold of .90, indicating a very good fit. The root mean square error of approximation (RMSEA = .048) has met the cut-off point requirement for a reasonable error of approximation. The normed chi-square of 2.578 for a good fit is also met [26]. The final fit index indicates that the test failed to reject the hypothesised model. Therefore, there is a strong significant relationship with a
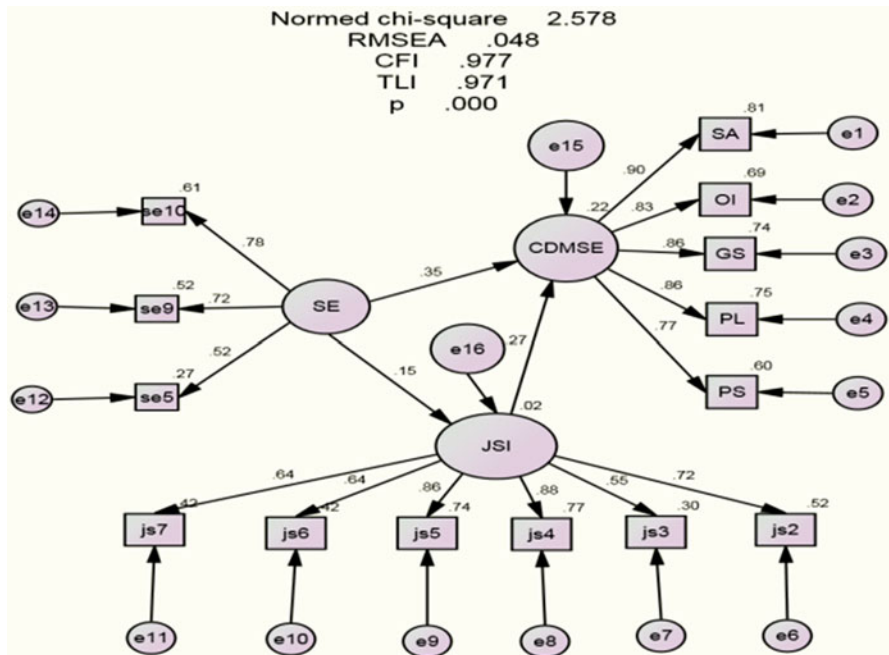
Fig. 31.1 The revised results of the hypothesised structural relationship of the SAO model

value of .35 between self-esteem and career decision-making self-efficacy among undergraduate students. There is a significant relationship with a value of .27 between job-search intensity and career decision-making self-efficacy among undergraduate students, and there is a significant relationship but rather weak with a value of .15 between self-esteem and job-search intensity among undergraduate students. As such, the researcher concludes Fig. 31.1 to be the validated structural equation model.

Therefore, a self-action-outcome model is developed as shown in Fig. 31.2. The items for self (S) represent self-esteem, which indicated three statements related to attitude towards self, feeling about self and thinking about self. These three statements show the factor loading above .50 [26] which indicated that the statements represent the self-esteem indicator. The items for action (A) show six items related to resume preparation, job-search information, sending a resume to potential employers, filling out job application, contacting relevance agency, and using of computer services to locate a job. These six statements also show the factor loading above .50 [26] which indicated that the statements represent the job-search intensity indicator.

The outcome (O) components show that 25 statements related to the 5 sub-scales. The sub-scales involved are Self-Appraisal, Occupational Information, Goal Selection, Career Planning and Problem Solving. *Self-Appraisal* (SA) refers to the confidence one has for assessing and making career-related decisions. The factor loading for this sub-scale is .90. *Occupational Information* (OI) refers to the ability to find job information. The factor loading for this sub-scale is .83. *Goal Selection* (GS) refers to the confidence in deciding upon a major, occupation or career. The factor loading for this sub-scale is .86. *Career Planning* (PL) refers to the ability to make career plans. The factor loading for this sub-scale is .86. Finally, *Problem Solving* (PS) refers to the confidence to face and to solve career-related problems. The factor loading for this sub-scale is .77. The factor loading for all five sub-scales above .50 shows that these sub-scales represent the career decision-making self-efficacy scale.

The findings of the present research have expanded the knowledge on the relationship among self-esteem, job-search intensity and career decision-making self-efficacy among undergraduate students. The results indicate that self-esteem is strongly related to career decision-making self-efficacy among undergraduate students. The self-esteem and career decision-making self-efficacy have a positive relationship in the full-fledged structural equation modelling model. The result of this finding shows that if self-esteem increases, the career decision-making self-efficacy also increases among undergraduate students. Therefore, it is important for the undergraduate students to build up their self-esteem in order to make them more confident in preparing themselves for career. Individuals with high self-esteem are generally confident of themselves, self-directed, decisive, loving and lovable, eager to express idea and assertive and get along well with others. They also accept themselves unconditionally and are willing to take calculated risks [5].

The results indicate that the job-search intensity have a significant relationship with career decision-making self-efficacy. The result of this finding shows that if

Self (S)	**Action (A)**
• Feel proud of oneself. • Ability to contribute. • Ability to think well.	• Prepare / revise resume. • Read a book or article on getting a job. • Send a resumes to potential employers. • Fill in job application. • Contact an employment agency, executive search firm, or state employment services to locate job openings. • Use the internet or other computer services to locate job opportunities.

Outcome (O)

Self-Appraisal (SA)

- Accurately assess ability.
- Determine the ideal job.
- Decide what value most in an occupation.
- Select what to or not to sacrifice to achieve career goals.
- Define lifestyle.

Occupational Information (OI)

- Seek information on interested occupations in the library.
- Find out employment trends for an occupation over the next ten years.
- Find out the average yearly earning of people in an occupation.
- Talk to a person already employed in the field interested in.
- Seek information about graduate and professional schools.

Goal Selection (GS)

- Select one major occupation list.
- Select on occupation from potential occupations list.
- Choose a career that matches preferred lifestyle.
- Make a career decision regardless whether it is the right or wrong decision.
- Choose a major or career that will fit interests.

Planning (PL)

- Make a plan for the next five years.
- Determine the steps needed to take to complete a chosen major successfully.
- Prepare a good resume.
- Identify employers, firms, and institutions relevant to career possibilities.
- Manage the job interview process successfully.

Problem Solving (PS)

- Determine the steps to undertake when facing academic problem.
- Work persistently on the major or career selected.
- Change to other academic majors when encountered problem.
- Change the occupations if you are dissatisfied with the one you selected.
- Identify some reasonable major or career alternatives if unable to get the first choice.

Fig. 31.2 Self-action-outcome (SAO) model of self-esteem, job-search intensity and career decision-making self-efficacy

job-search intensity increases, the career decision-making self-efficacy also increases among undergraduate students. Therefore, it is important for the undergraduate students to actively involve with job-search behaviour in order to make them more confident in preparing themselves for career. The finding of the research affirms the study done by other researchers [7, 9, 13, 27, 28] and shows that there is a significant relationship between job-search intensity and career decision-making self-efficacy.

The results also indicate that self-esteem has a significant relationship with the job-search intensity. Therefore, it is important for the undergraduate students to build up their self-esteem in order to make them more productive. Individuals with high self-esteem will take more risks in job selection and more likely to choose unconventional jobs than people with low self-esteem [5]. Individuals with high self-esteem tend to be successful in their job searches than those with low self-esteem.

The results of the research have highlighted several invaluable contributions and implications for professionals and particularly practitioners. The main practical contribution of this study for practitioners is to bring to their attention the relationship among self-esteem, job-search intensity and career decision-making self-efficacy. The results are useful in helping the transition process of students from university to work. Such information could lead to an improvement in planning and policymaking for the development of a more effective and efficient counselling and career guidance system in the university settings. Practices of counselling by guidance counsellors are to provide guidance to students in preparing for their working life. This includes the development of attitude, beliefs, and students' psychological development.

Based on tracer study reported by the Ministry of Higher Education Malaysia (MOHE), only 23.5 % of the students sought help from the guidance and counselling services centre, and only 39.9 % of the students sought help related to career guidance [29]. This report indicated a gap in the MOHE tracer study. The gap is caused either by the guidance counsellor, counselling service or the graduates. As a policymaker at the Ministry of Higher Learning, the MOHE can enforce undergraduate students to go through the process of career guidance in preparing them for the world of work. At the same time, it is possible to make it compulsory for universities to offer courses or programmes for the career guidance centre related to help prepare student readiness for the careers available.

Career counsellors can assist through training workshops provided with tools, manuals, annual labour supply/demand report. Alumni mentorship programmes can be created to link students with successful alumni working in a career field of similar interest. Online community portal can include an interactive website for posting questions and answers to facilitate collaboration among career counsellors, students, new graduates and employers. It is imperative for policymakers at the faculty or centre level to scrutinise the contents in educational institutions. Curricula with psychology and soft skills will go a long way in building student confidence in dealing with the environment of work. Hopefully, issues pertaining to students soft skills and confidence level as reported in the UNESCO report [30] as well as feedback from CEO of large corporations [3, 4] can be dealt and looked into.

The present study is focused on the relationship of self-esteem, job-search intensity and career decision-making self-efficacy**.** Furthermore, it would be interesting to investigate other variables involved in self-categories, job-search behaviour and the linking of the predictors' variables with the outcome variables for future studies as suggested by Saks [13] in his model. The self-action-outcome (SAO) model is the ultimate finding from the current study. This model is a good-fit model based on the structural equation modelling analysis. For future research, this model can be tested again to prove the validity of a good-fit model with different respondents and locations.

The current study used the self-report methodology without any external corroboration; thus, the findings are limited to what have been included in the self-report measures. The future study needs to address this limitation. Longitudinal studies using self-report measures combined with other research methods, including qualitative methods (e.g., interviewing, observations), would be likely to reveal more outcomes that may be useful in understanding students' self-esteem, job-search intensity and career decision-making process of young adults.

Conclusion

In conclusion, this study examined the relationship between self-esteem, job-search intensity and career decision-making self-efficacy among undergraduate students. The findings show that there are significant relationships between self-esteem and career decision-making self-efficacy, between self-esteem and job-search intensity and between job-search intensity and career decision-making self-efficacy. Self-esteem and job-search intensity have a mediating effect on career decision-making self-efficacy. At the end of the research, a model of self-action-outcome (SAO) was developed as shown in Fig. 31.2.

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Chapter 32
An Empirical Analysis of Consumers' Behavioural Intention Towards Perceived Usefulness and Service Quality: A Malaysian Perspective

Audrey Ann Balraj and Kavitha Balakrishnan

Introduction

Several surveys have proven that many online selling web sites do not provide the basic and useful information in their respective selling web sites that is needed by the consumers to buy online products. Sometimes when there is lack of product information available, consumers hesitate to buy those products as they are unaware of product information. For example, a company manufactures a product and decides to sell it online. The customers will not be able to know detailed information about the product if the company does not state the useful information about the product such as the uses and the benefits of the product. Therefore, it is important to study the information needed by the consumers to buy or purchase online products, and this research identifies the perceived usefulness and service quality of e-commerce to the customers. Unlike face-to-face shopping experience where the consumers can actually discern the actual quality of the product, they cannot judge the quality of the products while purchasing them online. Therefore, this research also aims to identify if the consumers are provided with the actual quality of product as promised to them during the business transaction online.

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Literature Review

According to [1], "perceived usefulness" can be affected by trust both in the short term and in the long term. According to [2] perceived service quality may not have a separate ontology as a multidimensional construct, but it may have overall effect towards the service quality of a web site which is likely to be the result of the perceived usefulness and perceived trust towards the service. Reference [3] findings illustrated that perceived usefulness, which is the factor of the technology acceptance perspective, positively moderates the relationship between e-service quality, perceived service value and service satisfaction.

Research of [4] found that perceived usefulness for search function influences "perceived ease of use", whereas PEOU and perceived usefulness for purchase function influence the intention. These results tell e-tailers that cognitive beliefs in search function are important to the overall purchase function. For instance, an easy search function positively influences the ease of use of the purchase function, the usefulness of purchase function and, subsequently, the intention to purchase. Reference [5] structural equation modelling (SEM) showed that perceived enjoyment was a significant predictor of perceived usefulness and intention to use technology.

Perceived Usefulness

Perceived usefulness is one of the major behavioural beliefs that influences consumers' intention in selecting an e-commerce business. The consumer feels comfortable if the system is clear and easy to understand. Perceived usefulness is the consumers' understanding that a particular system would enhance the consumers' belief in the business. Reference [6] noted that perceived usefulness is the strongest predictor of intention to use and remain significant over a long period of time. Perceived usefulness encompasses behaviour, attitude and ease of use to generate revenue in e-commerce. When the acceptance over a certain product has somewhat satisfied the customer, then trust and perceived quality will follow suit. Reference [3] research findings illustrated that perceived usefulness is the factor of the technology acceptance perspective which positively moderates the relationship between e-service quality, perceived service value and service satisfaction. A study found "perceived usefulness" as a factor for search function and purchase function [4]. According to [2], perceived usefulness can influence perceived ease of use, perceived service quality and perceived trust.

Perceived Service Quality

According to [7], perceived service quality was found to have a significant impact on customer satisfaction. In turn, customer satisfaction was found to have a significant effect on trust. Perceived service quality is one of the potential factors which

influences the e-commerce business. The web site for the business must be properly organised. The web site must be user-friendly, must be catered for all consumers and must enable smooth shopping experience and process for the online shoppers. There are some problems which can be highlighted based on the quality of an e-commerce business. First is the web site. The web site should be designed in a way where everyone can easily get to the web page they want. The font and the colours used must be clear and attractive. Second is the quality of the server. To provide the flexibility needed to respond to customers' requests, web pages that typically support e-commerce applications must be dynamically computed. This means that the delays witnessed by users are directly affected by server performance and not simply by download times. Inevitably, more requests are made for servers' performance so that they can immediately handle the magnitude of user demand which outstrips server capacity. The outcome of poor server performance is that often some users are denied access to the server, or the accessed service is unacceptably slow. According to [2], perceived service quality and perceived usefulness are interrelated. Therefore, perceived service quality may not have a separate ontology as a multidimensional construct. The author also says that user's perceptions of detailed affordances of the service, such as the relevance and timeliness of the information, are antecedent to the overall effect towards the service, rather than being additional dimensions of perceived service quality online.

With the above literature review and findings, the researcher would like to test on the factors that will influence the behavioural intention of e-commerce consumers in Malaysia. The theory will be tested and analysed with substantial analysis and survey of 500 data.

Methods

In this study, 500 respondents were used as samples for this study. Of 500 respondents, 48.6 % were males and 51.4 % were females with 48 % within the age range of 21–30 years old and about 95 % with undergraduate qualification and above. The respondents were full-time students, part-time students, salaried professionals or educated workers who perform a semi-professional office, administrative and sales coordination tasks. Questionnaires were carefully developed, tested and debugged before they are administered on a large scale. The questionnaires were self-administered and distributed via e-mail to the respondents within Malaysia only. Convenience sampling method was used by the researchers for this research. This sampling allows the researchers to obtain responses from those people or units that are most conveniently available. Reference [8] defined perceived usefulness as the degree to which a consumer believes that using the system from a web site would provide access to useful information, comparison and faster online shopping. Generally, there is a consensus among many studies that perceived usefulness is strongly correlated to user's acceptance and should not be ignored by those attempting to design or implement successful systems and services [9].

Perceived usefulness is mostly used in the behavioural and marketing science research. Perceived usefulness is a degree which the person believes that using the particular technological system would expand his/her job performance and purchasing activities. Perceived usefulness has been authenticated in many studies of e-commerce and IS research [10]. Reference [11] also found that the relationship between e-service value and e-service is positively influenced by perceived usefulness. Reference [12] findings show that technological readiness influences perceived usefulness. Reference [13] mentioned that perceived usefulness is the extent to which a person believes that using a system will enhance their performance. Thus, the hypothesis may be stated:

H1: Perceived usefulness has a relationship with consumers' behavioural intention.

Based on computer-mediated environments like online communities, service quality is deemed as company's core service infrastructure for a company to interact with their customers [14]. Service quality could be measured by interface design, confident service, prompt service and interesting service. Service quality is referred to as the point of contact represented by the image for the company [15]. In social media context, service quality is considered as key determinant for online success [16]. According to [17], the special characteristics of the Internet make it relatively easy for online customers to switch from one e-vendor to another if one e-vendor offers better web site quality than the other. Practitioners for long have known and are aware that web site quality must be presented to competitive advantage. Overall, the authors suggest that practitioners improve the quality of their web sites to meet consumers' expectations. According to [18], consumers these days have an abundant choice of web sites and can switch vendors easily without incurring any cost. Providing the means for consumers to shop online is not enough to guarantee success in online business. An online business depends not only on consumers visiting their web site and buying their products or services but also on converting casual consumers to loyal consumers via their service quality. Thus, the following hypothesis is formulated:

H2: Perceived service quality has a relationship with consumers' behavioural intention.

Findings and Discussions

An SPSS 17.0 statistic programme was used to analyse the data collected from the respondents. In this study, 500 respondents answered the questionnaires which were self-administered and distributed via e-mail to the respondents within Malaysia only.

Table 32.1 Distribution of gender

Attributes	Frequency	Percent
Male	243	48.6
Female	257	51.4
Total	500	100.0

Descriptive Statistics

The purpose of this statistic result is to determine the respondent's demographic information. This descriptive analysis consists of gender, age, race, education background, occupation and respondent's experience towards Internet and e-commerce in Malaysia. In this section, bar chart is used to show the results from the descriptive analysis.

Gender

In this study, 500 questionnaires were collected which include 243 male respondents and 257 female respondents. The gender percentage shows that male respondents are more than female respondents which is 48.6 % for male and 51.4 % for female as shown in Table 32.1.

Age Group

Table 32.2 identifies respondent's age group towards factors on customers' behavioural intention in e-commerce transactions at Malaysia. From the result, most of the respondents are in the age range of 21–30 years old with 48 %. The findings suggest that the younger group respondents are more active in technology products and services compared to other age group in Malaysia.

Education Background and Race Group

Table 32.3 shows the education background of the respondents. From the collected data, it is evident that most respondents have undergraduate qualification and above. On the other hand, Table 32.4 shows the racial distribution of the respondents towards factors on customers' behavioural intention in e-commerce transactions at Malaysia. The Chinese respondents participated the most in this study followed by Indian and Malay respondents. Since this study was conducted within Malaysia, most of the respondents mainly belong to the three predominant races which are Chinese, Malay and Indian with a handful of other races.

Table 32.2 Distribution of age

Attributes	Frequency	Percent
20 and below	51	10.2
21–30	240	48.0
31–40	165	33.0
41–50	35	7.0
Above 51	9	1.8
Total	500	100.0

Table 32.3 Education background

Attributes	Frequency	Percent
Primary	3	0.6
Secondary school	26	5.2
Undergraduate	287	57.4
Postgraduate	50	10.0
Professionals	134	26.8
Total	500	100.0

Table 32.4 Distribution of race group

Attributes	Frequency	Percent
Malay	129	25.8
Chinese	200	40.0
Indian	156	31.2
Others	15	3.0
Total	500	100.0

Table 32.5 Number of times purchases made online per month

Attributes	Frequency	Percent
Never	65	13.0
1–5 times	273	54.6
6–10 times	145	29.0
More than 15	13	2.6
Total	500	100.0

Respondent's Usage of Internet per Month

Table 32.5 shows that most of the respondents use Internet services one to five times in a month to purchase goods and services, which is 54.6 %. This also means that the Internet has become an essential tool for purchasing goods online as it is faster and cheaper. On the other hand, some respondents also use the Internet for purchasing more than six times in a month with a percentage of 29.0 %. From the result, 13 % or 65 respondents have never participated in the Internet services in Malaysia. In contrast, only 2.6 % or 13 respondents are frequent users of Internet, and they use the services more than 15 times in a month. This shows that there are people who actively engage in purchases using the Internet every month.

Table 32.6 Variables ANOVA

Variables		Sum of squares	df	Mean square	F	Sig.
PU	Between groups	177.232	21	8.440	57.370	0.000
	Within groups	70.318	478	0.147		
	Total	247.550	499			
PSQ	Between groups	160.356	21	7.636	64.431	0.000
	Within groups	56.650	478	0.119		
	Total	217.006	499			

Table 32.7 Correlation analysis for hypothesis H1

		Perceived usefulness	Consumers' intention
Perceived usefulness	Pearson correlation	1	.791[a]
	Sig. (2 tailed)		.000
	N	500	500
Consumers' intention	Pearson correlation	.791	1
	Sig. (2 tailed)	.000	
	N	500	500

[a]Correlation is significant at the 0.01 level (2 tailed)

Table 32.6 presents the results of the one-way ANOVA test for the two dependent variables. Both the variables revealed a significant difference at the 0.05 significance level.

Pearson Correlation Testing

This section examines if there is significant or insignificant relationship of the independent variables which are perceived usefulness and perceived service quality with the dependent variable which is consumers' behavioural intention towards e-commerce in Malaysia (Table 32.7).

Objective 1

To identify the usefulness of online shopping towards consumers

H1: Perceived usefulness has a relationship with consumers' behavioural intention

Based on the above results, perceived usefulness has a strong relationship with consumers' intention. The Pearson correlation of this variable is 0.791 which indicates that perceived usefulness has a positive relationship with consumers' intention. Besides that, the significant value of the perceived usefulness is 0.000 which is exactly with the par value (0.000). Thus, this shows that these two variables are significantly correlated. These outcomes were consistent with the previous studies conducted by [13] that

Table 32.8 Coefficients

Model		Unstandardised coefficients		Standardised coefficients			Collinearity statistics	
		B	Std. error	Beta	t	Sig.	Tolerance	VIF
1.	(Constant)	.009	.126		.068	.946		
	PU	.232	.567	.160	4.220	.000	.236	3.816

[a]Development variable: consumers' behavioural intention

perceived usefulness directly influences the intention to use through attitude towards computer use. The author also stressed that the influence on consumers' intention is stronger with significant results. This is also supported by [19] study that perceived usefulness has significant relationship with behavioural intention. According to [20], perceived usefulness and satisfaction influence loyalty intention towards e-commerce. Reference [21] further stated that perceived usefulness is one of the belief constructs that displays significant determinants of consumers' attitude towards usage and their intention in using online technology. Therefore, H1 is accepted and it is confirmed that perceived usefulness had a strong influence towards consumers' intention.

According to Table 32.8, perceived usefulness is found to be a significant factor in consumers' behavioural intention ($t = 4.220$, p-$value = 0.000$). In addition, perceived service quality has a significant factor in consumers' behavioural intention ($t = 4.543$, p-$value = 0.000$). Besides, no multicollinearity problems exist as the variance inflation factor (VIF) values are below 10. The study confirms that consumers' behavioural intention towards e-commerce is influenced by perceived usefulness. The findings indicate that all the hypotheses were supported. Therefore, we can assume that e-commerce has developed well in Malaysia and many people intend to apply this service in their daily life. The study concludes that certain factors contribute and influence the consumers' behavioural intention towards e-commerce. According to correlation analysis, the study indicates that perceived usefulness has a significant relationship in consumers' behavioural intention towards e-commerce services. Consumers feel that the e-commerce is useful in providing the respondents with timely and updated information. Furthermore, the respondents prefer online purchasing to the traditional shopping as they can purchase goods and services faster. Thus, purchasing an online ticket is faster and can suit an individual's needs and wants.

Objective 2

To identify the quality perceived by the customer through e-commerce shopping

H1: Perceived service quality has a relationship with consumers' behavioural intention

According to Table 32.9, there is a positive relationship between perceived service quality and consumers' intention ($r = 0.00$, $p < 0.01$), which indicates that perceived service quality has a positive relationship with consumers' purchase intention. In addition, this implies that these two variables are significantly correlated.

Table 32.9 Correlation analysis for hypothesis H2

		Perceived service quality	Consumers' intention
Perceived service quality	Pearson correlation	1	.810[a]
	Sig. (2 tailed)		.000
	N	500	500
Consumers' intention	Pearson correlation	.810[a]	1
	Sig. (2 tailed)	.000	
	N	500	500

[a]Correlation is significant at the 0.01 level (2 tailed)

Table 32.10 Coefficients

Model		Unstandardised coefficients		Standardised coefficients			Collinearity statistics	
		B	Std. error	Beta	t	Sig.	Tolerance	VIF
1.	(Constant)	.009	.126		.068	.946		
	PSQ	.262	.058	.230	4.543	.000	.202	4.942

[a]Dependent variable: consumers' behavioural intention

This is consistent with [7] study that perceived service quality was found to have a significant impact on customer satisfaction. Furthermore, in social media context, service quality is considered as a key determinant for successful online business [16]. These results show that service quality plays an important role on consumers' behavioural intention towards e-commerce. Thus, H2 is accepted and it is confirmed that perceived service quality has a strong influence towards consumers' intention (Table 32.10).

The present study shows that perceived service quality had a significant relationship with the consumers' behavioural intention towards e-commerce services. The consumers believe that the online web sites provide better up-to-date information on their services and products. The consumers also are given real-time information which at times can reduce their anxieties, concerns and problems.

Conclusion

Overall, customers were quite positive about e-commerce activities and their roles. Perceived ease of use and perceived service quality show a significant variable in explaining consumer's behavioural intention to use e-commerce. It clearly shows that there is continuing improvement on e-commerce usage in Malaysia. As a result, in order to increase the behavioural intention of consumers' perceived usefulness, e-commerce activities must be enhanced. Besides, organisations should meet customers' request in an efficient manner, by providing customers with precise, error-free and updated information to inform them of their needs accurately. The

research further demonstrated that individual characteristics and technological factors may have a significant influence on instructors to adopt e-portfolios into their courses. Hence, the organisation should always make sure their e-commerce is user-friendly and can provide timely information to their consumers. This is in line with the research objective 1, which is to identify the usefulness of online shopping towards consumers.

According to [22], customers' perceptions of usefulness positively moderate e-service quality. Thus, behavioural intention of consumers can be increased further by incorporating the ideas in future study. Organisation can design their e-commerce activities in a way which is easily accessible by consumers as well as their employees. Reference [23] also agreed that consumer satisfaction is a much better predictor of behavioural intentions, whereas e-service quality is more closely related to specific evaluations about the service. Hence, building the appropriate service package can boost their intention to go online.

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Chapter 33
The Effect of Zikr on Physiological Coherence: A Case Study on Selected University Students

T.M. Tuan Sidek, J. Abdul Kamil, and A.W. Nubli

Introduction

Islam demands Muslims to perform *zikr* or remembrance of God anywhere and at anytime. *Zikr* itself can be obligatory like five daily prayers and commendable like commendable prayers, reciting Quran, and others. According to Abd Basit [1], the form of *zikr* can be divided into three:

1. *Zikr Qauli – zikr* in the form of reciting particular words or phrases like *subhannallah*, *alhamdulillah*, and *lailahalillah*, reciting certain prayers before embarking at a journey, entering toilet, wearing clothes, reciting Quran, and others.
2. *Zikr Qalbi – zikr* in the form of remembering the God in the heart. A person always tries to remember God anywhere he is, during working, driving, looking at the universe, and particularly during praying or performing rituals.
3. *Zikr Fi'li – zikr* in the form of action like movement of lips, head, and other parts of the body during utterance of certain *zikr* words or calculating the amount of *tasbih* using fingers or walking to masjid, helping needy, and others.

There are many verses in the Holy Quran which encourage *zikr* and emphasize the importance of it in daily life. Among them are verses no 190–191, Chapter *Ali Imran:* "Behold! In the creation of the heavens and the earth, and alteration of night and day, there are indeed Signs for men of understanding. Men who celebrate the praises of God, standing, sitting and lying down on their sides and contemplate the (wonders of) creation in the heavens and the earth (with the thought): our Lord! Not for naught hast Thou created (all) this! Glory to thee! Give us salvation from the penalty of the fire." In the verse no. 28, Chapter *al Ra'du*, the Al Mighty God has mentioned the effect of *zikr* in His saying: "Those who believe and whose hearts

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find satisfaction in the remembrance of God for without doubt in the remembrance of God do hearts find satisfaction." This verse clearly mentions that remembrance of God contributing to the satisfaction of heart (*idtmi'nan al Qalb*).

Therefore, a study has been done to find out the relationship between the satisfaction of heart (*idtmi'nan al Qalb*) and *zik*r by using one of the biofeedback devices, emWave PC Stress Relief System. The objective of the study is to identify the effect of *zikr* on physiological changes.

Materials and Methods

Biofeedback and emWave Pc Stress Relief System: Biofeedback is a method by which a person learns to control their heart rate or other physical or mental processes by using information from recordings of those processes [2]. According to John L. Andreassi [3], biofeedback means providing immediate information regarding physiological processes about which the individual would normally be unaware. Thus, a person might be given information regarding muscle potential in the forearm, or level of blood pressure, heart rate, or perhaps the type of brain wave being produced at that moment. According to basic premise in biofeedback applications, if an individual is given information about biological processes, then the person can learn to regulate this activity. According to the website of the Association of Applied Psychophysiology and Biofeedback [4], biofeedback is a process that enables an individual to learn how to change physiological activity for the purposes of improving health and performance. Precise instruments measure physiological activity such as brain waves, heart function, breathing, muscle activity, and skin temperature. These instruments rapidly and accurately provide feedback information to the user. The presentation of this information often in conjunction with changes in thinking, emotions, and behavior supports desired physiological changes.

There are various biofeedback equipment. Among them is emWave Pc Stress Relief System. It is used to measure the heart rate. This device shows the effects of stress by measuring the subtle changes in heart rhythms. It objectively monitors heart rhythms to confirm one's physiological level of coherence. Coherence is an optimal state in which the heart, mind, and emotions are operating in sync and in balance which has been proven to have numerous mental, emotional, and physical benefits. Physiologically, when coherent, the immune, hormonal, and nervous systems function in a state of harmonious coordination. When a person is in a state of relax and calm, normally his or her coherence level is higher [5], whereas if he or she is in the state of stress, the coherence level is lower. Figure 33.1 shows how the device provides the data.

The methodology of the study is that we choose some of students randomly and some other students based on their religiosity scale. The religiosity scale is based on a set of questions pertaining to the religiosity of the students. Selected students are required to be measured by emWave PC Stress Relief System at least two times: first, without reciting *zikr*. What he or she does is coming to a room, sitting in a chair, resting for 2 min, and trying to relax without doing anything. Then the first

Fig. 33.1 Band "coherence ratio"
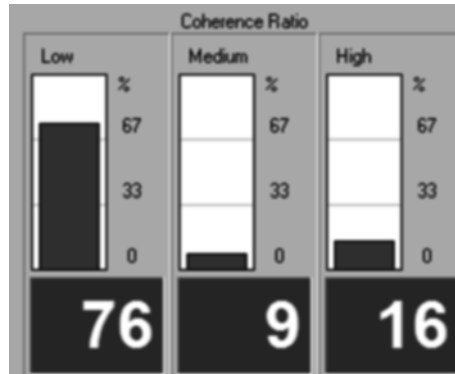
Table 33.1 Measurement protocol

No	Steps	Duration	Scale
1	Rest	2 min	–
2	Normal relaxation without *zikr*	2 min	Coherence ratio
3	Rest	1 min	–
4	Relaxation with *zikr Subhanallah, walhamdulillah, Allahuakbar, laillahaillah*	2 min	Coherence ratio

measurement is taken in 2 min. Then, the student is asked to rest for 1 min. The second step is a student recites certain *zikr* that he or she is familiar with and tries to focus to the *zikr* as much as possible to gain the state of "*khusyuk*." The measurement is also done within 2 min. Students choose to recite simple *zikr* that they are familiar with which are *laillahaillahllah, Subhanallah, Walhamdulillah,* and *Allahuakbar*. Along this study, the number of the students that have been successfully measured is ten. Table 33.1 shows measurement protocol.

Result and Discussion

The first measurement shows the coherence levels of the samples are at certain states and vary from one to another. In the second measurement, the coherence levels of most of the samples are higher. Tables 33.2 and 33.3 show the result.

The measurement in most of the samples shows that the coherence level during "during *zikr*" is higher than "without *zikr*." However, a few samples (2 out of 10 – sample 5 and sample 9) show different results. Their coherence ratio high is lower during with *zikr* compared to without *zikr*. From the feedback given by these two samples, they have difficulty to focus on the *zikr* to gain the state of *khusyuk*.

Table 33.2 Coherence level without *zikr*

(Participant)	C. ratio low	C. ratio medium	C. ratio high	HR average
1	90	10	0	88
2	91	9	0	89
3	52	14	33	82
4	62	19	19	105
5	**24**	**48**	**29**	68
6	100	0	0	100
7	71	14	14	88
8	52	43	5	72
9	**14**	**14**	**71**	69
10	80	10	10	66

Table 33.3 Coherence level during *zikr*

(Participant)	C. ratio low	C. ratio medium	C. ratio high	HR average
1	33	29	38	81
2	10	65	25	91
3	38	24	38	77
4	5	33	62	83
5	**81**	**19**	**0**	64
6	60	16	24	85
7	52	10	38	116
8	43	19	38	82
9	**55**	**36**	**9**	71
10	24	38	38	68

Table 33.4 The mean of coherence ratio without *zikr* and during *zikr* for all participants

(Participant)	Mean C. ratio low	Mean C. ratio med.	Mean C. ratio high	Mean HR average
Without zikr	63.60	18.10	18.10	82.70
With zikr	40.10	28.90	31.00	81.80

Table 33.4 shows the mean of coherence ratio for all participants. The mean of coherence ratio low "without *zikr*" is 63.60, whereas mean of it in "during *zikr*" is 40.10. It shows that without *zikr*, coherence ratio low is higher. However, in both coherence ratio medium and coherence ratio high, the mean of during *zikr* is higher. The mean of coherence ratio medium during *zikr* is 28.90 compared to 18.10 during without *zikr*, and the mean of coherence ratio high during *zikr* is 31.00, whereas in without zikr is 18.10. Besides, heart rate average also shows a slight decrease from 82.70 during without *zikr* to 81.80 during *zikr*.

Conclusion

Based on the result, we conclude that *zikr* has effect on one's physiological coherence if he or she is able to concentrate and focus to the recited *zikr* to gain the state of *khusyuk*. If not, it will not give significant effect. However, this study is only conducted on ten samples in a few minutes. The result will be more significant if the measurement is done in longer time and the quantity of the samples is higher.

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Chapter 34
Supply Chain Integration Implementation and Operational Capability in SMEs: A Literature Review and a Research Agenda

Thoo Ai Chin, Abu Bakar Abdul Hamid, Amran Rasli, and Zhang Dawei

Introduction

SMEs form as the potential economic backbone of many regions and make a large contribution to employment than large firms [1]. A similar trend exists in Malaysia too where SMEs have potential to be a powerful engine growth and innovation with the constitution of 99.2 % businesses [2]. Malaysian SMEs are distributed into four broad economic segments: services, manufacturing, basic raw materials producers and agriculture [3]. SMEs contributed 32 % of GDP in 2010; service sector contributed the largest share with 20.2 %, followed by manufacturing sector with 8.7 % [2]. Survival and growth of SMEs can be difficult in current competitive business environment and global marketplace; customers are more demanding to have better and cheaper products, higher service levels, more product varieties and faster delivery [4, 5]. It can be a real challenge to deliver a right product and service at the most opportune time and at the lowest possible cost to the right customer [6, 7]. In addition, the changes of business models such as lower production cost, delivery of ever-increasing customer value, flexibility with superior service and the pervasive impact of information technology [8] are increasingly creating mammoth challenges for businesses to survive. These challenges stress the importance of managing cross-boundary relationships between business partners. Therefore, many companies have begun to identify that today competition occurs between supply chains networks rather than individual firms [4, 6, 9]. To gain competitive advantage, supply chain management (SCM) is one of the effective tools to achieve it [5, 6, 10, 11].

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Importance of SCM to SMEs

The main focus of SCM is to provide right product to the right customers at the right cost, right time, right quality and right quantity [7]. Meanwhile, the short-term strategic goal of SCM is to reduce cycle time and inventory and thus increasing productivity, whereas the long-term goal is to enhance profits through market share and customer satisfaction [10]. According to Mohanty and Deshmukh [12], quantified benefits of SCM include lower supply chain costs, overall productivity, inventory reduction, forecast accuracy, delivery performance, fulfilment cycle time and fill rates. SCM delivers improvement up to 60 %, which ranges between 10 and 60 %. Fulfilment cycle time records the highest improvement from 30 to 60 %. In the context of SMEs, cost-effective SCM is critical for its survival and growth as purchasing cost makes up the largest share in sales revenue – approximately 80 % [13]. Meehan and Muir [14] conducted a study in SMEs in Merseyside, UK, to reveal the perceived benefits of SCM to SMEs. The potential benefits include increased customer service and responsiveness, improved supply chain communication, risk reduction, reduced product development cycle time processes, reduction in duplication of inter-organisational processes, inventory reduction and improvement in electronic trading. In another study involving SMEs manufacturing companies in Turkey, Koh et al. [9] found that the execution of SCM practices could deliver benefits to SMEs in terms of reduced inventory level, reduced lead time in production, increased flexibility, forecasting accuracy, cost saving and accurate resource planning.

Supply Chain Integration Practices

An integrated supply chain framework is needed to tie the whole network together in order to reduce perennial supply chain challenges. Supply chain integration (SCI) plays a pivotal role in improving organisational performance [15, 16], and it is collaborative efforts among suppliers, cross-functional departments and customers that are linked and coordinated by the flow of processes and information [16]. Collaboration effort is the main ingredient of SCI that facilitates the flow of communication and cooperative efforts between departments [17]. External integration refers to supplier and customer integration which focuses on dense and interactive relationships development with suppliers and customers. Integrating with supplier is considered the most prevalent practice of SCI [18]. Supplier integration is the interaction between firms and their suppliers in the effort of information sharing, effective alignment and participation [19]. Also, supplier integration involves the coordination of core competencies of firms and its critical suppliers [20]. Supplier integration extends from unproductive arm's length supply chain relationship to long-term contract yet cooperative relationship through joint efforts in product development, problem solving, design support and technology exchange [21]. Apart from the integration supply side of a supply chain, the demand side can be integrated as well into a synchronised process in order to fulfil customers' demand.

Customer integration involves rapid responses to customer's needs and requirements related to better understanding of the customer organisation's product, market and culture [21]. The external and internal supply chain integration practices have been found to create value in numerous ways: reduced operation cost, increased customer satisfaction [22], faster delivery [6, 12], strong market share [10], reduced inventory cost [9, 14], improved quality [23] and stronger competitive advantage [6]. Apart from external integration, the integrative philosophy involves internal integration as well. Internal integration aims to eliminate traditional functional silo where functional departments of a company are integrated into a single entity [17] to meet customers' requirements at the lowest system-wide cost [21]. Brown [24] suggested that the inter-functional integration is based on the theory of interdependence where the relations between two working units are described as individual and collection activities and behaviour of individuals or a group [25]. Internal integration can be optimal when the complementary cross-functional teams of a firm including procurement, production, logistics, marketing, sales and distribution act as a whole to coordinate information flow, share resources and work as a team to achieve a mutually organisational goal. Internal integration can be operative or functional integration [26]. Internal integration is found to have greater impact on business performance if compared to supplier integration [17].

Operational Capabilities

Operation encompasses all facets of firm's activities directed towards producing a product or rendering a service. The activities include, but are not limited to, planning, scheduling, performance measurement, delegating and supervising the work, SCM, procurement, purchasing, logistics/warehousing, etc.. [27]. Resources and capabilities developed from operations are the basis for corporate profitability and source of direction to define a firm's identity because they are the foundation for business strategy in gaining competitive advantage [28]. Capability is a superior and distinctive way of coordinating, deploying and allocating resources [29]. Firms need capability from overall operations including cooperation, responsiveness, customisation, improvement, reconfiguration and innovation [17, 30]. The capabilities are imperative that enable firms to cope with uncertainty and gain competitive advantage through supply chain responsiveness. For example, operational capability necessitates the respective manufacturing systems to become highly responsive in terms of equipment, material and labour [27]. However, the majority of existing frameworks – relationship between supply chain practices and performance [4, 6, 10, 23, 31] – are deficient to explain the mutual dependence between and within its "internal determinants" and "external requirements" to trigger the new product more rapidly throughout the entire supply chain and store the lesser "old" product which should be used first [32], thus fulfilling customer requirement faster and contributing to higher organisational performance. The two constructs are important and cover the "internal determinants" such as supply chain integration practices and operational capabilities that enable the responsiveness of a supply chain,

followed by "external requirements" which are factors that necessitate a responsiveness of the supply chain including uncertainty in demand, technology and competitive threats in the industry.

Conclusion and Recommendation

This paper extensively reviews the literature in the field of supply chain implementation in SMEs and highlights that supply chain implementation allows SMEs to enhance their operational and financial performance. Though SCM and operations capabilities continue to play a critical role that influences the firm's ability to compete in the market, to the best of the author's knowledge, the linkages of supply chain integration practices and operations capabilities have not yet been addressed explicitly and modelled collectively in respect to their contribution to organisational performance. Indeed, previous studies have found there is a linkage of supply chain practices and organisational performance [4, 6, 10, 23, 31]. For example, Li et al. [6] have suggested an overarching framework to address downstream, internal and upstream sides of supply chain. They found that organisations achieved better performance when they embraced a higher level of supply chain practice. But, this framework is not really applicable to SMEs as inconsistent results from previous literatures are found on the direct relationship between supply chain practices and organisational performance in large companies and SMEs. Supply chain practices in SMEs are more relevant to operational performance and have an indirect relationship between supply chain practices and organisational performance. As indicated by Koh et al. [9], implementation of SCM practices has a significant impact on the operational efficiency of small manufacturers in developing countries. This implies that the actual contribution of SCM practices to organisational performance may not be direct; perhaps it is probably mediated by a number of competencies and interrelated objectives [33]. In view of scant research efforts that have attempted to investigate the link between supply chain practices, operational capabilities and organisational performance in manufacturing industry, this paper is needed to fill the research gap. The research presented in this paper has implications for both academicians and practitioners with an interest in considering and knowing how SCI practices and operational capabilities might impact upon business performance. Ultimately, such thought depends upon more detailed empirical research in Malaysian SMEs.

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Chapter 35
Solar Cooking Activity for Preschoolers in Developing Inquiry Skills

Hashimah Mohd Yunus and Nooraida Yakob

Introduction

Preschool teachers have great responsibility in ensuring children to like science in the early stage of schooling. This stage is very important in order to develop interest towards science. However, the questions raised are as follows: What is the best way to teach science to young children during the preschool? What practices are most likely contributed to children's cognitive development, especially on scientific skills? These are among the questions that preschool teachers want to be answered. We know that young children's thinking is expanded through their cognitive development as well as their personal experiences. Children in this stage (ages 4–6) have high curiosity about things and ask many questions to get information or to clarify the idea. Thus, preschool teachers should be able to prepare activities that children can explore, ask questions and revise their thinking to accommodate new ideas.

Nowadays, most science teachers agreed that science inquiry is an effective way to teach science [1]. In fact, science inquiry is not new in Malaysian education system because it is already suggested in the new syllabus of preschool – *Kurikulum Standard Prasekolah Kebangsaan* in science and technology theme. According to [2] with this approach, children can develop their scientific understanding and investigative skills through active activities, connecting their previous knowledge with new ideas and evidence. Science inquiry becomes an important approach that can help children involve actively in their learning process and understanding science as a way of knowing. The importance of this approach is also recommended in the National Curriculum Policy documents throughout the K-12 science curriculum in the USA as well as in the Singapore education system.

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To implement science inquiry in the classroom, the vital element is the activity. Inquiry activities allow children experience being a scientist. Children try to be scientists as they conduct investigations where they will develop their scientific skills and thinking skills. This will be achieved if teachers are able to provide inquiry activities which involved "hands-on" and "minds-on" activities. "Hands-on" means children do the activity through physical exploration, whereas in "minds-on", children have to think the "why and how" of the given activity. Based on [1] to help children to "minds-on", teachers should provide thoughtful questions, encourage dialogue and keep children's natural curiosity alive. Preschool teachers should be aware of this situation and have the ability to carry out the activities as such. Teachers must firstly understand the meaning of inquiry and its goal and how it is compared to the science process skills in order to implement the science inquiry in their classroom.

The process of inquiry not only enhances children's understanding of natural phenomena but also develops children's science process skills. The scientific method and the inquiry process require children to conduct research investigations by formulating a question, developing a hypothesis, conducting an experiment, recording data, analysing data and drawing conclusion [3]. Meanwhile [4] suggests that opportunities for process skill development have to be provided frequently, if not continuously. This can be done by providing an opportunity for children to encounter materials and phenomena to explore at first hand and using questioning to encourage the use of process skills. Likewise [5] emphasizes that inquiry involves students in observation, imagination and reasoning about the phenomena under investigation. A toddler will imitate actions or behaviour by observation. In addition, observation is the first skill for inquiry skills before children can communicate and make classification [6]. By observation, children will see details, detect sequence and events and notice change [7]. Observation is one of the strategies that can be used to promote inquiry skills [8]. They start to ask questions, discuss to clarify ideas and share information with others. They begin to socialize and communicate to each other. Besides, children also build their group coping skills and make certain behaviour such as giving responses to their friends' feedback. Therefore, observation is the fundamental skills and can enhance other skills such as social skills, coping skills and classroom behaviour skills. However, the environment in the preschool does not support science learning. Usually children involved in science only during their free play, but it was only about 15 % activities [9]. Preschool teachers did not know how to plan science activities [10]. Therefore, children lacked "hands-on" and "minds-on" activities. Through inquiry activity every child could develop and enhance their social skills, coping skills and classroom behaviour skills which are needed in their future life. Thus, to assist the preschool teachers to have an inquiry activity, researchers have developed an activity based on science and technology theme which is known as solar cooking activity. This activity was chosen as to introduce the children with the concept of renewable energy. The objectives of this study are:

 (i) To explore the classroom behaviour skills among preschoolers
 (ii) To explore the social skills among preschoolers
(iii) To explore the group coping skills among preschoolers

Fig. 35.1 Relationship
between social
constructivism, inquiry
activity and skills
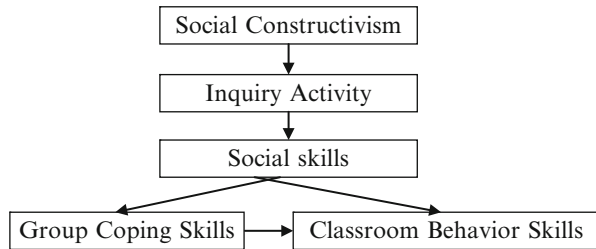
Inquiry Activity and Social Constructivism Theory

In social constructivism theory, learning occurred when children actively socialized among themselves [11]. It involved social process. Thus, children will cooperate to each other to develop their own understanding of a certain concept and develop children's intersubjectivity. Based on this theory, an inquiry activity known as solar cooking activity was developed. We choose solar cooking because children can observe how solar energy can be used as a renewable energy to bake biscuits. Reference [12] emphasized that an inquiry activity will benefit children when the concept is concrete and observable. Teachers and researchers will act as a facilitator to guide children to do the solar cooker by using a pizza box.

However, the instruction and materials of doing a pizza solar cooker are already prepared by the researchers. This part is important since this approach is quite new to preschool teachers and wants to reduce the belief that inquiry is difficult to manage [12]. In addition, questions were also presented to enable children to continue their investigation and increase their curiosity about the use of solar energy for cooking. By having this activity, children would socialize not only among themselves but also with teachers. They asked questions and discussed to clarify ideas and gathered new information. This skill will help children to have a positive harmonious relationship [13] and obtain social outcomes such as group acceptance [13, 14]. With this skill, children will build up another two skills: group coping skills and classroom behaviour skills simultaneously. Both skills are significant to assist children to be productive members in completing a given task. Those relationships are illustrated in Fig. 35.1.

Methodology

Twenty children at age 5–6 years old and two teachers from one selected preschool were involved in this study. Sample selection was based on convenient sampling. Children are divided into two groups, boys and girls, and monitored by a teacher for each group. Each group consists of ten children. Data was collected by using video-tape observation and was analysed based on a rubric developed by [15] known as Skills Required for Success in Inquiry (SRSI) in which descriptive analyses such as

frequency and percentage were used. SRSI included six skills: social skills, classroom behaviour skills, group coping skills, basic academic skills, science process skills and inquiry skills. However, only three skills were used in this study: social skills, classroom behaviour skills and group coping skills as the sample was preschool children. For each skill, there were several items developed. The items were rated as high, middle, low and not applicable for each skill observed. For the purpose of this study, the scales used are defined as high 3, children always perform the skills; middle 2, children sometimes perform the skills; low 1, children rarely perform the skills; and not applicable 0, children did not perform the skills. The class-wide skill level is used to determine the level of children's skills.

Findings and Discussion

Social Skills

Findings showed majority of children (80–90 %) have high skills in terms of interacting appropriately with others, have acceptable conversation skills and showed a friendly attitude. This situation happened because children involved in this study have known each other for several months. They did not have problem to socialize because they feel confident and secured within that group. However, their skill in using language appropriately was in a middle level (70 %). Children should have this skill in a high level since at the age of 3, they already developed language fluency [16]. The use of dialect in their daily conversation would interfere the children to identify a proper standard language. Unfortunately, all children in this study did not think before acting (100 %) due to their high excitement to do the activity. Refer to Table 35.1.

Classroom Behaviour Skills

The result showed children in this preschool have high skills (80–100 %) in listening to the directions and instruction, following directions accurately, asking for help and completing work at acceptable level. This situation occurred when the materials such as pizza box, flour, eggs and aluminium foil trigger the children's curiosity.

Table 35.1 Social skills

Item	Frequency ($n=20$)	Percentage (100 %)
Interacts appropriately with others	1=4, 2=0, 3=16	20 %, 0 %, 80 %
Has acceptable conversation skills	1=0, 2=2, 3=18	0 %, 10 %, 90 %
Thinks before acting	1=20, 2=0, 3=0	100 %, 0 %, 0 %
Shows a friendly attitude	1=0, 2=3, 3=17	0 %, 15 %, 85 %
Uses language appropriate	1=6, 2=14, 3=0	30 %, 70 %, 0 %

Table 35.2 Classroom behaviour skills

Item	Frequency ($n=20$)	Percentage (100 %)
Listens quietly to directions and instruction	1=0, 2=0, 3=20	0 %, 0 %, 100 %
Follows classroom rules	1=16, 2=2, 3=2	80 %, 10 %, 10 %
Follows directions accurately	1=1, 2=3, 3=16	5 %, 15 %, 80 %
Begins work promptly	1=3, 2=12, 3=5	15 %, 60 %, 25 %
Works quietly	1=20, 2=0, 3=0	100 %, 0 %, 0 %
Asks for help when needed	1=0, 2=0, 3=20	0 %, 0 %, 100 %
Completes work on time	1=20, 2=0, 3=0	100 %, 0 %, 0 %
Completes work at acceptable level	1=0, 2=0, 3=20	0 %, 0 %, 100 %
Accepts criticism and corrections	1=11, 2=6, 3=3	55 %, 30 %, 15 %

They were very excited and actively involved in doing the activity and begin to explore "why and what" they need to do with those materials. Because of this, their skill in starting the work promptly was at the middle level (60 %). Besides, most of the children have low skills in following the classroom rules (80 %). The impact from this situation is they have low level in completing the task on time (100 %). They also have low level in accepting criticism and correction (55 %) from teachers and friends because at this stage children's thinking is egocentric [17], difficult for them to accept others' opinion. Refer to Table 35.2.

Group Coping Skills

Most children have high skills in items working cooperatively in a group, contributing to group work and negotiating and compromising (60–70 %) because they already know each other for sometime. They already developed a positive relationship. They knew their friends' needs and interest that would benefit the group. However, majority of the children (85 %) have a low level in listening to others because they want to build the solar cooker quickly and use it to cook biscuits. Thus, they fulfilled their physiological needs – foods. Finding also showed that children in this study have low skills in accepting criticism (65 %) and expressing their opinion (65 %). Even though they have a positive relationship, they hardly accept their friends' view since their thinking is egocentric. Because of this, they have hard time to express their opinion. This situation would cause children not to give another opinion. They would be afraid to be rejected. Refer to Table 35.3.

Conclusion

Solar cooking is one of the activities that help children become good inquirer as well as introduce them to the renewable energy concept in emphasizing the Education for Sustainable Development. Inquiry skills are important skills that

Table 35.3 Group coping skills

Item	Frequency ($n=20$)	Percentage (100 %)
Works cooperatively in a group	$1=0, 2=7, 3=13$	0 %, 35 %, 65 %
Contributes to group work	$1=0, 2=8, 3=12$	0 %, 40 %, 60 %
Expresses opinions	$1=13, 2=5, 3=2$	65 %, 25 %, 10 %
Listens to others	$1=17, 2=3, 3=0$	85 %, 15 %, 0 %
Negotiates and compromises	$1=6, 2=0, 3=14$	30 %, 0 %, 70 %
Accepts criticism	$1=13, 2=7, 3=0$	65 %, 35 %, 0 %

every child should have. In nature, children already have these skills, but teachers need to nurture them so it could be developed and improved. Furthermore through inquiry, preschool teachers should be able to develop children's social skills, classroom behaviour skills and group coping skills from the early stage so that these skills will help them to develop their other soft skills during their primary, secondary and tertiary education easily and smoothly for their future undertakings.

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Chapter 36
Anxiety in Learning English Among Low Achievers: The Questions of Gender, Language Preference and Academic Performance

Norzie Diana Baharum and Kamisah Ariffin

Introduction

Anxious feelings while learning language or better known as language anxiety are the feelings of nervousness, tension and worry experienced by learners who lack proficiency in the targeted second language [1]. Despite permitting differences in individual level, language anxiety is no doubt influential, as the nervous feeling can be both facilitative and debilitative on second language learning [2]. Researches by Casado and Dereshiwsky [3] and Hauck and Hurd [4], for instance, have consistently shown the negative correlation between learners' anxiety and their language achievement, thus proving the importance of detecting this feeling among learners as to ensure effective learning.

This paper specifically focuses on the English language learning anxiety among the low achievers, namely, the participants of 'Mengubah Destini Anak Bangsa' (MDAB) programme. The 'Mengubah Destini Anak Bangsa,' loosely translated as 'changing a destiny of a nation', is a programme specially designed for (1) the Bumiputera students – the original inhabitants of Malaysia inclusive of the Malay and indigenous tribes residing in the West and East Malaysia of Sabah and Sarawak (2) whose economic background is low (family earning below RM 2000). With a very minimal academic achievement of 3 credits, inclusive of Bahasa Melayu (Malay language) and few other requirements, these Bumiputera students are admitted into either a pre-diploma programme in commerce or science. The low requirement here thus sees that most of MDAB students have only obtained a grade D in the English language paper at the *Sijil Pelajaran Malaysia* (SPM) – a nationwide middle

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school examination equivalent to O-Level taken by Form 5 students at the end of the academic year. Given that most MDAB students studied here either got grade D or E for the English subject in their SPM examination, classroom observation has generally indicated the existence of language anxiety among these low achievers who have to adapt to the English-medium learning environment in UiTM.

Studies by Horwitz et al. [5], Bailey [6], Ohata [7] and Liu and Huang (2011) [5–8] and many others have suggested various categories that can cause anxiety. This study examines the language learning anxiety among the low achievers of the MDAB programme in UiTM and the possible contributing factors that might be derived from their gender, language preference and their English subject achievement in the previous SPM examination.

Language Learning Anxiety: Contributing Factors

Language anxiety is unique. It is a universal occurrence with both similarities and distinctiveness shared globally by English as second/foreign language (ES/FL) learners. The anxious feeling an individual is facing while learning language, for instance, does exist among the EFL distance learners in China [9]; EFL non-English majors of universities in China [8]; the Japanese EFL learners [7, 10, 11]; the Malaysian university ESL learners [12–15]; the EFL learners of Indonesia [16]; the international postgraduate students in South England [17]; the Dutch-, French-, Chinese-, Tunisian Arabic- and Thai-speaking learners of EFL in Belgium [18]; and many others. These studies have proven that language anxiety does appear among ESL/EFL learners of different geographical areas and levels of studies.

In discussing language learning anxiety among low achievers in Universiti Teknologi MARA (UiTM), a study by Ariffin and Baharum [12], for example, has found that the respondents in general were really apprehended by English verbal communication of which they have been forced into upon entering UiTM. Panic, self-consciousness, fear and uncertainty are among the feelings dominating most respondents while attempting English verbal communication. Among the seven statements categorised under the Foreign Language Classroom Anxiety Scale (FLCAS) communication apprehension construct applied by the researchers, it was found that having 'to speak without having preparation in the EL class' scored the highest, showing how unpreparedness in English verbal activities can cause the respondents' high language learning apprehension. Besides, the study also found that the respondents' fear of being laughed at by friends when speaking English could be the factor of their language apprehension. As suggested by Ariffin et al. [13], this might be due to the Malay mindset that often sees the negatives in poor evaluation and criticism by others. This finding affirms even more the result that has been found by Steinberg and Horwitz (1986) as cited in [5] and found by Mejias et al. (1991) as cited in [11]. Similar finding was also reported in [19]. The study [12] also found that test anxiety ranked the second, followed by fear of negative evaluation and anxiety of English classes.

In addition, a research on test anxiety among Iranian respondents found that 'time limit, length of the test and lack of confidence' are 'among the most common

sources of test anxiety' [20, p. 214]. Furthermore, another Iranian study [21, pp. 1813–1814] argues that 'different social and cultural environments, particularly the environments where L1 and L2/FL learning takes place' can also contribute to language apprehension with 'strict and formal classroom environment', 'exposure to the new language', 'cultural differences' and 'social status and self-identity' among the possible categories of language anxiety admitted by the respondents.

Language Learning Anxiety: Other Variables

In some studies, gender has been found to play a significant role in determining the level of language learning anxiety among learners. A research by N. E. Pappamihiel [22, p. 327] involving 178 middle school Mexican immigrant students, for example, proves '… several related but different types of English language anxiety and a significant gender difference'. In addition, Mejias et al. (1991) as cited in [11] found that Hispanic male students in their study permitted higher anxiety compared to their female counterparts. Furthermore, a study [23] on a group of Chinese students also produced the same result in which the males were found to be more anxious in language learning. However, Machida (2001) as cited in [11], in contrast, found higher anxiety among her Japanese female respondents. Other researchers such as [24] have also found a significant correlation between gender and other types of anxiety such as test anxiety.

Besides gender, Yan and Horwitz (2008) as cited in [25, p. 203] identified 11 other major thematic variables in relation to their Chinese FL learners, namely, 'regional differences; language aptitude; foreign language anxiety; language learning interest and motivation; class arrangements; teacher characteristics; language learning strategies; test types; parental influence; comparison with peers and achievement' – all of which have significant impacts on language learners. As language anxiety is distinctive from one learner to another, a discussion on the matter is thus inexhaustive. This study would therefore add more to the literature with Malaysian low achievers as the respondents.

Methodology

Participants

Participants of this study comprised 277 MDAB low achievers, of which, 95 (34 %) were male and 182 (66 %) were female. The majority of the respondents were 18 years old. These students were mainly enrolled in two pre-diploma programmes offered by the university, namely, Pre-Diploma in Science and Pre-Diploma in Business Management. It is important to note that the MDAB programme participants are basically a group of Bumiputera students whose parents' monthly earning falls below RM2000. They are enrolled by UiTM with a very minimal academic

Table 36.1 Respondents'
SPM English language results

Grade	Number of respondents
D	199 (72.0 %)
E	78 (28.0 %)

requirement of three credits (inclusive of Bahasa Melayu) in the SPM examination with few other requirements for each programme offered.

The duration of study for Pre-Commerce is 6 months, while 6–12 months is allocated for the Pre-Science programme.

The analysis of the respondents' English language competency based on their English examination results at the SPM level indicates that all of them had very low competence level. The following table shows the details (Table 36.1).

The analysis of the respondents' English language examination results may explain any level of anxiety that they had in learning English.

Research Questions

The main purpose of this study is to examine the correlation between the respondents' language learning anxiety and their (1) gender, (2) language preference and (3) English subject achievement in the SPM examination. This can be expressed in the following research questions:

1. Is there any correlation between low achievers' language learning anxiety and their gender?
2. Is there any correlation between low achievers' language learning anxiety and their English subject achievement in the SPM examination?
3. Is there any correlation between low achievers' language learning anxiety and their language preference?

Instrumentation and Data Processing

The survey instrument used for data collection consisted of 33 items from the FLCAS questionnaire designed by Horwitz et al. [5]. The scale is designed based on the three major causes of language anxiety which are communication apprehension, test anxiety and fear of negative evaluation. In this study, the students' anxiety was examined under the three mentioned categories (communication apprehension, test anxiety, fear of negative evaluation) with one more category – anxiety of English classes – being added as to see the possible effect an English class itself could have in inducing English language anxiety among these low achievers.

Table 36.2 Categories of anxiety

Categories	Statements number
1. Communication apprehension	1, 9, 14, 18, 23 and 31
2. Fear of negative evaluation	3, 7, 13, 15, 20, 22, 24, 30, 32 and 33
3. Test anxiety	2, 8, 10 and 19
4. Anxiety of English classes	4, 5, 6, 11, 12, 16, 17, 21, 25, 26, 27, 28 and 29

Table 36.3 Mean score and categories of anxiety level

Total mean score	Categories of anxiety level
0.00–1.99	High
2.00–2.99	Average
3.00–4.00	Low

The statements were translated into *Bahasa Melayu* to facilitate understanding. For the current study, a reliability coefficient of .857 (Cronbach's *alpha*) was observed with a total sample population of 277 participants. The questionnaire comprised of two parts. The first part looks at the demographic background of the learners such as age, gender and grades obtained for the English subject at their SPM examination and language preference at home and with friends. For this part, the questionnaire adopted both open-ended and close-ended questions. The second part consisted of 33 statements which were later categorised under the 4 categories mentioned earlier. The four-point Likert scale was applied, omitting the original 'neutral' point as to avoid participants from being simply undecided while answering the questionnaire, which thus helped in increasing the reliability of their responses. The participants were asked to score each statement on a four-point Likert scale ranging from 1 being 'strongly disagree' to 4 being 'strongly agree' for 24 statements positively keyed for anxiety (items 1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 26, 27, 29, 30, 31 and 33). The scores for other nine statements (items 2, 5, 8, 11, 14, 18, 22, 28 and 32) which were negatively keyed for anxiety were calculated using a four-point scale with 1 being 'strongly agree' and 4 being 'strongly disagree'. Higher scores recorded here show a higher level of anxiety among the participants (Table 36.2).

The questionnaires were distributed to the respondents during their English class with some assistance from the researcher's colleagues. A total of 277 questionnaires were returned completed. The data were treated quantitatively involving statistical analysis (using SPSS, version 16) of the items in Part II of the questionnaires. Descriptive analysis was carried out to compute the mean and standard deviation for each item in order to find out the general situation of the students' anxiety. The level of anxiety was classified under three categories based on the mean score as shown below (Table 36.3).

Findings and Discussion

Low Achiever Learners' Language Learning Anxiety: Overall Situation

On the whole, the results reveal that the respondents' anxiety is at the average level (mean = 2.33). The results show that all of the participants do have anxiety in learning the English language although the level differs from one participant to another. This is not surprising as all of them obtained either grade D or E for their English subject in their SPM examination. Thus, having to learn everything in English at UiTM might add to the anxiety of learning the language.

The data also indicate that among the four categories examined, 'communication apprehension' is ranked as the highest anxiety level faced by the participants. This is followed by 'test anxiety', 'fear of negative evaluation' and 'anxiety of English classes'. The following table shows the overall results based on the four broad categories (Table 36.4).

Research Question 1: Low Achievers' Language Learning Anxiety and Gender

As can be seen, in general there is no significant difference between male and female low achievers as far as language learning anxiety is concerned. However, this is not entirely true when the analysis on each item is done individually as seven statements (items 3, 4, 16, 17, 22, 31 and 33) have been found to be showing a higher level of anxiety with a significant difference between participants' language learning anxiety and their gender. The gender difference in all these six statements can be seen from the following table (Tables 36.5 and 36.6):

These interesting findings show, despite the absence of significant difference between all the four broad categories of language learning anxiety (communication apprehension, test anxiety, fear of negative evaluation and fear of English classes) and respondents' gender, the above seven statements in contrast indicate a significant difference. This reflects how anxious feeling could differ from one gender to another

Table 36.4 Overall situation of language anxiety among low achievers

Category	Descriptive statistics		
	N	Mean	Std. deviation
Communication apprehension	277	2.0879	0.4638
Test anxiety	277	2.2016	0.4380
Fear of negative evaluation	277	2.2188	0.4011
Anxiety of English classes	277	2.5145	0.3093

Table 36.5 Language learning anxiety and gender

Category	Gender	Mean	Std. deviation	Skewness	t-test	p-value
Communication apprehension	Male	2.1366	0.4743	−0.253	1.266	0.207
	Female	2.0624	0.4574	0.072		
Test anxiety	Male	2.1737	0.4318	0.189	−0.765	0.445
	Female	2.2161	0.4417	0.209		
Fear of negative evaluation	Male	2.2512	0.4238	−0.325	0.970	0.333
	Female	2.2019	0.3889	0.119		
Anxiety of English classes	Male	2.5219	0.3034	−0.194	0.286	0.775
	Female	2.5106	0.3132	−0.043		

Table 36.6 Individual analysis on statements 3, 4, 16, 17, 22, 31 and 33

Statements	Mean	Std. deviation	Skewness	t-test	p-value	Mean according to gender	
						Male	Female
S3: I tremble when I know that I'm going to be called on in the EL class	3.993	0.811	0.074	3.993	0.000*	2.52	2.12
S4: It frightens me when I don't understand what the teacher is saying in the EL	2.953	0.789	0.218	2.953	0.004*	2.37	2.07
S16: Even if I am well prepared for the EL class, I feel anxious about it	1.746	0.694	0.570	2.746	0.006*	2.07	1.84
S17: I often feel like not going to my EL class	−2.543	0.692	−1.724	−2.543	0.012*	3.41	3.65
S22: I feel pressure to prepare very well for language class	−2.539	0.792	−0.218	−2.539	0.012*	2.40	2.65
S31: I am afraid that the other students will laugh at me when I speak the EL	3.624	0.820	0.339	3.624	0.000*	2.30	1.93
S33: I get nervous when the EL lecturer asks questions which I haven't prepared in advance	2.143	0.700	0.564	2.143	0.033*	1.96	1.77

*p-value <0.05 (significant difference between male and female)

in various situations. From the seven statements, five statements (items 3, 4, 16, 31 and 33) show a higher level of language anxiety among the female participants compared to their male counterparts. Female low achievers in this study have been found to be more anxious of (1) being called in the EL class, (2) not understanding

what the teacher is saying in the EL class, (3) being in EL class despite their being well prepared, (4) being laughed at by other students when speaking EL and (5) being spontaneously asked by the lecturers. The male low achievers however emitted more anxiety in statements 17 and 22 by showing (1) more hesitance to attend English class and (2) more pressure in preparing well for the language class attended.

Furthermore, slightly more anxiety among the female low achievers can also be seen in most of the FLCAS items despite the average overall level of anxiety permitted. This is in line with the findings by Daly et al. (1994) and Felson and Trudeau (1991) as cited in [23, p. 12] which suggest that '…female L2 students were frequently more worried and anxious than their male counterpart'.

Research Question 2: Low Achievers' Language Learning Anxiety and English SPM Results

This study has also proven a connection between these low achievers' language learning anxiety and their English SPM results, despite an average level of anxiety emitted in general. This is understandable as people with low language competence, as pointed by Price (1991) and Hembree (1988) as cited in [7] more often than not permit less confidence, lower self-esteem and feeling of discomfort while using the language. In addition, Krashen (1981) as cited in [7, p. 5] found the connection between people's low self-esteem and their worry of others' perception, stemming from their fear of others' '…negative responses and evaluation'.

Research Question 3: Low Achievers' Language Learning Anxiety and Language Preferences

In addition to the findings above, it is also found that all the participants of this study preferred *Bahasa Melayu* over English as their medium of instruction with family and friends. It can be suggested here that the minimum use and exposure of English at home and among friends might cause their low proficiency in the language, thus the existence of language anxiety among these low achievers in the three broad categories especially in 'communication apprehension'. All of the three categories here are closely related to the fact that the students are demanded to apply English communication skills in their English classes which could intimidate those who often use *Bahasa Melayu* with family and friends. Their inability to speak English fluently and pronounce the words correctly might cause them to exhibit higher level of communication apprehension which could be indirectly connected to a higher fear of negative evaluation as most respondents in general have been reported as showing fear of being laughed at by others when attempting English oral communication.

Conclusion

This study, despite its average overall level of language learning anxiety, has found that anxious feeling does exist among these low achievers, with female respondents exhibiting more anxiety compared to their male counterparts. It also suggests that their low grade in English SPM results might induce their language learning apprehension. These low achievers' language preference which was *Bahasa Melayu* could also indicate their minimal exposure and use of the language at home and friends which could indirectly lead to higher anxiety in language learning. The results from this study suggest the needs for language instructors to consider many things such as the low achievers' exposure to English and their academic performance prior to their admission to UiTM in ensuring the fruitful learning of English.

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Chapter 37
Electronic Reservation Services in Malaysia from Customers' Perspective

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Introduction

Nowadays, many people are attracted to use the Internet as an information gathering tool in comparison with other media. Internet allows bidirectional marketing and offers wider and deeper materials and richer advertisement content. Internet provides boundless platform for marketing and advertising and even as a distribution channel to generate additional sales. The popularity of Internet, both as an interface to all resources on the Web and as an advertising medium, is increasing rapidly and no end seems to be insight. In Malaysia, the growth of electronic reservation services has been enormous over the last few years as the services offer many advantages to the involved parties, especially customers and retailers. Responding to the widely used of the electronic reservation services, the study is conducted to determine perceptions and preferences of customers toward the services offered in Malaysia. There is not much research or study that has been conducted in Malaysia to enhance the understanding on customers' demographic information and customers' perceptions toward the services. Hence, these study objectives are to identify customers' perceptions toward the electronic reservation for hotel services and to provide recommendation for retailers to enhance their electronic reservation services quality.

The target customers for the study include all hotels' customers in Malaysia; either they are using the electronic reservation services in carrying out their reservation affairs or not. Customers are randomly selected in gaining their perceptions toward the existing electronic reservation services and suggestions in improving the services quality.

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The study conducted is valuable for customers as they are given a chance in sharing their perception regarding the services and expressing their opinion in enhancing the services quality. Moreover, through the study, customers who have no experience in using electronic reservation services in conducting their reservation affairs will indirectly realize the capability of the services in making their reservation affairs simpler and faster. The study paper also can be used as guideline for potential research regarding this area.

Review of Literature

According to the statistics of the Internet Data Center (IDC), one of the world's leading providers of technology intelligence and industry analysis shows that the number of Internet users around the world is expected to increase every year. With the increasing number of online users worldwide, firms are compelled to take advantage of the Internet technology [1]. According to [2], the users groups that could possibly gain much out of Internet usage are:

1. Anyone seeking international business on a product or services.
2. Anyone looking for Internet-related work.
3. The services industry: work samples can be displayed online, and orders may even be executed over the Internet.
4. Hotels, tourism industry, and travel agencies.
5. Services that could justify online reservation systems: hotel bookings, airline reservations, and exhibition space booking.
6. Activist organizations: the Web is an inexpensive way to reach a large audience.
7. Social agencies: organizations like UNICEF could achieve wider reach and raise public awareness more effectively.
8. Conferences and seminars: parallel virtual conferences could be held on the Web, so more people can attend and actively participate, without having to be physically present.
9. Exhibitions: InterOp + Net World is a virtual networking exhibition held on the Web.
10. Event advertisers: sports events, award ceremonies, and so on can reach a wider audience at a low cost and assure high visibility.
11. Educationists: free knowledge dissemination, high reach, and positive feedback with only interested students.
12. Governmental and regulatory bodies: easily accessible information about rules and regulations, facilities for international business, taxation, taxation laws, and other governmental information can be remotely accessed.
13. Job and project marketers: the Web is an easy way to look for or offer jobs, offer projects with all specs, or even call for international proposals, at least the technical ones.
14. Companies wanting to promote an image internationally: being on the Web makes it easier for overseas investors looking for joint venture partners in India to at least know of one's existence.

In the travel and tourism industry, travel products and services appear to be well suited to Internet marketing because of their distinctive high-priced, high involvement, intangible, heterogeneous, high-risk, and well-differentiated characteristics. It is also noted that the hypertext feature of the Internet may have been specially designed for the tourism industry, and because of that, travel sector is rated among the top three product or services categories purchased via the Internet [3]. According to [4], nowadays, more rooms are being sold directly to consumers via the direct online channel, i.e., the hotel's own website.

Reference [5] noted that travel products and services are perfectly suited to online selling because they possess the necessary characteristics that can function in the electronic environment. Reference [6] point out three main characteristics of products and services that function in the electronic environment which are cost and frequency of purchase, value proposition, and the degree of differentiation. These three characteristics are likely to influence Internet usage that seeks information and makes online purchases. Travel products such as travel vacation in general engage a higher level of involvement, intangibility, and higher level of differentiation than other tangible customers' goods [7]. The ease of description and commodity such as nature of many travel products like hotel rooms also favors the development of electronic commerce. Reference [8] suggests that services like travel and tourism are ideal for selling over the Internet since there are no transportation costs. As for the revenue earned in the travel online industry, empirical evidence has shown that the total revenue generated from the online purchase of travel products has been increasing.

Reference [9] stated in his research that the use of Internet as a business medium in the travel industry allows travel suppliers to reduce transaction costs like commission, which means travelers are able to bypass the retail travel agencies to deal directly with the suppliers of travel products. On the other hand, travelers are also able to enjoy the provision of extensive information, lower price, discounts, time saving, and cost saving due to the emergence of electronic market. With the adoption of electronic commerce and its benefits being gained by both travel suppliers and travelers, the travel industry has become one of the strongest performing sectors of electronic commerce.

Responding to the expand usage of Internet as an electronic commerce medium, electronic reservation services were introduced and universally used by many retailers including retailers that engage to hotel services. Electronic reservation is an act of reserving (a place or passage) or engaging the services of (a person or group) or writting a record or promise of an arrangement by which accommodations are secured in advance which is done via electronic devices.

The study comprised of gathering and analyzing information regarding electronic reservation for hotel services from one perspective which is from customers' perspective. The study emphasizes several significances toward the involved parties. The study provides collection of data and information regarding customers' perceptions toward existing electronic reservation services in Malaysia. Via this information, hotel retailers can enhance and improve their online services and marketing strategies in ensuring customers' satisfactions and fulfilling their needs. Other than that, from the study, retailers can identify strategies needed to be

taken to enhance the efficiency of the electronic reservation process. Furthermore, retailers' awareness regarding the importance of electronic reservation services as one of the key factors in increasing their profits will be enhanced. Not only that, retailers will realize that the utilization of the services is an important tool to increase overall services quality and create a higher standard in various industries.

Methodology

To accomplish the study objectives, a suitable research approach and methodology have been used. Based on the approach, five steps need to be taken in carrying out the study. See Fig. 37.1.

Based on Fig. 37.1, five steps need to be taken in carrying out the research. The five steps are:

- **Problem assessment and research study**
  Problem assessment and research study is the first step taken in the study process. By undergoing these processes, few problems that arise regarding the study topic are identified and assessed. Through the identification, objectives of the study are recognized.
- **Knowledge acquisition**
  Knowledge acquisition is the next step taken. In this stage, data and information needed are collected. Data and information are divided into two categories which are primary data and secondary data:

  - **Primary data**
    Primary data are acquired by distributing questionnaires. Primary data are used as main sources of data and information for this study.

Fig. 37.1 Research approach and methodology

   – **Questionnaires**

   Two hundred copies of questionnaires are distributed to hotels' customers which have been chosen randomly. Through the questionnaires, data and information regarding customers' perceptions toward the electronic reservation services are gathered. Other than that, customers are required to give suggestions and recommendations to improve the services quality. Customers' perceptions are assessed by using 11 dimensions of Internet services quality of electronic retailing. The 11 dimensions are reliability, security, efficiency, ease of use, information, appearance, linkage, structure and layout, support, communication, and incentives which have been explained in detail in research model developed by [10]. The questionnaires are divided into three sections. Section A required respondents to fill in questions regarding demographic information and respondents' profile. Respondents are provided with multiple-choice answers in this section. Section B consists of questions that are derived from the 11 dimensions stated above. Each question is provided with five scaling points starting with 1, strongly disagree; 2, disagree; 3, neither; 4, agree; and 5, strongly agree. Section C consists of open-ended questions that asked for respondents' comments and suggestions.

   – **Secondary data**

   Secondary data are obtained through two ways which are revising on existing journals and articles related to the topics and revising related sources from the Internet, books, and thesis. Secondary data are used as additional information in the study other than primary data.

- **Data analysis**

  The process of knowledge acquisition followed by data analysis involves abstraction of knowledge based on data and information that are gathered from previous activities. In this stage, data and information are analyzed and documented for the next stage. Data are analyzed using SPSS 15.0.

- **Knowledge representation**

  Knowledge representation process includes presentation of data analysis on electronic reservation services and recommendations on improving electronic reservation services quality.

- **Research report preparation**

  The last process of this study is preparing complete research report which consists of all data and information that are gathered through this study.

Research Model

Research model that has been chosen is a research model of electronic services quality that has been adopted by [11]. The model was chosen as it represents all aspects of characteristics related to the topics. The model consists of 11 determinants that were ranked in the order of importance and were clustered into two major dimensions which are incubative dimension and active dimension.

Reference [12] have identified 25 factors that combine to be an index of electronic customer relationship management (e-CRM) activities of the firm

with another 17 additional features defined by [10, 12] who have compiled the 42 factors and analyzed whether the factors are implemented by hoteliers. The model consists of 11 determinants that were ranked in the order of importance and were clustered into 2 major dimensions.

Results and Discussions

Data analysis and findings section will discussed the detail of numerous results and findings that were gathered through the study of electronic reservation for hotel services. The study has achieved its objectives which are to identify costumers' perception toward electronic reservation for hotel services and provide recommendation in improving the services quality.

There are four subtopics that will be discussed which are customers' demographic information, customers' perception, correlation coefficient test, and lastly Cronbach's alpha test.

Customers Demographic Information. Figure 37.2 shows that 60.8 % or 101 respondents have experienced in using electronic reservation for hotel services in conducting their reservation affairs, while another 39.2 % or 65 respondents have no experience in the services process due to a variety of reasons. Some of the reasons are no facilities to do electronic reservation services and reservations through telephone are easier and faster. There are respondents who think that electronic reservation is not secure and they are afraid their personal information will be shared with other parties.

Table 37.1 shows the demographic information of experienced respondents that have been gathered in the study. The table is divided into nine classifications which are gender, age, race, status, level of education, profession field, job sector, income per month, and numbers of reservation for the past 6 months. The study that has been carried out indicates that female is the majority customer that uses electronic reservation services with 52.5 % (53 customers), while male with 47.5 % (48 customers). Customers who are 26-year-old to 30-year-old are the most popular users of the services with 29.7 % or 30 customers, while 46-year-old to 50-year-old customers are the least that use the services with 7.9 % or two customers. Malay is the dominant users of the services with 66.3 % (67 customers) followed by Chinese with 22.8 % (23 customers) and Indian with 10.9 % (11 customers). The study also found that married customers are the most popular customers (64.4 %) that use the services if compared to other customers' status such as single customers (32.7 %) and single parent customers (3.0 %). Bachelor holders constitute the highest number of customers that use the electronic reservation services with 39.6 % or 40 customers,
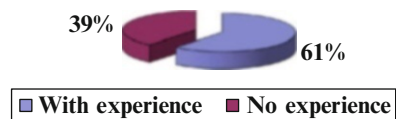
Fig. 37.2 Customers' experience in using electronic reservation for hotel services

39%   61%

□ **With experience**   ■ **No experience**

Table 37.1 Customers' demographic information

Classification	Frequency (S=101)	Percentage (%)
Gender		
Female	53	52.5
Male	48	47.5
Age (years old)		
18–25	10	9.9
26–30	30	29.7
31–35	19	18.8
36–40	14	13.9
41–45	18	17.8
46–50	8	7.9
51 and above	2	2.0
Race		
Malay	67	66.3
Chinese	23	22.8
Indian	11	10.9
Status		
Single	33	32.7
Married	65	64.4
Single parent	3	3.0
Level of education		
SPM/STPM	17	16.8
Diploma	29	28.7
Bachelor	40	39.6
Master's	14	13.9
PhD	1	1.0
Profession field		
Government workers	14	13.9
Private sectors	51	50.5
Student	1	1.0
Semigovernment	27	26.7
Self-employed	8	7.9
Job sector		
Engineering	15	14.9
Information system	18	17.8
Architecture	2	2.0
Education	5	5.0
Business	14	13.9
Management	21	20.8
Marketing	10	9.9
Student	1	1.0
Others	15	14.9
Income per month		
None	1	1.0
Less than RM1,000	4	4.0
1,001–RM3,000	57	56.4
3,001–RM5,000	32	31.7
5,001–RM7,000	6	5.9
9,001 and above	1	1.0
Numbers of reservation		
1 to 2 times	62	61.4
3 to 5 times	31	30.9
6 to 8 times	2	2.0
9 times and above	6	5.9

Table 37.2 Customers'
perceptions toward electronic
reservation services

E-services quality dimensions	Perceptions (%)
Reliability	73.55
Security	73.42
Efficiency	74.59
Ease of use	74.42
Information	73.61
Appearance	75.50
Linkage	76.24
Structure and layout	77.03
Support	75.70
Communication	76.57
Incentive	79.21

followed by diploma holders (28.7 %), SPM/STPM holders (16.8 %), master's holders (13.9 %), and lastly PhD holders (1.0 %). Private sector workers (50.5 %) are identified as the most common users of the electronic reservation services compared to semigovernment workers (26.7 %), government workers (13.9 %), self-employed workers (7.9 %), and students (1.0 %). Customers that work in management job sector compose the maximum number of customers with 20.8 % or 21 customers, while students only contribute 1.0 %. The study also points out that customers with 1,001–RM3,000 income per month (56.4 %) are those who use the services most frequently rather than customers with an income of 3,001–RM5,000 per month (31.7 %), income of 5,001–RM7,000 per month (5.9 %), income less than RM1,000 per month (4.0 %), income of RM9,001 and above (1.0 %), and no income per month (1.0 %). The study result shows that 62 customers or 61.4 % of respondents have undergone reservation for one to two times for the past 6 months, 31 customers (30.3 %) for three to five times, two customers (2.0 %) for six to eight times, and six customers (5.9 %) for nine times and above.

Customers' Perceptions Toward Electronic Reservation Services. Table 37.2 shows the results of the customers' perception toward each electronic services quality dimension. There are 11 dimensions of electronic services quality which are reliability, security, efficiency, ease of use, information, appearance, linkage, structure and layout, support, communication, and incentive. Result of the study indicates that 73.55 % of respondents claim that reliability is important and has been applied by hotel retailers in their electronic reservation services. 73.42 % agree that security is crucial and has been actively applied by hotel retailers in ensuring customers' satisfaction. Other than reliability and security, 74.59 % of respondents have the same opinion that efficiency is also vital in implementing the electronic reservation services in ensuring customers' happiness. 74.42 % of respondents claim that information is important, while 73.61 % agree that appearance is also significant. Based on the study, 76.24 % of respondents declared that linkage is also needed in good electronic reservation services. Structure and layout are crucial in attracting customers. The statement is approved by 77.03 % of respondents who believed that

Table 37.3 Summary results of customers' correlation coefficient test

Hypothesis	Correlation coefficient value	P-value
HI: there is positive relationship between retailers' perception and reliability dimension	0.712[b]	0.01
H2: there is positive relationship between retailers' perception and security dimension	0.570[b]	0.01
H3: there is positive relationship between retailers' perception and efficiency	0.647[b]	0.01
H4: there is positive relationship between retailers' perception and ease of use	0.681[b]	0.01
H5: there is positive relationship between retailers' perception and information	0.669[b]	0.01
H6: there is positive relationship between retailers' perception and appearance dimension	0.715[b]	0.01
H7: there is positive relationship between retailers' perception and linkage dimension	0.690[b]	0.01
H8: there is positive relationship between retailers' perception and structure and layout dimension	0.645[a]	0.05
H9: there is positive relationship between retailers' perception and support dimension	0.717[b]	0.01
HI0: there is positive relationship between retailers' perception and communication dimension	0.616[b]	0.01
HI1: there is positive relationship between retailers' perception and incentive dimension	0.433[b]	0.01

[a]Significant at 0.05
[b]Significant at 0.01

structure and layout of electronic reservation services are able to attract customers. 75.70 % of respondents stated that support is another important feature that should be included in the services, while 76.57 % agree that communication is important in implementing electronic reservation services. The last dimension which is incentive obtained the highest score with 79.21 % of respondents who believed that good and beneficial incentives are able to persuade customers to use the electronic reservation services. As an overall view, the result of the study indicates that respondents acquire and need good application of all 11 electronic services quality dimensions in fulfilling their needs and satisfying them.

To determine the relationship between customers' perception with the 11 electronic services dimensions, correlation coefficient test was conducted. If the result of the test conducted shows significant value, the dimension is considered as having positive relationship with customers' perceptions, and if not, the dimension has no relationship with customers' perceptions.

Table 37.3 shows the result of the correlation coefficient test that has been carried out. The result shows that there is a statistically significant positive relationship between customers' perception and all 11 electronic services quality dimensions.

Table 37.4 Customers: summary results of Cronbach's alpha test of reliability

E-services quality dimensions	Alpha value	Result
Reliability	0.7462	Consistent and reliable
Security	0.7107	Consistent and reliable
Efficiency	0.7554	Consistent and reliable
Ease of use	0.7714	Consistent and reliable
Information	0.6836	Inconsistent and not reliable
Appearance	0.6904	Inconsistent and not reliable
Linkage	0.6460	Inconsistent and not reliable
Structure and layout	0.5942	Inconsistent and not reliable
Support	0.7845	Consistent and reliable
Communication	0.5596	Inconsistent and not reliable
Incentive	0.6355	Inconsistent and not reliable

This is because most electronic reservation systems provide facilities that fulfill those 11 dimensions in ensuring customers' satisfaction. The test also indicates that the significant value for all 11 dimensions is 0.01.

Customers: **Cronbach's Alpha Test**. In evaluating the customers' perceptions toward electronic reservation for hotel services, Cronbach's alpha test was conducted in order to determine the reliability of each 11 electronic services quality dimension. If the alpha value of each dimension is higher than 0.7, the statements used in evaluating the dimension are considered consistent and reliable. If alpha value is below 0.7, the statements used in evaluating the dimension are inconsistent and not reliable.

Table 37.4 shows the summary result of Cronbach's alpha test of reliability. From the test conducted, the result shows that 5 out of 11 electronic services quality dimensions are consistent and reliable. The five dimensions are reliability, security, efficiency, ease of use, and support. The study also indicates that the other six dimensions are inconsistent and not reliable. The six dimensions are information, appearance, linkage, structure and layout, communication, and incentive.

From the study, the objective of the study has been accomplished, as the objective of the study is to identify the customers' perception toward electronic reservation for hotel services in Malaysia. The study indicates that as an overall view, customers' perception score can be considered as high with all 11 dimensions of electronic services quality obtained being more than 70 % out of 100 %. However, there are some differences with the comments provided by the study respondents in which most of them are not satisfied with the electronic reservation services as the services still lack of important features. Through the study, it is identified that customers are really concerned about incentives given to them by hotel retailers when they carried out their reservation affair online.

Through the recommendations and suggestions part, respondents have given their opinion on how to improve and enhance the electronic reservation services quality. The suggestions and recommendations are classified into 11 electronic services quality dimensions which are reliability, security, efficiency, ease of use, appearance, linkage, information, structure and layout, support, communication, and incentive:

- **Reliability**
  Through the study, most respondents suggest and recommend that hotel retailers should provide reservation confirmation not only through e-mail but also through phone to inform customers about their reservation status. Customers also must be assured that the electronic reservation provides faster confirmation services than the current confirmation services which are usually through e-mail. Majority of respondents suggest that hotel retailers should provide appropriate customer services that will assist customers when needed. The customer services also must be able to respond to customers need quickly and efficiently.
- **Security**
  The study identifies some of the reasons that decrease the customers' desire in conducting their reservation affairs regarding the security of their personal information and reservation information. Most respondents recommend that hotel retailers should strictly protect customers' personal information from other parties. It is also suggested that the services should offer protection in the form of password or others.
- **Efficiency**
  Almost all respondents imply that hotel retailers should reply and respond to customers need appropriately. Process of reservation also should be as simple as possible and user friendly to avoid difficulties to customers.
- **Ease of use**
  Through the study, few respondents propose that hotel retailers that offer electronic reservation services should use simple website address so that the address is easy to be remembered by customers. Contents of the website also should be simple but clear and easy to be understood.
- **Information**
  According to some customers, information is an important factor that will improve the electronic reservation services quality. Most respondents suggest that the hotel retailers should provide accurate information in the website and ensure that information provided through the website is similar with information that the customers can get through phone. Information or any promotion should be frequently updated to ensure that the information provided is accurate and up-to-date. Some respondents also imply that the hotel retailers should provide detailed information about particular promotion so that customers do not need to contact customer services to obtain detailed information.
- **Appearance**
  Appearance is also important and crucial in enhancing the electronic reservation services quality. According to some respondents, hotel retailers should provide simple but attractive web pages. The web pages also must use suitable colors, graphics, images, and animation together with appropriate size of web pages.
- **Linkage**
  Through the study, it also points out that some respondents prefer more links to external website, while some prefer that only related website should be included in the electronic reservation services. Hotel retailers should do regular checking to eliminate links that are not appropriate or less visited by customers. Hotel retailers also must ensure that links to the external website are valid and needed by customers.

- **Structure and layout**
  According to some respondents, most websites are too messy as the website contains so much information and interrupts customers' attention. Therefore, it is suggested that the hotel retailers should provide simple, clear, and consistent structure of a web page. Structure of the website also should be appropriate and suitable with customers' preference.

- **Support**
  Support is the most popular topic that has been discussed by respondents in the recommendation part as most hotel retailers ignore this services dimension. Most respondents acquire good customer services and well-trained customer services staff that should be able to answer to any customers' problems and able to assist customers. As electronic reservation services can be undergone 24 h per day, it is also suggested that customer services are provided for 24 h per day. Customer services should not only be able to be contacted through online but also should be able to be contacted through phone at anytime. Some respondents considered electronic reservation services as non-user friendly as there is no "personal touch" between customers and retailers. Therefore, appropriate customer services are important, as the help page is unable to answer questions which are out of its "box."

- **Communication**
  According to some respondents, some hotel retailers that offer electronic reservation services use "high level" of language and hard to be understood by customers. Responding to that, some respondents imply that hotel retailers should use clear and simple way of delivering their message by using "suitable level" of language. Other than that, hotel retailers should offer many contact media other than e-mail, telephone, fax, and postal address. To be more user-friendly, hotel retailers also must provide language other than English.

- **Incentive**
  Incentive is another important topic that has been discussed by respondents other than support. Majority of respondents suggest that hotel retailers should give discounts or special rate for online customers as the electronic reservation will decrease reservation cost compared to traditional reservation process. Hotel retailers also should offer membership facility in which customers will get reduction of price when doing their reservation. Customers should be given incentives and the incentives should be clearly stated so that customers are encouraged to do reservation online.

Conclusions

The objectives of the study are to determine customers' perceptions toward electronic reservation for hotel services and to provide recommendations and suggestions for retailers that can be used in improving their electronic reservation. The study is conducted by distributing questionnaires to 200 customers that have been

randomly selected. The study is based on 11 dimensions of electronic services quality and 42 e-CRM features. Both groups of factors are used in assessing customers' and retailers' perception. In assessing the state of electronic reservation for hotel services, e-CRM features that have been implemented in the electronic reservation services have been taken into consideration.

The study indicates that as an overall view, customers' perceptions score can be considered as high with all 11 dimensions of electronic services quality obtained being more than 70 % out of 100 %. Through the study, it is identified that customers are really concerned about incentives given to them by hotel retailers when they carried out their reservation affair online. Through the recommendations and suggestions part, respondents have given their opinion on how to improve and enhance the electronic reservation services quality. The recommendation and suggestion have been grouped into 11 dimensions of electronic services quality.

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Chapter 38
Teenagers' Interaction in Photo Story: A Discourse Analysis

Normaliza Abd Rahim, Nik Ismail Harun, and Arbaie Sujud

Introduction

A photo is a story that has many different stories. It all depends on the person who has seen it. Usually the owner of the photos knows the underlying meaning of the story. Photo story has been an interesting activity among professional photographers but rarely among people who are not interested with the story. Some of us would rather look at the photos where there are people in it, and most of us would rather have photos with the person whom we recognize. As for sceneries, only nature lovers would appreciate the photos most. Photo and camera came hand in hand. Camera is a technology where it started by having professional photographer underneath a cloth holding a big flash until the new technology where we have digital cameras. In fact, nowadays, there were also cameras in mobile phones with millions of mega pixels in order to have sharp photos. Small children were given the opportunities to hold the camera and have their photos put in their own web sites. This has given them the chance to use the technology wisely [1].

According to Normaliza Abd Rahim et al. [2], the use of technology can be done according to the needs of a person. The technology should be disseminated among the community so that they would not be left behind with the new technology. The research done by Normaliza Abd Rahim et al. [2] among students at Nottingham, United Kingdom, showed that the subjects were given the opportunity to write the storyboard before having to deal with the camera. The subjects involved in the task

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were college students aged between 17 and 18. They were in small groups and they had to make a One Stop Motion video by using the camera. The camera was used to take photos of the figurines. The One Stop Motion consisted of 345 photos for only a 15 s motion. The results stated that the subjects had high confidence in giving ideas and comments [3, 4] and at the same time enjoying the task by using the camera. The results had given the great impact towards learners of media and at the same time implicate other researchers in researching by using the technology with students at schools either younger or adult learners. Therefore the use of technology is crucial to enhance learning [1, 5].

Ali Salman et al. (2010) in Normaliza Abd Rahim et al. [2] stated that the Internet is widely used among teenagers in schools in Kelantan. The objectives of the study were to identify the positive and assumption factors towards the use of the Internet. The model used for this study was from Rogers [6] where it was for the innovation in giving decisions. This study used the inferencing techniques to analyze the findings. The results revealed that the Internet has great influences towards the subjects and the most used websites were *Twitter* and *Facebook*. Besides the Internet, there was also research on the use of photos, Internet, and the computer among students at schools. According to Normaliza Abd Rahim and Nik Ismail Harun [7], the use of photos to enhance the learning of the special needs children would be the best way in creating new scenarios for the children. The technology has helped the children in learning since they were seen excited and contented with the task given. The samples of the study consist of three subjects who were selected at random from a school at Lynncroft Primary School, Nottingham, United Kingdom. The subjects were diagnosed with autism and dyslexic with ages 7–11. The subjects collaborated with their friends and they used the pictures given to them. The pictures were taken from the website. This study is adapted from the Perceptual Learning Style Preference Questionnaire [8], and they were interviewed throughout the process of learning. The results of the study revealed that all the subjects were opened to working on collaborative hands-on project. This result was similar to Reid [9] where tactile learning style was favored. The results hoped that the special needs children were happy and contented with the learning process and would want to learn new things in the future.

According to Hess and Waller [10], Y*ouTube* is also one of the technologies to disseminate knowledge. This paper traces the history of the blockbuster as a way of large commercial media adapting to social and technological change after World War II, to its refinements in the 1970s to cater for younger audiences and changes in the media landscape, to its most recent incarnation in *YouTube. YouTube* has been a major technology for most people in the world [11]. Hess and Waller [10] argue that the economic and cultural values of the blockbuster are being transformed and refigured by the new form it has begun to take within convergence culture. The research by Hess and Waller [10] showed that media technology played a major role in our society nowadays by having the videos to view by all. Also, media technology has given enough space for learning in an inviting environment [1].

Hence, with the use of the technology, a research by Normaliza Abd Rahim [12] looked at small group discussion in dealing with media technology. The research investigates the communication occurred during storyboard writing of a video task. The subjects involved were five pairs of subjects. A task was given to each pair and the length of time for them to discuss about the layout and the content of the storyboard was 3 h for each pair in 5 weeks. The discussion will be taped and analyzed accordingly. The subjects were learners involved in a media course ages between 16 and 18 at one of the colleges in Nottingham, six females and four males. According to Normaliza Abd Rahim [12], the results of the study showed that the subjects participated in the task given and they were given the chance to give ideas to their group members. They were confident in dealing with negative comments by the group members, and at the end of the task, they managed to sort the differences positively. Wan Adli Ridzwan Wan Hassan [5] and Yap Chui Yan and Nor Ashikin Abdul Aziz [1] research showed the same results where subjects would be able to show their confidence in small group discussion task related to technology. Moreover, self-produced media [4] were able to have a group of proactive learners.

Therefore, the objectives of the paper were to identify the interaction pattern and to discuss the utterances during the photo story task among teenagers in Putrajaya.

Methodology

The subjects involved were 20 students in one school in Selangor, Malaysia, ages between 12 and 13. The subjects volunteered and were divided into groups of four. Each group was given a digital camera. They were given a task on creating a story by using photos that they have taken. They decided on the theme of the project and were given 5 h each week to complete the task. The tasks identified were creating story line, photo shoots, and story creation with photos. Selected interactions were discussed for the purpose of the study. The interactions were analyzed by using the discourse analysis method by Brown and Yule [13].

Results and Discussion

Interaction During Story Line Creation

Story line creating has been crucial stage where most of the subjects were seen arguing among each other in the group. This was due to the fact that the subjects were not happy with the suggestion given by the group members. Some of the subjects were not ready to accept the opinion, and besides ignoring the questions by the members,

they were stressing that the suggestions were not related to the story line. The questions asked by the subjects were stated as below.

Why do you have to put the climax of the story at the beginning of the story?
Why is the story line so boring?
Do you think people will watch this?
Don't you think that the whole story line is just a piece of crap?
Don't you have any good ideas to give?

The questions above showed that the group members were not happy with the suggestion given. They were questioning the other group members, but there were no answers by them. This showed that the questions uttered were not appropriate and sensible, and therefore the best way was to ignore. The other group members seemed to be happy with the suggestion and only a number of students were not. This showed positive collaboration among the subjects in dealing with the task given [14].

Other than that, the subjects seemed to be agreeing with the suggestion given by other members. This showed that there were interactions between them. They were negotiating as well as contented with the ideas. The agreed statements were stated as below.

That is great. I liked it!
Interesting ideas!
Where did you get that ideas from? I loved it!
That is really superb!
Good ideas with the hero falling down!
This will make people want to watch our photos!

The above statements showed that the subjects were happy and contented with the ideas given by the other members. They were praising their friends and it seemed that the friends were smiling while nodding their heads. They agreed with the suggestions. They knew that all the ideas given were for their own good. The groups' project will succeed if the photo story compilation were interesting and watchable. Therefore, they had to decline the ideas and with that they apologized to the other group members at the end of the discussion. This showed that they had positive interaction among the group members.

Besides that, the subjects were collaborating with the group members. This was showed when they were trying to add suggestions to their friends' comments and suggestions. It seemed that the friends were happy to accept the suggestions. At times, the subjects were criticizing the comments given by their friends, but surprisingly although they were arguing, they were still discussing about the task given. The subjects' statements were stated as below.

I disagree with your suggestion and what do you think of this?
What if we use her suggestion instead?
Your suggestion does not reveal this task given!
His comments were not suitable!

The statements above showed that the subjects were not happy with the suggestions given by the group members. The subjects were giving other suggestions, and by looking at their faces after getting the criticism, the subjects were able to accept with open heart. This showed that the subjects knew that the criticism would make the task even better than before. Collaboration and acceptance by the subjects seemed to be a positive value towards better understanding of the task.

Interaction During Photo Shoots

Photos shoots had to be done according to the plan that they had discussed previously. The place and how the photos should be will be according to the plan in the story line. The subjects were seen looking and referring to the plan that they had made, and all the subjects participated in the photo shoots. As a matter of fact, they were also the models for some of the photo shoots. They were heard saying the statements as below.

According to the plan, I will be the person here!
The trees don't look like what we planned!
Shall we just focused the flowers here instead!
This part of the setting here will be suitable!
You are blocking the way there!

The utterances above showed that the subjects were referring to the plan as well as looking at the place. There were occasions where they were not happy with the place and they had suggested elsewhere. They actually did not want to change a lot since they had already planned in advance. The other group members agreed with the suggestion where in some occasion they had to accept the changes made due to the wrong location. Most importantly, the subjects were collaborating well with their group members [14].

Other than that, the subjects seemed to ask questions when they reached the destination of the photo shoot. The subjects looked puzzled with what they saw and they were not happy with the situation. In the middle of the photo shoots, they had to change location and the models since they found that it was not suitable. The subjects asked questions as below.

Why did you jump just now? It's not even stated here!
Where have you been? You were supposed to be there near the trees.
What have you done with that cap of yours?
Why did you wear that outfit?
Why did you smile?
Why did you sit on the grass?
Why did you not hold that bottle over there just now?

Some of the questions above showed that they were angry and they wanted to know the reason of the action. They seemed to really involve with the photo shoots and they were not happy when everything went wrong. At certain times, the subjects were playful and they were serious again after being told off by the group leader. Overall they seemed to be accepting the remarks given by the group leader since they knew that they had made mistakes and they were happy to finish with the photo shoots. The attitude of acceptance was the first step in order to build up confidence among the subjects [10].

Besides that, during the shooting at the location, there were suggestions from the subjects. The subjects were volunteering to replace the cameo since most of the time there were not enough cameos during the scene. This showed that the subjects were hoping that the outcome of the task would be great with the volunteers. The subjects' statements were stated as below.

Can I just pretend to be doing something at the back there?
What if I sit down there while reading a book?
There should be more than five people as the cameo for this scene!
I will replace the man there for the cameo!

The above statements showed that the subjects were happy to replace or to be the cameo for the shot. The subjects really wanted to be part of the scene and also they wanted to have a good photo shoot. The subjects were hoping that the cameo will also be a very important part in the scene. The statements were agreed by the other group members where they were happy and contented with the ideas. They were seen acting out and practicing a number of times before the actual shot. This showed that the subjects were serious about the task given to them.

Interaction During Story Creation

The subjects went back to the classroom and printed all the photos that they had taken. The photos were arranged according to the story line. All the group members were seen busy referring to the story line, and they were discussing among each other to make sure that the story was interesting. At certain times, the subjects uttered sentences as below.

The photos turned out well here.
Look at this one. He is hilarious!
The jumping part was really great!
Look at the both of you here! Fantastic really!
You had done a good job being the cameraman here!
The eyes looked great!

The utterances above showed that the group members were happy and contented with the printed photos. Most of the group members had chosen the right photos according to the story line. They were seen smiling with their work and some of them were patting each other's shoulders for a job well done. Some of the group members were also looking at the other groups' photos which were laid on the tables in the classroom. With confidence, they were trying to compare with their photos although they did not know the story line, but they were amazed to see good photos. Here, the use of the technology has increased the confidence level of the subjects [10, 14].

Some of the subjects were also heard questioning about the photos. Maybe they were puzzled or not sure about the photos and the story line that they had. The subjects were asking questions to the other group members but were seen smiling after getting the answers. The questions asked by the subjects were stated as below.

Why did you put the photo there, whereas according to the story line, it should be here?
What is this photo for? Nothing here in the story line?
Did you arrange this?
Why did you put the photos of him? This was supposed to be a girl!
Did it say that the boy is jumping?
Why did you put the girl crying here, whereas you should put it over there?

The questions were answered well by the group members. After the explanation, they were happy and contented. They were seen referring to the story line all the time and they hoped that their story was interesting. They kept on moving the photos everywhere and questions were heard every time they moved the photos. Some of the subjects were playing with the other group members and put the photos back at the original place after they got scolded from the group members.

Although the subjects were happy and contented with the photos, at times they were not happy with some of the photos. After a long discussion with the group members, they were smiling again since they had come up with solutions regarding the not related photos. At first they were thinking of taking new photos, but after the discussion, they decided to use the existing photos by just changing the story line. The changing was not massive, so therefore, they decided to proceed with the suggestion. The subjects' statements were stated as below.

Why not we change this part of the story to a new one since this photo is really good!
Look here, the photos were suitable and we can just change the story about the girl!
Change this story here and make sure to put the boy jumping here!
The story line will only change for this part!

The statements above showed that the subjects agreed with the change since the story was still the same. The subjects discussed in positive way and they were participating in the task until the end. It was obviously seen that the subjects were pointing and changing the positions of the photos to create the story. Therefore, the collaboration among the subjects seemed to have positive impact towards the end of the task where they were contented with the comments from the researcher.

Conclusion

To summarize the above results and finding, the photo story had given the chance to communicate with the other group members. They also managed to discuss, negotiate, question, and give reasons to what they did. The photo story had given them the courage to voice out and at the same time finish the task given in their group. Besides that, the subjects were confident in speaking and giving ideas and they were contented and happy with the group members. The results of the study were parallel to the study by Normaliza Abd Rahim [12] where subjects not only communicate well in small groups but also build up their confidence level. Moreover, the subjects were given the chance to speak up and negotiate with the group members, and this result was also parallel to the study by Normaliza Abd Rahim et al. [2] and Stahl [15]. This study had given the subjects time and space to work on their own and produce the product [4]. This study implicates not only to researcher but also to educators and students in schools and universities. The task given to them may vary by looking at the needs of each subject. Researchers will continue working on with new media technology that relates to subjects of the research considering self-produced product. Besides that, this study implicates the students at schools and universities in Malaysia in learning to collaborate with their friends and produce products which were self-produced with the use of the media technology. It is hoped that future research will look at younger subjects and adult learners in small groups working with new media technology.

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Chapter 39
Exploration on Innovation Culture in Batek Tribe

Sri Yusmawati Mohd Yunus, Mohd Amli bin Abdullah Baharum, and Naliza Solat

Innovation

Innovation is a subjective concept and whether any activity qualifies as innovative or not depends on the perspective of the observer. Obviously, the criteria for innovation become stricter when one zooms out from a micro to a macro perspective, and the "right perspective" is in essence determined by the question one is asking [1]. Another argument explains that small incremental changes can be equally innovative and are often overlooked [2]. There are others who state that innovation is intrinsically about identifying and using opportunities to create new products, services, or work practices [3].

The mark of a strongly held learning culture is that it always constructs further with methodical innovation and renovation [4], rather than mere repetition of information, which would result in an integrated and sophisticated climate [5] that would increase accuracy, appropriateness, output, and innovative behaviors [6]. Several past studies on innovation culture are more focused on innovation elements [7], innovation product [8, 9], market orientation [10], business performance [11–13], competitive strategy [14], leadership [15], and organizational learning [16]. If the right types of norms are held and are widely shared, then culture can activate creativity. Apart from that, an organic structure also would promote innovation where it is free from rules, encourage participation, and are informal would promote innovation among its people [17].

Batek tribe is one of the major Orang Asli tribes that can be found in Peninsular Malaysia. This tribe is unique and there are only few studies that are involved this

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tribe. This study is an initial knowledge to better know about Batek tribe in the perspective of innovation culture among the tribe members as there was lack of reference on it. To date there are no findings on any academic studies on how Orang Asli Batek creates innovation culture in their lifestyle. As such the purpose of the study is to reveal, if any, the innovation culture among the Batek.

Objective of the Study

The objectives of this study are:

1. To identify the types of innovation existed in Batek culture
2. To understand the factors influencing the innovation behavior in Batek tribe

Significance of the Study

It was stated by previous study that Orang Asli is a primitive tribe that ignores and is against any development [18]. By revealing the innovation culture in Batek tribe, it is hoped to reject the previous assumption, as well as to show that development does exist in their society. It also gives a new perspective of strength of Batek tribe in the development of the society.

Methodology

This study used ethnography method as it involves exploring the nature of the phenomenon and working with unstructured data, analyzing data through interpretation of meanings attributed by research respondents [19]. Standard rule for taking field notes was used to make sure that data is reliable to answer the objectives of this study [20]. A preliminary observation was done through discussion with local people in Kuala Tahan to identify the settlement of Batek tribe as they always moved from one settlement to another. Through the exploration, all notes were jotted immediately during observation. All events were recorded by sequence and no prejudgment was made during the interviews.

Orang Asli and Batek Tribe

The indigenous people of Malaysia consist of various tribes, and each tribe has its own language and culture which makes it unique and different from one another. Orang Asli in Malaysia are divided into three main groups which are Negrito, Senoi,

Picture 39.1 Sipai anak
Cemetung and wife

and proto-Malay [21]. The term Orang Asli is used to refer to the aborigines in
Peninsular Malaysia. Under the Orang Asli Act (Act 134) 1954 which was revised
once in 1974, a person is considered as an Orang Asli if one of his or her parents is
a member of an Orang Asli ethnic group and lives according to the laws, beliefs, and
rituals of that group.

The Batek is one of the aboriginal people found in Peninsular Malaysia and they
are categorized as Negritos. According to early anthropologists' writings, the Batek
is referred to as Bateg, Batek, and Ngok [21].

Batek is considered as one of the 20 or so indigenous ethnic minorities of
Peninsular Malaysia [22] (refer to Picture 39.1). They live in lowland forests in the
states of Kelantan, Pahang, and Terengganu. In Northeast Pahang, Batek settlement
can be found near Sungai Tembeling, Sungai Kechau, and Teluk Gunung. They
primarily dwell in Taman Negara (National Park) [23]. They also live near Sungai
Gala, Sungai Chiku, Sungai Tako, Sungai Lebir, and Sungai Airing in Kelantan. In
Terengganu, the tribe's settlement can be found near Sungai Berua, Besut. The
Batek language belongs to the Aslian subbranch of the Mon-Khmer branch of the
Austroasiatic language family [24]. The Batek are involved in a number of eco-
nomic activities. One important economic activity of the Batek is collecting and
trading rattan in return for cash, or other basic necessities. They also collect other
forest produce to be traded such as wild rubber, resins, honey, fragrant woods, or

forest medicines in the form of wild plants and herbs if the demand rises [24]. The Batek tribe also works as guides for exploring Taman Negara for tourists.

The Batek still preserve their nomadic lifestyle and do not stay permanently in one place. They would move to a new location within a 6-month period. One of the profound reasons for any movement would be the death of a community member or because of a disease. According to Dali@Amir anak Kapak, an elder in the Batek community, "*Kami akan pindah bila ada kematian. Tempat itu akan kami tinggalkan*" (We will leave when there is death in the community).

Taman Negara (National Park) is one of the oldest tropical land forests in the world, and it is situated in the center of the Peninsular Malaysia. It has the most extensive protected area of pristine, lowland, evergreen rainforest and spans across three states Kelantan, Terengganu, and Pahang. An expedition was conducted in Taman Negara, to a few small and medium settlement of Batek. The expedition was assisted by the local guides who are constantly in contact with the Batek. Boats have to be used as these settlements were inaccessible by land. The expedition was led by Alias bin Abu Nipah who has a close relationship with the Batek headman and also proficient in their language. The settlements are identified as Kampung Sungai Yong, Kampung Lubuk Ceruk @ Seberang Kanopi, Kampung Terisik, Kampung Atok, Kampung Dedari, Kampung Aur, Kampung Kuala Keniam, Kampung Rinching, and Kampong Ulu Sat. All of this settlement is not a permanent settlement as Batek tribe usually travels from a place to another place and does not stay permanently in one place. However, due to some unforeseen circumstances, the expedition was restricted to Kampung Lubuk Ceruk @ Seberang Kanopi, Kampung Aur, and Kampung Rinching.

The first settlement of the journey was Kampung Lubuk Ceruk or also known as Seberang Kanopi. The coordination of the settlement is N4°23.518′ E102°24.844′. The second settlement was Kampung Aur and the coordination is N4°25.739′ E102°26.712′. The last settlement was Kampung Rinching (N4°33.301′ E102°27.462′). The coordination of the settlements was taken by using Garmin Oregon 450.

Innovation in Batek Tribe

This study used the four basic types of innovation [25] to measure innovation type among the Batek (Refer Fig. 39.1). The four types of innovation are invention, extension, duplication, and synthesis [26].

Nature Inspired Innovation

From the observation and interviews, one of the unique innovations among the Batek is the use of forest plants and herbs in curing illness among the tribe members. Forest food often is considered by many Batek as being extremely powerful
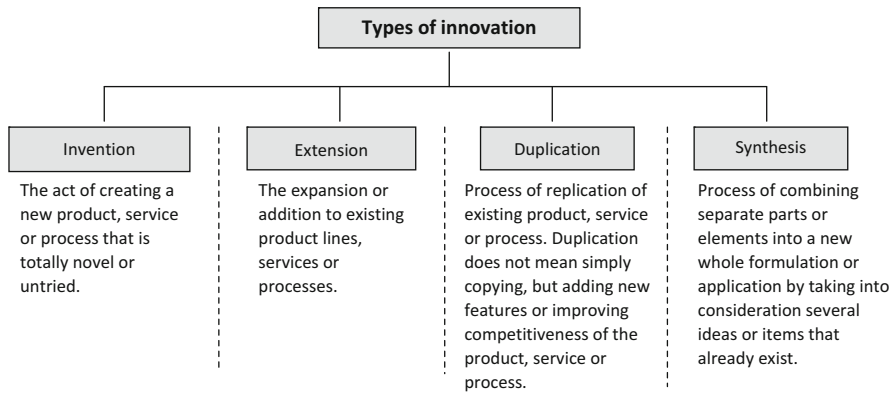
Fig. 39.1 Types of innovation [25]

sources of health and strengths, while shop-bought foods are increasingly associated with weaknesses, diseases, and death [27]. According to Menderu anak Chepetung, one of the elders, if any of the tribe members are sick, or have bruises and cuts, they do not go to the local government clinics or general practitioners. Instead, they would use herbs and plants that are available in their surroundings to cure the sickness or cuts. This indicates that the Batek have the capabilities to use the elements in their environment in improving their quality of life. The knowledge of the forest has allowed the Batek to use it as a safe haven for their families. Their traditional knowledge systems are also innovation systems [28]. Based on the types of innovation, this falls under invention as they create new or alternative medicine for their consumption.

Another innovation that falls under invention is the innovation on craftsmanship. The innovation can be seen through their creativity in cutting and carving bamboo to make *belau* (blowpipe), *kenla* (bracelet), and *cenilas* (comb) (refer to Picture 39.2). Most of the motives carved are based on animals and plants that they see in the forest. From our observation, the process of imitating nature and using it in their living is high among the Batek. Animal motives on the blowpipe include chicken, lizard, and butterfly, while plant motives include coconut tree, lempoyang hitam, and ferns (refer to Picture 39.3). All handcrafts made are usually sold to the tourists that come to the settlement and local resellers. Batek women also participate in the economy as the producer of handicrafts with men to market the products [29].

Innovation in Batek normally depicts their lives and their relationship with the surrounding environment. It also reflects their identity, which differentiates them from other Orang Asli in Taman Negara. Limited works have been done to capture the innovation of the Batek, and this could prove to be dangerous as this knowledge may be lost if they are not preserved. If indigenous people want to bring their innovations to market beyond their customary ones, the network cooperation between indigenous innovators and scientist will be important [28].

Picture 39.2 Menderu
anak Chepetang making
the blowpipe

Picture 39.3 Motives on the blowpipe

Batek Social and Clothing

From the observation, Batek tribe does not have any uniqueness in either socializing or clothing. They merely imitate how the locals socialize and wear clothing that is the same as the locals. Indigenous minority people have needed to be competent in the sociocultural world of their more powerful neighbors [27]. We also identified that their learning behavior is unique as they do not have any formal education. The children of Batek do not go to school even though there are primary schools in Taman Negara. Previous study on aborigine's pupil absenteeism listed lack of parents' commitments, too much homework, strict teachers, uninteresting activities, and tiredness as some of the reasons for staying away from school [30]. In our study, a test was given to a few Batek teenagers to know their writing capabilities and understanding of Malay words. It was found that not only they can write but also can translate the words into their language. Some words that have been translated and written down were *rumah* (house) in Malay language to *hayaq* in Batek language and *tidur* (sleep) in Malay language to *ten* in Batek language. From the interview with Sipai @ Balang anak Cemetung and his brother Hawang anak Cemetung from Kampung Aur, they explained that they learn the Malay language through their interaction with the locals, either socially or through business endeavors.

Evidence of writing capabilities can be seen on the wall of their house (refer to Picture 39.4). The wording says "*Wap.. malam ini aku rasa suka..*" (Wap.. I feel happy tonight). All of them in the tribe do not receive any formal education, but a few of them can do simple calculation. This unique learning can be

Picture 39.4 Writing on the wall

categorized under synthesis which is one type of innovation. In addition, learning and innovativeness are separate constructs that are interrelated. In focusing on learning orientation as a cultural construct, there is a need to emphasize cognition to distinguish learning orientation from innovativeness [31].

Conclusion

Batek is a unique tribe who still preserves their traditional way of life. As such, preservation of their innovation is pertinent for it will have an ongoing contribution, not only to the tribe itself but also to the study of Orang Asli. Their innovation in using natural plants and herbs for medicinal purposes and their craft capabilities need to be further studied, preserved, and promoted. Their unique learning abilities need to be delved deeper so that they could be further helped to improve their lifestyles. As conclusion, the innovations in the Batek tribe are based on necessity and process needs in their daily life [32].

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Chapter 40
Analysing the Use of Superiority Claims in the Local Complementary and Alternative Medicine Print Advertisements in Malaysia

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Introduction

Advertising is an essential element in the marketing process. It plays a role in carrying out the promotion of a product. Without advertising, people will not have adequate knowledge of the wide range of products available in the market. Thus, advertising acts as a medium of information between the producers and the consumers or the potential consumers. However, the development of technology has led to mass production of the same product brand which has resulted in tough competition among the product manufacturers. This means that the consumer market needs to be stimulated to persuade the consumers to arrive at the desired action, that is, to choose and buy the product. As a result, the role of advertising has changed from that of proclamation to persuasion [1]. However, persuasion usually leads to exaggeration. Advertisers usually exaggerate their products in the form of claiming their superiority. Language that is used to claim the superiority is usually cleverly and creatively manipulated to create persuasive impacts in the advertisements.

Superiority claims are factual statements – explicit or implicit – about a product or a service: the facts that make a direct claim of superiority or convey superiority by implication [2]. The primary function of these claims is to create an illusion of superiority [3] which the advertiser hopes will attract the consumers. However, studies on claims made on product advertisements have revealed that most of the claims 'balance on the narrow line between truth and falsehood by a careful choice of words' [3]. Language forms and linguistic features are cleverly and creatively

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used to attract consumers' attention and lead them to the desired action, that is, to purchase the product.

This paper focuses on the claims made on the complementary and alternative medicine (CAM) products in print advertisements in Malaysia. It is reported that the sales of CAM products are estimated to be RM1000 million annually [4]. This suggests that this type of product has become increasingly popular among the consumers in this country. However, there have also been some disturbing reports with regard to CAM product usage and consumption [5–7]. Although no particular report is found alleging that consumers were misled by the superiority claims, the claims themselves may have influenced them to purchase and use the products. This is because it is through the claims that consumers can get the first hand, direct information with regard to the effectiveness of the product(s). This has provided the motivation for this research, that is, to inform and educate consumers about the claims that may be misleading by analysing and classifying the superiority claims utilised in advertisements through language use.

Advertisements: An Overview

Advertisements are an important medium for producers to get their products out there in the public eye. Advertising has been described as 'any paid form of non-personal communication about an organisation, good, service or idea by an identified sponsor' [8]. There are basically three forms of advertisements, namely, 'informational', 'persuasive' and 'reminder' [8]. The nature of advertisements itself means that producers try to communicate as much about the product in as little space as possible. Thus, the words in advertisements are carefully chosen for the most impact. Print advertisements are still a popular medium among advertisers despite current advances in technology. This is because such advertisements are usually more detailed and can be read for much longer [9].

Informative Versus Persuasive Advertisements

Both informative and persuasive advertisements are designed to highlight the good qualities of a product. However, one difference between the two is that informative advertisements are mainly based on facts while persuasive advertisements tend to appeal to potential customers' emotion [10]. In persuasive advertising, there is more use of 'trickery and flash'. One example is by using a famous person to endorse products. This will cause the consumers to view the product positively even though the product may be flawed [10]. In making the truth fascinating, some advertisers resort to using means to exaggerate their products' effectiveness such as puffery. Puffery can be understood as 'exaggerated, often subjective claims that can't necessarily be proved true or false such as "the best" or "the only way to fly"' [9].

Deceptive advertising can occur in subtle ways that are difficult to establish as outright deception, such as puffery, incomplete comparisons and implied superiority claims [11]. One way to counter such deception is through informational priming, that is, feeding factual truths to the customers [11]. Thus, the customers can make their own comparison and not be easily misled by what they read.

Both informative and persuasive contents present an appeal to the consumer to buy the product [12]. One type of appeal is the fear appeal. We can find this quite often in the marketing of traditional medicine. For example, the advertiser of certain products that claim to combat diabetes may instil fear in diabetic patients that they might lose their limbs if they do not take the product.

Superiority Claims in Advertisements

There are nine types of superiority claims [3], namely, the 'weasel' claim, the 'unfinished' claim, the 'we are different and unique' claim, the 'water is wet'/'so what' claim, the 'vague' claim, the 'endorsement or testimonial' claim, the 'scientific or statistical' claim, the 'compliment the consumer' claim and the 'rhetorical question'. Each of these claims can be defined as:

(a) The 'weasel' claim – claims which are actually insignificant and meaningless despite the way the claims are presented. The words 'fight', 'help' and 'goodness' are among the examples of weasels [3].
(b) The 'unfinished' claim – claims that say certain products are better than the other, having more of something that finally leads to unfinished comparison, for instances, 'Supergloss does it with more colour, more shine, more sizzle, more!' [3].
(c) The 'we are different and unique' claim – the claims that say certain products are incomparable because they are really different and unique. Among the examples are 'Cougar is like nobody else's car' [3].
(d) The 'water is wet/so what' claim – the claims made by telling the true quality appears in a product of any brand, a fact which according to Schrank [3] '… not a real advantage over the competition'. An instance for this is 'SKIN smells differently on everyone'.
(e) The 'vague' claim – the ambiguous claims that use colourful but meaningless words like 'For skin like peaches and cream' [3].
(f) The 'endorsement or testimonial' claim – the claims made by using a known personality or an authority. This can easily influence the viewers who can be attracted to certain qualities owned by the chosen personality [3]. Numerous examples of this claim appear on Malaysian TV commercials where artists like Wardina Safiyyah, Nora Danish and Fahrin Ahmad are used as the spoke persons for certain products.
(g) The 'scientific or statistical' claim – the claims that use scientific findings, percentage, numbers and figures as to persuade consumers like 'Special Morning – 33 % more nutrition' [3].

Table 40.1 Categories of complementary and alternative medicines

	Category	Description	Examples
1.	Whole medical systems	The complete systems involving both theory and practice	Traditional Chinese medicine, homeopathy, ayurveda and naturopathy
2.	Mind-body medicine	The holistic approach exploring the interconnection between the brain, mind, body and behaviour	Meditation, yoga, acupuncture, deep-breathing and relaxation exercises, hypnotherapy, tai chi and qigong
3.	Biology-based product/practices	Involving the use of substances found in nature	Herbs, foods, vitamins, probiotics, minerals and other natural products
4.	Body-based practices	Practices that feature manipulation or movement of body parts, focusing on the structures and systems of the body, including the bones and joints, soft tissues, and circulatory and lymphatic systems	Various types of massage and Pilates
5.	Energy medicine	The use of various energy to improve health	Biofield therapies, bioelectromagnetic, hydrotherapy

(h) The 'compliment the consumer' claim – claims that offer flattery to consumers like 'The lady has taste' [3].
 (i) The 'rhetorical question' claim – these are the rhetorically asked questions that 'demand a response from the audience'. A good example for this kind of claim is 'What do you want most from coffee? That's what you get most from Hill's' [3].

Complementary and Alternative Medicines

The American National Health Interview Survey (NHIS) in 2007 [13] revealed that approximately 38 % of adult Americans use complementary and alternative medicine (CAM). Although such survey is not found in Malaysia, the increasing number of CAM products in the market can be an indication that CAM has become increasingly popular among the local consumers. CAM is the term given for medical products that are not part of the standard care which is provided or practised by medical doctors or allied health professionals such as nurses or therapists. Thus, CAM can be said as non-standard medical products or treatment used along with the standard ones.

CAM products and practices are varied. According to the National Center for Complementary and Alternative Medicine of America (NCCAM), there are five broad categories of CAM as shown in Table 40.1. However, as the CAM categories have not been formally defined, it is very important to note that some CAM products and practices may fall into more than one category.

In Malaysia, this type of medicine has become increasingly popular among the consumers. Unlike mainstream medicine, alternative medicine often lacks or has only limited experimental and clinical study. Claims about the efficacy of alternative medicine tend to lack evidence and have been shown to repeatedly fail during testing. For example, POM Wonderful LLC claimed that its product, pomegranate juice, and supplements prevent or treat prostate cancer, erectile dysfunction and heart disease. However, such claim has been challenged by FTA that it does not have enough scientific backup. Thus, the knowledge gained from the findings may be the first step towards consumer education in identifying claims that may be false and misleading. In turn, consumers can be more informed, thus, discerning in making decisions in purchasing a product.

The Study

Empirical studies on advertising messages on consumers have agreed that persuasive language and superiority claims are very influential and pose a big impact on consumer's decision making and choices of products [14–17]. Thus, the main focus of this paper is to disclose the common words and phrases used in the advertising claims that have the tendency to mislead the consumers. Thus, the objectives of this paper are:

1. To analyse the types of superiority claims used in print advertisements of the local complementary and alternative medicine (CAM) products in Malaysia through language use
2. To classify the type of superiority claims as the most/least commonly and frequently used in the CAM advertisements

Methodology

The study employed a text analysis method that focused on the superiority claims used in the printed materials of local CAM. Print advertisements of CAM in Bahasa Malaysia from newspapers, magazines, brochures and promotional leaflets were collected to provide a corpus of data for the identification, description and categorisation of the superiority claims. Samples of CAM medicines were those described by the National Center for Complementary and Alternative Medicine of America and do not fall within the realm of conventional medicine. The description of the National Center for Complementary and Alternative Medicine of America was used as there have been no clear guidelines on the types/categories of CAM produced by relevant authorities such as pharmaceutical bureau of Ministry of Health in Malaysia.

The samples chosen were non-probability and purposive as they have to fulfil the following criteria: (1) must be in any of the CAM categories described above and (2) must contain verbal messages (words, phrases, slogans). In addition, any repetitive advertisement found was only analysed once.

Data Analysis

The data were treated to both quantitative and qualitative analyses. The framework used to quantify the CAM categories of the advertisements collected was the definitions suggested by the National Center for Complementary and Alternative Medicine of America, that is, (1) whole medical systems, (2) mind-body medicine, (3) biology-based practices, (4) body-based practices and (5) energy medicine. The frequency count which was later calculated into percentage was used to find out the type of local CAM that appears the most in printed advertising campaigns.

As for analysing the superiority claims, Schrank's (1998) nine types of superiority claims, namely, the weasel claim, the unfinished claim, the we are different and unique claim, the water is wet/so what claim, the vague claim, the compliment the consumer claim, the scientific or statistical claim, the endorsement or testimonial claim and the rhetorical question claim, were applied. To do this, the verbal messages, which included words, phrases and slogans, in the advertising claims were analysed to determine and identify the presence of the nine types of superiority claims. As the corpus was in Bahasa Malaysia, the words/phrases/slogans were translated into English to match the meaning of words/phrases/slogans described in Schrank's framework.

The frequency counts which were later calculated into percentage were used to find out the type of superiority claims that is utilised the most/least in the local CAM advertisements. The text analysis also reports and describes the words/phrases/slogans that are commonly used in the claims to create superiority of the products.

Findings and Discussion

Distribution of CAM Products in Advertisements

Altogether 132 CAM advertisements were collected during the period of data collection for this study (May to June 2012). The following table shows the distribution of the CAM advertisements based on the types of CAM as prescribed by the National Center for Complementary and Alternative Medicines of America (2012).

As shown in Table 40.2, the most popular type of CAM advertised was biology-based product and practices; 96 out of 132 (72.7 %) advertisements collected fell under this category. The products/practices advertised under the biology-based category included herbal food and drinks claiming their superiority in boosting energy, reducing weight and rejuvenating body. Among sample products found were *D'Elegant Secret Cappucino, Fara Slimming Beauty Juice, Minuman Herba Misai Kucing, Vasia-vit c + collagen series* and *Jamu Ratu Dara*. Other products advertised in this category were biology-based skin care products, hygiene care products and beauty care products. Among sample products found were *Yusmira losyen serai wangi, Putri binari perut xlim cream, Segarapat Wash* and *Virgin cream*.

Table 40.2 Distribution of CAM products in advertisements

	Types of CAM	No. of advertisements	
1.	Whole medical systems	12	(9.1 %)
2.	Mind-body medicine	0	(0 %)
3.	Biology-based product/practices	96	(72.7 %)
4.	Body-based practices	1	(0.8 %)
5.	Energy medicine	23	(17.4 %)

The second most popular type of CAM advertised was energy medicine (23 out of 132, or 17.4 %). The products advertised were energy-based products claiming their superiority in improving health through the use of field therapies. Sample products found included *Blue Ocean Therapy, Happy Feet Therapy Socks, Al Jabbar – Dr jism, Diamond Energy Water* and *Magnetic Necklace*.

Whole medical systems came third in the list of popular CAM advertisements (12 out of 132, or 9.1 %). The products advertised claimed superiority in their ability to heal or improve health through health maintenance and disease prevention. Among samples found were *Examo, Salindah, Growell* and *Rawatan Islam*.

Only one body-based practice advertisement was found in the samples (0.8 %). The body-based practice, that is, traditional massage, was advertised as part of the whole medical system. The sample found was *Rawatan Islam dan Urutan Tradisional*.

None was found on the mind-body medicine type which indicates that this is the least popular type of CAM advertised. One of the reasons was probably due to the nature of the type itself. Mind-body medicine type, such as hypnotherapy and tai chi, is normally practised by groups of people with special interest rather than those who can be persuaded through the use of persuasive advertisements.

Distribution of Superiority Claims in Advertisements

The textual analysis of the samples shows the presence of all types of superiority claims in the advertisements. Altogether, 811 superiority claims were recorded in the 132 advertisements analysed. The distribution, however, varied among the types of claims. Table 40.3 shows the details of the distribution.

As can be seen from the table, the data clearly show that the most frequently and commonly used claim is the 'weasel' with more than half of the claims (53.9 %) found belonging to this type. This is followed by 'endorsement or testimonial' claim (25.6 %). The rest of the claims, although evident, can be considered as less popular, as they each contribute less than 10 % to the overall statistics. The claims are 'scientific or statistical' (5.3 %), 'we are different and unique' (4.7 %), 'vague' (3.9 %), 'rhetorical question' (2.3 %), 'unfinished' (1.9 %), 'compliment the consumer' (1.5 %) and 'water is wet' (0.7 %) claims.

Table 40.3 The types of superiority claims used in advertisements

No.	Types of superiority claims	Distribution	
1.	Weasel	437	(53.9 %)
2.	Unfinished	16	(1.9 %)
3.	We are different and unique	38	(4.7 %)
4.	Water is wet	6	(0.7 %)
5.	Vague	32	(3.9 %)
6.	Compliment the consumer	12	(1.5 %)
7.	Scientific or statistical	43	(5.3 %)
8.	Endorsement or testimonial	208	(25.6 %)
9.	Rhetorical question	19	(2.3 %)
	Total	811	

The analysis reveals that the 'weasel claim' is found in all the advertisements. Weasel words and phrases like 'membantu' (helps), 'mencegah' (prevents), 'melawan' (fights), 'meningkatkan' (enhances) and 'dapat/boleh' (can/able to) are found throughout the corpus. Some of the examples are:

Membantu menurunkan berat badan (sample 7 – energy-based product)
(Helps reducing weight)
Melawan obesiti (sample 8 – biology-based product)
(Fights obesity)
Meningkatkan penggunaan tenaga (sample 18 – energy-based product)
(Enhances energy use)
Dapat mengawal selera makan (sample 16 – biology-based product)
(Can control appetite)

From the examples, it can be seen that the CAM advertisers/providers make the benefits of the products sound promising. Words used such as 'membantu' (helps), 'melawan' (fights), 'meningkatkan' (enhances) and 'dapat' (can/able to) may appear substantial. However, a close analysis shows that these words only act as qualifiers to the claims made. In other words, the products do not guarantee whatever they claim they would do. For example, the product (sample 7) does not guarantee that it will reduce weight, but only will help to reduce weight. Similarly, the product (sample 16) does not guarantee that it will control appetite, but only will help to do so. Such use of words is a strategy to retreat from a direct statement [15] for these words function as 'little disclaimers' [6] of the products advertised. Consumers are very likely to miss such disclaimers and only focus on the promises of the (non-guaranteed) claims [18].

The second most frequently and commonly used type of claim is the 'endorsement or testimonial' claim. The data show that the endorsement or testimonial claims were made by three groups of people: (1) experts or professionals in the field, (2) celebrities who were selected as the product ambassador or spokesperson and (3) ordinary consumers. The analysis reveals that most of the endorsements/testimonials in the corpus

were made by the ordinary people who endorsed the effectiveness of the product. Samples of these include the following:

Dalam tempoh dua minggu, tahap kolesterol saya telah turun …. Josephine Chew (sample 17 – biology-based product)
(Cholesterol levels reduced in just 2 weeks…)
Setelah menjalani rawatan terapi Dr Jism …. Hjh Jamaliah Sulaiman (sample 19 – energy-based product)
(After going through Dr Jism's therapy treatment…)
Dengan pengesahan saintifik dan sijil daripada badan bertauliah seperti Persatuan Inframerah Jauh Korea (sample 21 – energy-based product)
(With scientific validation and certifications by reputable bodies such as Korean Far Infrared Associations…)

Such testimonials will make the claims of the products more credible and convincing, especially when they are accompanied by real pictures of ordinary consumers displaying or proving the effectiveness of the products. Potential consumers' emotions are more likely to be affected with impressive endorsements. This may lead to the desired action, that is, to purchase the product. However, a more discerning consumer should not be susceptible to the testimonials. As the products and the treatments are not clinically/medically endorsed, consumers should ask how safe the CAM products/treatments are or how well they work. This is because the testimonials usually do not describe the treatment process and its safety.

The 'scientific or statistical' claim is among the less frequently used in the CAM advertisements. The analysis shows that 11 out of the 43 claims found were scientific claims while the rest contain statistical evidence claiming the superiority of the products. Claims such as:

Magnet penyembuhan yang kuat – melebihi 5000 Gauss … (sample 21 – energy-based product)
(Powerful healing magnets – over 5,000 Gauss …)
Hasil kajian Universiti Harvard menunjukkan … (sample 7 – energy-based product)
(Research done by Harvard University shows…)

look impressive and credible. Thus, consumers may not question the truth as the claims appear to be well supported. However, a more critical look at a few of the claims shows that there is no substantial evidence to support them. Claims such as the following can be questioned as there is no further evidence given to support them. For example, the statistical claims in the following examples are questionable in terms of their credibility and completeness:

100 % selamat (sample 11 – biology-based product)
(100 % safe)
Dihasilkan daripada 100 % herba tradisional (sample 15 – biology-based product)
(Produced from 100 % traditional herbs)
10 kali ganda penangan (sample 12 – biology-based product)
(10 times better)

The next less used claim is the 'we are different and unique' claim. Words and phrases like 'yang terbaik' (the best), 'Nombor 1' (Number 1) and 'lain dari yang lain' (different from others) are some of the claims found in the data:

Pencuci wanita yang lain dari yang sedia ada (sample 11 – biology-based product)
(Feminine wash that is different from the available ones)
Tiada produk yang serupa dan seumpama dengan Ivy6! (sample 6 – energy-based product)
(No product is the same and similar to Ivy6!)
Terbaik di pasaran (sample 22 – energy-based product)
(The best in the market)

Such claims of superiority are used to evoke some kind of mental image in the consumers that the products are not only unique but the best in their class. Consumers may look forwards to purchase products that are 'the best' and 'different from the available ones'. However, a discerning consumer might question the truthfulness of the claim as there is no evidence to prove that the products are the best or different from the others.

The 'vague' claim only contributes 3.9 % to the data. In this type of claim, words and phrases are used to create an illusion of superiority of the products without having to elaborate the claim. Some of the samples found are:

Dinginnya lain macam … (sample 11 – biology-based product)
(Its coolness is different …)
Melekat dengan sempurna (sample 16 – biology-based product)
(Sticks perfectly)

The vagueness of the claims, that is, the different coolness and perfect stick, may evoke mental image and create consumers' curiosity and interest in the products. However, images evoked may be different from one person to another. People's curiosity and interest in the products are very much affected by the image that they form. This is probably the reason why this type of claim is not very popular. Producers may want people to have the same image of their products, thus, opt for a more influential claim.

Another claim along this line is the 'unfinished' claim which only forms 1.9 % of the corpus. Claims such as

Lebih mantap, lebih menyerlah … (sample 2 – biology-based product)
(better, more exquisite)
Bukan sekadar jus! (sample 15 – biology-based product)
(Not just juice!)

are incomplete and, thus, may also create people's interest and curiosity. However, similar to the reason for the 'vague' claim, producers are more likely to prefer a more direct claim that can boast the superiority of the products.

The 'rhetorical question' claim is also among the less frequently found claims in the corpus. The use of rhetorical questions that requires answers from the consumers may be effective in provoking their minds, which can eventually lead them to the

desired action. The analysis of the data shows that the rhetorical questions in the samples serve as a gambit in introducing the products:

Tahukah anda? … (sample 19 – energy-based product)
(Do you know? …)
Sejauh manakah khasiat minyak zaitun? (sample 7 – biology-based product)
(How far are the benefits of olive oil?)

However, there is one rhetorical question found in the samples that is used as a concluding persuasive tool to urge people to purchase the product:

Jadi, apa di tunggu lagi? (sample 7 – biology-based product)
So, what are you waiting for?)

Although this can be an effective promotional strategy, the producers may want to save the advertising space by inserting more direct information regarding the product. This could be one of the reasons for its rarity in the samples.

The 'compliment the consumer' claims are also found in the corpus. The use of this type of superiority claim is a strategy to make the products appealing to the consumers and, hence, leads them to the desired action, that is, to purchase the products. Some of the examples found are:

Pilihan VVIP (sample 19 – energy-based product)
(VVIPs' choice)
Untuk anda yang sentiasa inginkan kelainan (sample 9 – biology-based product)
(For those who always want a difference)

The claims indirectly compliment the consumers – that if they choose to use the products, they are equal to the VVIP and those who want something out of the ordinary. Thus, the producers of the products compliment them for their choice.

The least popular type of claim found in the samples is the 'water is wet/so what' claim. Only 6 out of 811 claims were in this category. These are:

Air bersih, kehidupan sihat (sample 24 – energy-based product)
(Clean water, healthy life)
Dalam sarang burung terdapat satu bahan yang dipanggil MILO ECHEO (sample 3 – biology-based product)
(The bird nest contains MILO ECHEO)

It is clear from the examples above that the claims only contain factual information or, rather, information that is already known. A closer analysis shows that the claims seem to suggest equality with other products of the same brand. Thus, the producers may not favour this type of claim as it does not exert any superiority of the products.

In summary, the data have shown extensive evidence of superiority claims in the advertisements, with weasel claims being the most favourite among the copywriters/producers. Although the corpus has been limited in terms of the number of advertisements being analysed, the findings can contribute towards understanding the techniques employed by the producers to make their products appealing to the

potential customers. Several studies have reported that a large proportion of their respondents admitted to have been misled by the claims and, thus, believed that they were true [19, 20]. Thus, the findings, especially on the use of empty words and modifiers, can also help the consumers to be more discerning and careful in evaluating the information given by the advertisements.

Conclusion

The findings have shown that superiority claims are extensively used in CAM advertisements. Among the nine types of claims, the weasel claim is the most frequently and commonly used in the advertisements. Although on the surface the claims that CAM producers/providers make regarding the benefits of the products sound superior and promising, consumers need to be more discerning in evaluating the claims in the advertisements. However superior and promising the CAM products, treatments and services may be, the analysis has shown that the claims made are questionable. Since many CAM products, treatments and services are not endorsed or certified by the standard conventional medicine/practices, consumers need to find out the safety of CAM practices and how well they work on different individuals.

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Chapter 41
Investigating the Satisfaction and Intention to Use Blog: The Application of Extended TAM

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Introduction

Blogs can be defined as online journals where the content is arranged in reversed chronological order [1]. Blog is also a Web site where someone writes about their personal opinions, activities, and experience, as a medium of communication, sharing information, and social interaction [2]. Blog is regularly updated and planned for the use of general public; it will normally represent the personality of the writer or reflect the function of the Web site that hosts the blog. A person who frequently to be the writer of a blog is called a blogger. In Malaysia, the scenario might be or might not be similar with the one in the United States of America. It can be seen that the accessibility to the Internet has increased dramatically from time to time especially in big cities, namely, the Klang Valley area. Free Internet access can be obtained at restaurants, cafe, shopping malls, and other public areas. This has also encouraged people from all generations to use Internet anywhere and everywhere at ease. The existence of blogs in Malaysia and the number of Malaysian bloggers have also increased tremendously recently. In February 2012, it was found that there are more than 500,000 local bloggers in Malaysia [3]. However, the exact number of active local bloggers was quite difficult to be identified because most bloggers tend to handle more than one account at one time and use different identity in their blogs. The huge number of Malaysian bloggers could be possibly due to their satisfaction with the Web site and system information as those elements are crucial antecedents of perceived usefulness and perceived enjoyment as mentioned by Kang and Lee [4]. For instance, if the users for Blogspot.com are satisfied with the weblog contents such as posting new entry, accepting comment, and adjusting

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layout and design, the users are more likely to perceive that using the weblog is enjoyable. It will then boost the customers' perceived enjoyment as they are satisfied with the system performance of the weblog. Thus, it is also important for companies that provide the platform for Internet users for blogging activities to monitor the satisfaction of their customers toward the service they offer [4]. In relation to that, we would like to investigate the relationship between users' satisfaction and users' intention to use blog by applying Technology Acceptance Model (TAM).

This study employs a model based on the extended TAM and ECT-IS with the following aims:

1. To examine the predictive ability of the integrated model of TAM and ECT-IS in Malaysian context
2. To explore the relationship between the perceived ease of use (PEOU), perceived usefulness (PU), and perceived enjoyment (PE) to satisfaction and intention to use blog

eTAM, Satisfaction, and Intention

Technology Acceptance Model (TAM) is primarily developed by Davis in 1989 explaining the individual's acceptance of computer [4]. TAM is based on the Theory of Reasoned Action (TRA) by Fishbein and Ajzen which suggests that social behavior is motivated by an individual's attitude toward carrying out that behavior. TAM adopts TRA's causal links to explain the individual's technology acceptance behaviors. TAM suggests that perceived ease of use and perceived usefulness are two major determinants of users' attitude and usage of technology [4, 5]. Perceived ease of use (PEOU) is defined as the strength of one's belief that interacting with technology is free of effort. Perceived usefulness (PU) represents the degree to which a person believes that the use of a particular system can enhance his or her work performance [4]. Later, perceived enjoyment is also considered in TAM to better predict the user behavior [4, 6] According to Davis et al. [7], perceived enjoyment (PE) can be defined as "the extent to which the activity using the technology is perceived enjoyable on its own right, apart from any performance consequences that may be predicted." PE is believed to provide adequate information on individual's opinion of novel technology systems [8].

A recent study by Shiau and Chua [9] applied comparison approach to examine the best model to predict user's intention on technology. They study TAM and expectation-confirmation model of IS (ECT-IS) which are believed to have two similarities: first, TAM and ECT-IS model employ individual cognitive factor of information system, and second, both model are capable to predict information system continuance. ECT-IS model was introduced by Bhattacherjee in 2001 to predict continuance intention of information system users [10]. ECT-IS consists three constructs of confirmation, perceived usefulness, and satisfaction which are related to each other to predict continuance intention. They exploit the integration
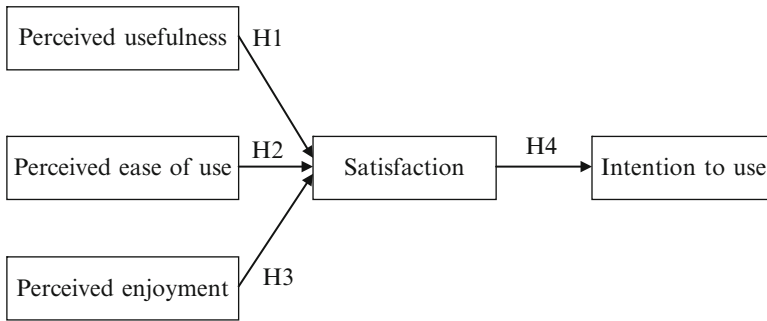
Fig. 41.1 The theoretical framework

of TAM and ECT-IS to postulate that PEOU, PU, and satisfaction could predict intention [9]. Satisfaction can be defined as "user affects (feeling) about prior blog use" and continuance intention as "individual intention to continue using the blog" [10]. We adopt the same definition as this study also examines blog users. In their integrated model, they found that PEOU and PU have no significant direct relationship to intention [9]. However, their finding indicates perceived usefulness has empirically significant effect to satisfaction that predicts information system continuance intention.

Based on reviewed literatures, we would like to test the validity of integrated model of TAM and ECT-IS as proposed by Shiau and Chua in Malaysian's context. However, this research will exclude confirmation construct in ECT-IS model. In addition to that, we would also like to explore the absence of PE to predict intention as the contribution to the theory development. This study will only explore the direct relationship between PU, PEOU, and PE to satisfaction and the relationship between satisfaction and intention (see Fig. 41.1).

Therefore, we derived the following hypotheses:

H1: Perceived usefulness is positively associated with the satisfaction.
H2: Perceived ease of use is positively associated with the satisfaction.
H3: Perceived enjoyment is positively associated with the satisfaction.
H4: Satisfaction is positively associated with the intention to use.

Methodology

To pool the response from expected respondents who are known as bloggers is quite difficult as there are no exact numbers of blogger from reliable source in Malaysia. Therefore, the online survey was targeted to convenience sampling. This survey is targeted to Internet users in Malaysia. The researchers used snowballing technique when the link was shared among bloggers. The online survey was developed by

using application provided by Google.docs.com. The questionnaire is divided into two parts: part A consists of demographic profile such as age, gender, etc., while part B consists of items for each variable. The respondent may respond by picking (1) strongly disagree, (2) disagree, (3) unknown, (4) agree, and (5) strongly agree for each statement.

This online survey was available for only 2 weeks. The total numbers of response from online survey were 152. To ensure we process the valid response, the researcher had include one question to confirmed only respondent who are have experience using blog using is valid to process: "*I am a…*" (*1*) *blogger*, (2) *blog reader*, (*3*) *both blogger and blog reader*, (*4*) *not related to me*. If the respondent state "*not related to me*" the researchers will delete the data. Out of 152, only 132 responses were believed to be valid and used for analysis (20 responses were deleted). The items for each construct were developed from previous study. All items were reliable and tested in few studies.

Measurement of Construct

The questionnaire contained 16 self-reported items related to four research constructs. In order to ensure content validity, items selected for the constructs were largely adapted from prior research. All the questionnaire items used a five-point Likert-type scale, ranging from (1) strongly disagree to (5) strongly agree. The scale items for perceived usefulness, perceived ease of use, perceived enjoyment, satisfaction, and intention to use were taken from Shiou and Chau [9]. The measurement for perceived enjoyment is adapted from Davis et al. [7].

Construct	Items	Source
Perceived usefulness (PU)	The blog enables me to search information faster	[9]
	The blog enhances my effectiveness in information searching	
	The blog makes it easier to search for information	
Perceived ease of use (EOU)	The blog is easy to use	[9]
	It is easy for me to become skillful at using the blog	
	Learning to operate the blog is easy	
Perceived enjoyment (PE)	I had fun using blog	[7]
	I am pleased when I use blog	
	I enjoyed using blog because it is exciting	
	Using blog provided me with a lot of enjoyment	
Satisfaction (SAT)	I am satisfied with my decision on blog usage	[9]
	My choice to use blogs was a wise one	
	I think I did the right thing by deciding to use blogs	
Intention to use (INT)	I intend to continue using the blog rather than discontinue its use	[9]
	I will always try to use the blog in my daily life	
	I will keep using a mobile blog as regularly as I do now	

Statistical Analysis

The partial least square (PLS) technique was used for the data analysis. Interest in the PLS method has been increasing in recent years because of its ability to model latent constructs under conditions of non-normality [11]. PLS is also suitable to use as predictive method for model. Given that the present study is exploratory in nature and that one of its major concerns is the predictive power of the research model, the PLS method was used to estimate the models. The adequacy of each multi-item scale in capturing its construct was assessed using a two-step approach: by checking internal consistency reliability, convergent validity, and discriminant validity and by testing the propositions via the causal models. PLS has several advantages over other analysis tools; for instance, it uses component-based estimation, maximizes the variance explained in the dependent variable, does not require multivariate normality of the data, and is less demanding as regards sample size [12].

Respondent Profile

Table 41.1 shows the demographic profile. There a total of 132 respondents for this study. Out of 132 respondents, 65.2 % are females and 40 % are between 18–24 and 25–31 years old, respectively. There are 64.4 % of them who hold bachelor's or master's degree. To explain the blogging activities among respondents, 34.1 % claimed they are both bloggers and blog readers, while 9.1 % are bloggers and the rest are blog readers.

Table 41.1 Demographic profile

Demographic		Frequency	Percentage
Gender	Male	46	34.8
	Female	86	65.2
Age	18–24	40	30.3
	25–31	40	30.3
	32–38	26	19.7
	39–45	19	14.4
	More than 46	7	5.3
Education	High school	8	6.1
	Diploma	34	25.8
	Bachelor or master degree	85	64.4
	Others (e.g., Ph.D., vocational certificate)	5	3.8
Occupation	Students	37	28.0
	Employed	93	70.5
	Unemployed	2	1.5
I am a.....	Blogger	12	9.1
	Blog reader	75	56.8
	Both (blogger and blog reader)	45	34.1

Reliability Test

The partial least square (PLS) approach using SmartPLS was used to analyze the measurement model. The first criterion that we examined was indicator loading in order to determine its reliability. Hair et al. [13] suggest that good indicator loading should be 0.70 or higher. As shown in Table 41.2, all loadings for each item have more than the cutoff value. However, due to low loading for item 3 of intention construct, INT3 was deleted and removed from the analysis. Table 41.2 shows the Cronbach's alpha for all constructs to assess the internal consistency. The result indicates the reliability of the five constructs with values ranging from 0.86 to 0.90, which exceeded the acceptable level of 0.70 [15]. The construct should have an average variance extracted (AVE) of more than 0.5 and a composite reliability (CR) of more than 0.7 as the cutoff value. All constructs exceed these criteria with AVE and CR generally greater than 0.7 to establish convergent validity.

Next, we measure the discriminant validity; there are two levels of discriminant test, which are at the indicator level and at the construct level. At the indicator level, we examined the indicator loadings and cross loading. As shown in Table 41.3, all items load highly on its assigned constructs. This indicated that there is an evidence of discriminant validity at the indicator level.

Table 41.2 Loadings, reliability, and convergent validity

Construct	Coding	Loadings	Cronbach's alpha	Composite reliability	AVE
Ease of use	EOU_1	0.90	0.86	0.91	0.78
	EOU_2	0.86			
	EOU_3	0.88			
Intention to use	INT_1	0.94	0.89	0.93	0.82
	INT_2	0.84			
	INT_4	0.93			
Perceived enjoyment	PE_1	0.89	0.90	0.93	0.76
	PE_2	0.81			
	PE_3	0.89			
	PE_4	0.90			
Perceived usefulness	PU_1	0.91	0.90	0.93	0.78
	PU_2	0.89			
	PU_3	0.89			
	PU_4	0.83			
Satisfaction	SAT_1	0.92	0.87	0.92	0.79
	SAT_2	0.86			
	SAT_3	0.89			
Cutoff value		0.7	0.7	0.7	0.5
		[13]	[13]	[13]	[14]

Note: INT3 was deleted due to low loading.

Table 41.3 Cross loadings

Items	Perceived ease of use	Intention to use	Perceived enjoyment	Perceived usefulness	Satisfaction
EOU_1	**0.90**	0.59	0.71	0.58	0.65
EOU_2	**0.86**	0.44	0.52	0.44	0.50
EOU_3	**0.88**	0.51	0.56	0.58	0.61
INT_1	0.54	**0.94**	0.79	0.69	0.78
INT_2	0.57	**0.84**	0.71	0.75	0.74
INT_4	0.49	**0.93**	0.79	0.71	0.74
PE_1	0.53	0.79	**0.89**	0.72	0.76
PE_2	0.64	0.66	**0.81**	0.61	0.66
PE_3	0.61	0.73	**0.89**	0.72	0.77
PE_4	0.61	0.77	**0.89**	0.66	0.78
PU_1	0.49	0.75	0.69	**0.91**	0.76
PU_2	0.53	0.65	0.63	**0.89**	0.74
PU_3	0.49	0.69	0.73	**0.89**	0.71
PU_4	0.63	0.71	0.69	**0.83**	0.72
SAT_1	0.60	0.86	0.83	0.76	**0.92**
SAT_2	0.58	0.66	0.66	0.68	**0.86**
SAT_3	0.61	0.69	0.77	0.77	**0.89**

Table 41.4 Discriminant validity

	EOU	INT	PE	PU	SAT
EOU	**0.88**				
INT	0.59	**0.91**			
PE	0.68	0.84	**0.87**		
PU	0.61	0.79	0.78	**0.88**	
SAT	0.67	0.84	0.85	0.83	**0.89**

To assess discriminant validity at the construct level, we compare the square root values of average variance extracted to the correlations among constructs. The square root of AVE for each construct should be larger than any correlations among any pair of latent constructs [16]. Table 41.4 shows each construct has adequate levels of discriminant validity.

Hypotheses Testing

In order to assess the research hypotheses, path coefficient levels should be examined (Fig. 41.2). The *t* statistics were calculated to assess the significance of these path coefficients. The path coefficients are shown in Table 41.4. PE was tested to have high influence on SAT ($\beta=0.460$, $p<0.01$). PU also demonstrate significant and
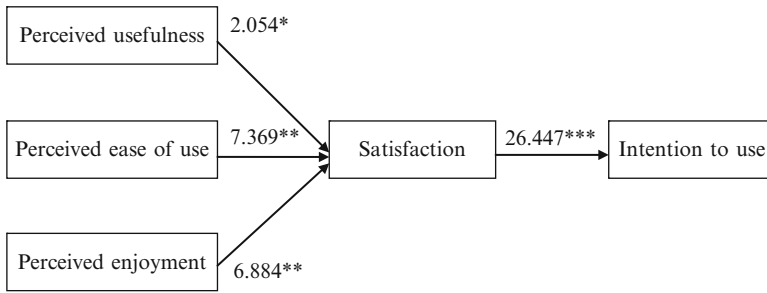
Fig. 41.2 Theoretical framework with result

Table 41.5 Results of hypotheses tests

Hypotheses	Path coefficients (β)	t-value (bootstrap)	Support
H1: EOU → SAT	0.113	2.054*	Yes
H2: PU → SAT	0.402	7.369**	Yes
H3: PE → SAT	0.460	6.884**	Yes
H4: SAT → INT	0.835	26.447***	Yes

Notes: ***p <0.001; **p <0.01; *p <0.05

positive relationship with SAT at $\beta=0.402$ ($p<0.01$). EOU demonstrates significant and positive relationship with SAT ($\beta=0.113$, $p<0.01$). Then, the link between SAT and INT indicates a positive and significant relationship ($\beta=0.835$, $p<0.001$) (Table 41.5).

Discussion and Conclusion

The finding of this study is consistent with finding by Shiau and Chau in examining the positive and significant relationship between perceived usefulness and satisfaction [9]. Furthermore, this study empirically tested there is a positive and significant relationship between perceived ease of use and perceived enjoyment to satisfaction. Interestingly, the result shows perceived enjoyment is the strongest predictor of satisfaction using blog. The finding is a good contribution to the body of knowledge. This study also confirmed the relationship between satisfaction and continuance intention in ECT-IS model.

There are some limitations in this study that need to be addressed. First, the findings in this study may not be valid due to the small sample size for generalized process. This study was focusing on direct relationship between PE, PU, and PEOU to SAT. For further research, it is recommended to explore other relationships as suggested in integrated TAM and ECT-IS model using other constructs. Since this integration model is quite new, it is a huge opportunity to contribute on the development of strong model.

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Chapter 42
A Preliminary Exploration: Chinese Popular Adjectives in Chinese Website

C.M. Bok and N.H.M. Ghazali

Introduction

The development of the Chinese website has produced popular Chinese adjectives. Beginning with the use of a normal conversation, ultimately the Chinese adjectives have been widely used as daily social communication in the society. Chinese adjectives increase importantly until it was made into social dialects in the Chinese website.

Literature Review

The process of organizing and categorizing the words of Chinese popular adjectives is important to identify the meaning of a word due to different grammar and sentence structuring. It has resulted in an empty translation which occurs as mentioned by Goh [1].

Categorization of Chinese popular adjectives in Chinese website is a common method of Chinese adjectives formation. With regard to Yang's view, using the words of adverbs that indicate the level that is cheng du fuci like hen, fei chang and so on, these can easily form new Chinese adjectives [2]. It is also a functional method to convert a noun in to an adjective.

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Materials and Methods

The study follows the qualitative categorization of selected vocabulary from Chinese websites which consist of blogs, Facebook, business websites and culture and literature websites. The data were collected by searching these websites (stated above), and the selection of words was done by looking at the usage frequency of the word by Chinese users. These words were later analysed and categorized based on its characteristics of how these words were coined. The meaning and usage of the words were analysed to further understand the lexicography and its use by Chinese speakers.

Results and Discussion

Popular Chinese Symbolic Adjectives

Chinese symbolic adjectives are very much unique in a way that it can be built by using short form. It can be seen as stated in the table below (Table 42.1).

Based on the table above, the coinage or formation of popular Chinese adjectives that can be seen is basically symbolic. Hence, it can also result to problems to determine the category of specific word.

Popular Chinese Adjectives That Are Formed by the Creation of Chinese Characters

Chinese adjectives can also be coined by the formation of unique Chinese characters. Ever since the modern Chinese words in websites became more popular, unique Chinese characters have been rapidly and widely used throughout the Internet. For example, '囧' (pronounced as jiong), '槑' (pronounced as méi) and others have never been taught in school. These unique characters have given new meanings and definitions that are current as stated below, 嘂(pronounced as jiào): The structure of this character consists of four mouths口(kQu) at both right and left top sides and both left and right at the bottom side and the word 叫(jiào) which is a shout or calling at the middle of the written character, which brings the connotation of four mouths shout at the same time. This character actually tries to explain that the sound which occurred is extremely loud.

圐圙(pronounced as kūlüH): This word is also used by Mongolians as one of the Mongolian dialects, and it is pronounced as 库伦(kūlüàn). The influence of foreign language in this popular Chinese adjective is very clear. Foreign language has

Table 42.1 Example of Chinese symbolic adjectives coinage or formation

Original words	Popular Chinese adjectives
"刀子" (daozi) – knife	"刀子心" (daozixin) – refers to hard and sharp heartedness and ability to protect one's heart
"豆腐" (doufu) – tofu	"豆腐嘴" (doufuzui) – refers to soft spokenness and not easy to reveal secrets
"雷" (lei) – lightning	"觉得很雷" (juede hen lei) – gives meaning of extremely shocked of something
"牛" (niu) - cow	"很牛"(hen niu) – refers to human's behaviour that is very high spirited in doing something

Table 42.2 Examples on the formation of popular Chinese adjectives from the Chinese unique characters

Popular Chinese adjectives used in Chinese language-based websites
'䨊' – pronounced as 'bìng', from the sound of thunder, and brings the meaning of extreme shock
'囧' – pronounced as 'jiǒng', which means very sad, a pain in the heart
'槑' – pronounced as 'méi', which means someone who is very stupid

become more and more rapid in growth since 2008. From 1978 to 2000, foreign language covers in about 9.9 % or 168 out of 1771 new words in Chinese language [3]. The writing structure of this word consists of 四方(sLfAng) which has four directions and 八面(bAmiDn) which has eight dimensions that are curbed with the word 口(kQu) which is the outer mouth. Two mouths have curbed the word 四方(sLfAng) and八面 (bAmiDn). The writing of these words are showing grass field that is caged. It also can be seen as directed in the table below (Table 42.2):

This method in a way has managed to add up the number of popular Chinese adjectives. It is also able to revive the use of classic words that are very much unknown and poorly used in daily life. Besides, it has also proven the creativity of Internet users who use Chinese language as their medium of interaction and able to create new vocabulary by blending words and characters together. This word formation method has included etymology as its method. It is different from the other eight formation methods as stated by Ge [4]. For example, the word '槑' (mFi) is actually a classic word that its usage has long been ignored; however, it has been given a new life and new usage in the latest popular Chinese used in the Internet.

In short, the formation of adjectives based on this method can easily be connected to the aspect of morphology – the study of word formation. This is very important because this research is related to listing down the coinage and formation of new vocabulary in Chinese language, specifically. Hence, this research is able to help in adding up vocabulary in dictionaries as this is very much related to vocabulary documentation.

Table 42.3 Example on the formation of popular Chinese adjectives adopted from English language

Popular Chinese adjectives used in Chinese language-based websites
'in' – means very popular and is suitable with the current trend/modern life
'酷' (kX)– it is coined from English word 'cool' that means very attractive and interesting
'Q' – magical letter and it means delicious, tasty and mellow food
'哈皮'(hapi)– it is coined from English word 'happy' which brings the meaning of being in a state of happiness

Popular Chinese Adjectives Adopted from Arabic and English Language

Popular Chinese adjectives are formed by adopting some Arabic and English language. It can be shown as prepared in the table below (Table 42.3):

The use of language in the Internet is able to give an impact on the interaction to the readers. Hence, adjectives that are taken from other languages are able to grab the attention of the readers while trying to put signature to its own language. The loan words are important because there are certain expressions that cannot be found in Chinese but can be found in other foreign languages.

These adjectives are used and very much popular based on the need of a culture. For instance, the usage of the word 'in' is very much needed in order to portray the modernity of current trend and lifestyle.

Other than that, the pronunciation of these adjectives has been changed from alphabetical English to those that can be used by most Chinese speakers. The restriction of the phonetic value is to make use of the loan vocabulary within the Chinese culture and language. To ensure that a word can be used widely and easily by the speakers of Chinese language, it is vital to reconstruct the pronunciation of the word that caters to Chinese speakers motor skills. For an example, VG is a shortened form of 'very good' which is an English expression. Also, when something is said 'high', it means very happy.

Chinese words have been transformed into short forms in English. For example, FDD is coined from the pronunciation in Chinese which is fFidūdū that means fat.

BMW :长舌妇(chBngshFfX) means talkative woman.
BC :白痴(bBichI) means mentally impaired.
BD :笨蛋(bHndDn) means stupid.
FDD :肥嘟嘟(fFidUdU) means very fat.
HIGH :很兴奋(hGnxLngfHn) means very high spirited.
PL :漂亮(piDoliang) means pretty.
VG :非常好(fEichBng hCo) means very good.

A continuous research is highly important to prove the pragmatism of these popular adjective words. Lexicography used in websites and its pragmatics elements are both interesting topics to look at. In pragmatics study, it is found that popular Chinese adjectives used in Chinese-based websites have changed Arabic numbers

into popular Chinese adjectives that are very much flexible with Hanyu Pinyin system. New words can be determined by the process that is shown below:

2(H): 饿(H) means hungry.

184(yIbAsL): 一辈子(yJbHizi) means lifetime.

286(HrbAliX): 落伍了(luRwWle) means outdated.

1314(yLsAnyJsL):一生一世(yLshEngyJshL) means for a lifetime.

1573(yLwWqIsAn):一往情深 (yLwCngqJngshEn) means a true feeling of love.

1711(yIqIyIyIyI):一心一意(yLxInyJyL) means sincere from the heart.

3399(sAnsAnjiWjiW):长长久久(chBngchBngjiWjiW) means forever.

3731(sAnqIsAnyI):真心真意(zhEnxInzhEnyL) means the sincere heart.

56(wWliX): 无聊(wVliBo) means doing something that does not give benefit to people.

686(liXbAliX): 很棒(hGn bDng) means very good.

7086(qIlJngbAliX):七零八落(qIlJngbAluR) means disorganized conditions.

8错(bAcuR):不错(bVcuR) means quite okay.

8384(bAsAnbAsL):不三不四(bXsAnbXsL) means not normal.

It seemed that these new words that are formed sounded so much similar to numbers in Chinese such as **2**, **56**,**184**, **1314**, and **7086**. These types of words are called音译词(yInyLcJ) or translated word based on pronunciation. However, **286** and **686** have meanings behind the numbers which means very much outdated just like the computer with the speed of 286, while 686 is good because of its symbolic meaning that is the computer's speed is 686 and fast. However, these adjectives might no longer be used because of the rapid growth of technological advancement. The growth of a language changes according to the inner factor of the language itself [5].

Popular Chinese Adjectives Formed by the Creation of Its Opposite Meaning

Popular Chinese adjectives used in the Chinese language-based website are also formed by creating it based on its opposite meaning, as stated in the table shown below.

Based on Table 42.4, a word that is connected to another word can create new meaning and this meaning is opposite than what it originally means. For instance, 可爱(kG'Di), which means cute, now has changed its meaning when the word 可(kG) is combined with character 怜(liBn) and will create a new word which is 可怜(kGliBn) which means how poor. Besides that, the character 爱(Di) combined with these characters 没人(mFirFn) at the front which means nobody will create a new combined word 没人爱(mFirFnDi) which means nobody loves you. When 可怜(kGliBn) is combined with the phrase 没人爱(mFirFnDi), it will create a new formation of word which is 可怜没人爱(kGliBnmFirFnDi). It brings the meaning or connotation on 'how poor and unlucky you have nobody who loves you' which is very much of the opposite to the original meaning which is cute.

Table 42.4 Example of the formation of adjectives based on its opposite meaning

Popular Chinese adjectives	Meaning behind the popular Chinese adjectives
'贤慧' (xianhui)	The original meaning is the character of a good wife; however, now it means someone who laze around in the house and do not know how to do work and house chores; 闲闲在家什么都不会(xianxian zai jia shenme dou buhui)
'可爱' (ke'ai)	The original meaning is cute, but now it means pity because no one loves him/her; 可怜没人爱(kelian mei ren ai)
'不错' (bucuo)	It originally means not at fault, but the current meaning is that it is not his/her fault for being ugly 长得那么丑不是她的错(zhangde name chou bushi ta de cuo)
'美女' (meinu)	It originally means beautiful girl, but the new meaning is a girl student who smells bad 发霉的女生(famei de nusheng)

Conclusion

In conclusion, the usage and the comprehension of popular Chinese adjectives in Chinese language-based websites should be highly supported and researched on. This phenomenon is very much important in the advancement of a language. Each and every user of the language has their own rights and freedom to use the language in further forming and developing their language use. Aspects of the characteristics and trend development as stated by Chen [6] prove that the impacts of the research can bring to the development of dictionary publishing, improvement and growth of language use in the Internet, language teaching and learning, standardization and so on. Thus, the need to list and documentize these words into dictionaries is important in order to support the extension of new coined words used by current Chinese speakers. This is also to ensure that the usage of these words will be known not only to native Chinese speakers but also to others who are learning Chinese. Hence, this will try to overcome the problem of inequality in the usage of popular Chinese adjectives in Chinese language-based websites now as stated by Feng, N and Feng, G.Y. [7].

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Chapter 43
Effects of Student Workload and Academic Procrastination on Attitude to Plagiarize: A Partial Least Squares Application

Ida Rosnita Ismail, Norsyazrah Zulkifli, Suria Fadhillah Md Pauzi, Khairul Anuar Abdul Hadi, and Nurul Afzan Najid

Introduction

Plagiarism is defined as the intentional and unintentional use of other people's works including ideas and words without clear or appropriate acknowledgment or referencing and passing as one's own works [1–4]. It may take the form of shamming, purloining, and verbatim plagiarism [5], and it may be in printed copies or be published online [3]. Research from the students' perspective found that students perceive plagiarism as cheating, stealing, or copying other's works; duplicating data; and copying and pasting without proper citation or credit given to the original source of information but yet claim the works as their own [6].

In a study on students' plagiarism conducted by the Institute of Quality & Knowledge Advancement (InQKA) of Universiti Teknologi MARA in 2010, the student respondents reported that "too many assignments to complete during the semester" and "forced to complete assignments at the eleventh hour" as two of the main reasons for plagiarizing. This study, however, is descriptive in nature. Furthermore, the effects of these two reasons, namely, student workload and

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academic procrastination on attitude to plagiarize, are yet to be tested. Therefore, the main objective of the current study is to examine the predictive effects of student workload and academic procrastination on attitude to plagiarize.

Effects of Student Workloads and Academic Procrastination on Attitude to Plagiarize

Assignments are part of a student's continuous assessment of their understanding of a subject. Although assignments are aimed at assessing student's knowledge and understanding of a particular subject, an accumulated number of assignments from various subjects taken by a student in a particular semester may be perceived as a heavy workload. A perceived heavy workload, in turn, will lead to procrastination because students, especially active procrastinators, may prioritize tasks according to the most important to the least important [7]. An indirect empirical support is provided in Whitley [8] who found that there is a moderate relationship ($d = .698$) between student's perceived workload and cheating. Therefore, the researchers hypothesize the following:

Hypothesis 1:   There is a positive relationship between student workload and attitude to plagiarize.

Apart from student workload, academic procrastination may also form a favorable attitude to plagiarize. In other words, students who procrastinate are more likely to have positive attitude toward plagiarism than those who do not procrastinate. As shown in Roig and deTommaso [9], college undergraduates who scored high on procrastination had high score on plagiarism than those who scored low on procrastination. There are also several indirect empirical evidences that provide support to this relationship. For example, Devlin and Gray [10] found that some of the students spend time a night before the deadline of their assignments. In support of this finding, Yardley et al. [1] reported that students' assumption that they do still have time to complete their assignments may be a reason for the students to procrastinate. This assumption indicates that students tend to procrastinate because they manage their time poorly. As a result of the poor time management, the students prefer to work last minutes and choose to plagiarize [11]. Similarly, Sohrabi et al. [12] found that the procrastinators feel that they can do the task in a few hours because the sources were easily available to plagiarize. Following this line of argument, the researchers posit that students who procrastinate have positive attitude to plagiarize. Therefore, the researchers hypothesized the following:

Hypothesis 2:   There is a positive relationship between academic procrastination and attitude to plagiarize.

This study also examines the mediating effect of academic procrastination on the relationship between student workload and attitude to plagiarize. Students who perceive that they have a burdensome workload may choose to plagiarize as a way

to ease their burden. The effect of the relationship between student workload and attitude to plagiarize may also be indirect; that is, students who perceive that they have a burdensome workload are more likely to procrastinate than students who do not perceive so, which in turn leads them to tolerate more on plagiarism. Therefore, the researchers hypothesize the following:

Hypothesis 3: Academic procrastination mediates the relationship between student workload and attitude to plagiarize.

Method

Data were collected from a convenience sample of 163 business and accountancy undergraduates in UiTM Pahang using a paper-and-pencil questionnaire. All respondents were Malay undergraduates. The majority of the respondents were female (79 %), were studying diploma (68 %) in business management (90 %), and were in semester four (77 %). The average age was 21 years old (*s.d.* = 1.14).

The student workload scale, academic procrastination scale, and attitude to plagiarize scale were adapted from previous studies. Attitude to plagiarize was measured using ten items adapted from Egan [13] and Mavrinac et al. [14]. A sample item is "Plagiarism is as bad as stealing an examination paper and memorizing the answers." Student workload scale was measured using four items adapted from Wilson, Lizzio, and Ramsden's [15] Course Experience Questionnaire. A sample item is "In general, my course workload is too heavy." For both study variables, the respondents were asked to indicate their level of agreement on a seven-point Likert-type scale ranging from 1 = strongly disagree to 7 = strongly agree. To measure respondents' academic procrastination, nine items were adapted from Lay [16]. The respondents were asked to indicate their level of agreement on a seven-point Likert-type scale ranging from 1 = extremely uncharacteristic to 7 = extremely characteristics. A sample item is "I generally delay before starting on assignment I have to do." In addition, the researchers also sought the respondent's demographic information, which includes age, gender, ethnicity, level of education, faculty, and current semester of studying.

Results

Data were analyzed using SPSS version 20.0 and SmartPLS 2.0 M3. The analyses include both preliminary analyses and main analyses. For preliminary analyses, there were no substantive problems except for two cases of outliers – which were then removed from further analysis – and skewed distribution for academic procrastination. Although data on academic procrastination were skewed, no data transformation was undertaken. It is because the partial least squares path modeling

Table 43.1 Mean, standard deviation, and correlations

	Variable	Mean	s.d.	1	2	3
1.	Student workload	4.93	1.00			
2.	Academic procrastination	4.72	0.74	0.50***		
3.	Attitude to plagiarize	4.61	0.86	0.61***	0.57***	

Note: N=163, ***p*<.001

Table 43.2 Cronbach's alpha, composite reliability, average variance extracted (AVE), and squared correlations among constructs

	Variable	Cronbach's alpha	Composite reliability	1	2	3
1.	Student workload	0.74	0.83	(.49)		
2.	Academic procrastination	0.76	0.83	.25	(.35)	
3.	Attitude to plagiarize	0.81	0.86	.37	.32	(.47)

Note: The AVE for each variable is shown in the parenthesis

(PLSPM) technique is robust against skewed distribution; thus, it avoids data transformation. Due to page limitation, only essential results of the data analysis were presented. Full results of analyses, however, may be obtained from the first author upon a written request.

Table 43.1 shows the means, standard deviation, and correlation among the study variables. The results show that all bivariate relationships among the study variables were statistically significant. The highest correlation is between student workload and attitude to plagiarize, and the lowest correlation is between student workload and academic procrastination.

According to the PLSPM technique, the assessment of a predictive model is divided into two stages, that is, outer model assessment and inner model assessment. For the outer model assessment, four criteria were used and the results were presented in Table 43.2. First, all the item loadings were 0.40 and above. Second, the internal consistency reliability values for all study variables were above 0.70. Third, the AVE values for student workload and attitude to plagiarize were satisfactory, that is nearing to the cutoff value of 0.50. Thus, these values indicate the presence of convergent validity. The AVE value for academic procrastination, however, was slightly below the cutoff value. It may be caused by items with relatively lower loadings than items on the other two study variables. Last, the discriminant validity at the item level was established because all items loaded on its assigned constructs. Similarly, there is an indication of discriminant validity at the construct level because the average variance extracted values for all study variables were larger than the squared correlations among constructs.

The inner model was assessed once a reliable and valid outer model was established. Figure 43.1 shows the results of the inner model assessment. The R^2 value for the endogenous variable attitude to plagiarize was 0.46, which means that 46 % of the variance in attitude to plagiarize was explained by student workload and
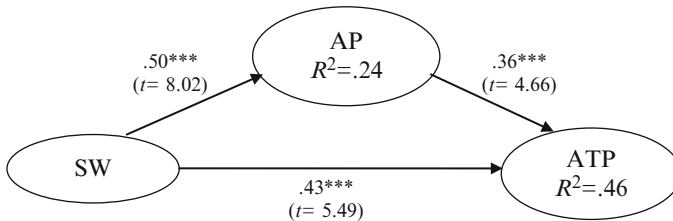
Fig. 43.1 Results of the outer model (*Note: SW* student workload, *ATP* attitude to plagiarize, *AP* academic procrastination, ***$p < .001$)

academic procrastination. The R^2 value for academic procrastination, however, was 0.24, which means that 24 % of the variance in academic procrastination was explained by student workload. The figure also shows that all paths were significant at 0.001 level. Because the path coefficients for the structural relationships between student workload and attitude to plagiarize, between student workload and academic procrastination, and between academic procrastination and attitude to plagiarize were found to be statistically significant, it indicates the presence of partial mediation. The researchers ran the Preacher and Hayes [17] macro to determine the statistical significance of the indirect effect. The result showed that indirect effect of student workload on attitude to plagiarize through academic procrastination was statistically significant ($CI_L = 0.11$, $CI_U = 0.27$).

Discussion

The study found that hypotheses 1, 2, and 3 were supported. Specifically, students who perceive that they have heavy workload are more likely to tolerate plagiarism than students who do not perceive they have heavy workload; thus, these students have positive or favorable attitude to plagiarize. Similarly, students who procrastinate are more likely to tolerate plagiarism than students who do not procrastinate. This finding is consistent with Roig and deTommaso [10]. In addition, on the basis of the findings, the researchers speculate that students who perceive that they have heavy workload may prioritize their works, which in turn leads them to procrastinate. When they procrastinate, they are more likely to have positive or favorable attitude to plagiarize.

Implications

In this study, it was found that student workload has both direct and indirect effects through academic procrastination on attitude to plagiarize. Therefore, actions should be taken to change students' attitude toward plagiarism by addressing the

issue of student workload and academic procrastination. For example, lecturers should plan what kind of assignments are to be given to the students in early semester. Also, the lecturers should explain the assignments in terms of expectation of the contents of the assignment and specification of time or date of submission. In addition, the lecturers should avoid giving assignments that do not suit to their level of education. The huge number of assignments may lead to students' procrastination. Hence, the lecturers may ask the students to submit their assignment drafts from time to time so that continuous evaluation may be done and procrastination may be avoided. It is also helpful if the lecturers explain to the students the negative effect of procrastination and plagiarism. By increasing their level of awareness, students may be able to change their attitude toward plagiarism.

Conclusion

The current study reveals that attitude to plagiarize may be predicted by student workload and academic procrastination. Future studies, however, are encouraged to replicate and extend this study to include other predictor variables such as goal orientation, cultural orientation, and peer influence by using probability sampling on different samples. It is also interesting to examine the effects of passive procrastination and active procrastination on positive attitude to plagiarize and negative attitude to plagiarize. Future studies may also examine how moderating variables such as personality traits affect the relationship between student workload and attitude to plagiarize.

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Chapter 44
A Study on the Relationship Between Awareness and Knowledge of Muslim Retailers Toward Halal Cosmetic Products

Faizan Abd Jabar, Maisarah Ishak, Norchahaya Johar, and Sharifah Norhuda Syed Wahid

Introduction

Cosmetics are a symbol of a woman's beauty. It is normally associated with women because of their nature to constantly look and feel beautiful. Women use cosmetics not only to enhance their features but also to project an image of poise and confidence. According to [1], cosmetic is a chain of product consisting of makeup, toner, shampoos and conditioners, bath and shower gels, talc and baby powder, perfumes and colognes, and personal care and oral care products. The Muslim community around the world is also huge contributors to the consumption of cosmetics. However, as Muslims, they have to be extra careful in their choice of products, as they have to ensure that the products they use comply with *syariah* law. Nevertheless, there are Muslim consumers who are not concern with this issue. It could be due to their lack of knowledge or lackadaisical attitude in the subject of *halal* and *haram*. It could also be due to the consumers' complete trust in Muslim retailers where they assume all products sold by Muslim retailers are safe and *halal* for consumption. Knowing this, Muslim retailers should not take advantage of this situation solely to gain profit. They should play their role to inform and educate their Muslim

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customers on the *halal* concept. Although the subject of *halal* products has become a major concern and constant discussion among Muslim consumers all over the world, the concept of *halal* cosmetics is still new to the Muslim world. *Halal* brings the meaning of wholesome. To Muslim consumers, a *halal* product is more important and meaningful than a product carrying ISO (International Organization for Standardization) or similar certification. The function of the *halal* label/logo is to facilitate the Muslim consumers' decision in product selection. Moreover, as Muslim consumers, they must be aware of the choices of product available in the market [2]. According to [3], the product that Muslim consumers consume should be *halal*; that is, it must be alcohol-free, animal cruelty-free, and pork meat-, residue-, and fat-free. *Halal* also includes cleanliness in the way the product is prepared and processed.

Awareness and Knowledge Toward *Halal* Cosmetic Brands

In Europe, the revenue for natural cosmetic sales is forecasted to approach USD2.4 billion among giant cosmetic manufacturers such as L'Oreal, Eugene Schueller, Elizabeth Arden, Helena Rubinstein, Revlon Estee Lauder, and others [4]. This shows that there is tremendous demand for cosmetics. However, non-Muslims generally own the cosmetic brands stated above and such the process of manufacturing the product may not comply with s*yariah* law. Muslim consumers are also contributors to the consumption of these product brands even though the products' *halal* status is questionable. The lack of knowledge about the concept of *halal*, attitude, or familiarity with the products may be some of the factors that contribute to Muslim consumers' use of the products. Ongoing *halal* inspection organized by the Department of Islamic Development Malaysia or JAKIM since 1982 often revealed that when making a purchase, Muslim consumers in Malaysia have lack of either knowledge or sources to refer to on any related *halal* matters. The consumers normally rely on the *halal* logo prescribed by JAKIM as a source in determining the *halal* status of the products. JAKIM's active participation in ensuring the status of *halal* products has turned Malaysia into one of the hubs for *halal* products including cosmetics.

The increasing awareness among both Muslim and non-Muslim consumers regarding *halal* cosmetic products has attracted the attention of Muslim cosmetic retailers. Although different consumers have different beliefs about the product, their buying intention is the same, that is, they look for products that are trusted and safe. It was mention by [5] that attitudes and subjective norm play an important role to perform intention agreed to this. He indicated in his research that a positive attitude and a subjective norm (knowledge and perspective regarding *halal* products) is the determinant factor on the decision to choose *halal* cosmetics. The attributes of subjective norms emerged as the most significant indicator of Muslim customers'

intention to choose *halal* cosmetic product. Recent study by [6] found that although *halal* cosmetics are fairly established in Malaysia, it still fails to capture the Muslim consumer market interest and to garner high market share in the industry. He also stated that among Malaysian *halal*-certified products, Unza's Safi brand ranked 34 out of 42 brands all over the world, whereas the other *halal*-certified cosmetics were classified under other categories. The consumer tends to buy noncertified *halal* products because of the aggressive promotion initiatives by the marketers of these brands.

As Muslim consumers are concerned with ensuring that the products they consume are *halal*, both retailers and manufacturers of cosmetic products should play an important role in providing consumers with products that conform to their religious beliefs. Therefore, it is imperative for the retailers and manufacturers to be aware and to be equipped with the knowledge on *halal and haram.* As [7] stated, the lack of knowledge on *halal* concepts among customers' purchase intention leads to ignorance of *halal* awareness and *halal* certification by marketers. As mentioned by [8], "manufacturers is[sic] not manufacture objects but manufacture righteousness, sellers is[sic] not sell objects and things, they invite into righteous life and buyers do not buy necessities and material comfort, they engaged in workship."

Research Methodology

A survey on Muslim retailers from Jengka, Jerantut, Temerloh, and Maran toward *halal* cosmetic products was conducted to examine retailers' awareness and knowledge on *halal* cosmetic products. Respondents were selected randomly to provide basic information on their *halal* cosmetic products' considerations. The case study approach used questionnaire as a primary approach for data collection, and it is distributed to 74 respondents from four selected towns. The data obtained were analyzed using statistical procedures executed by the IBM SPSS Statistics 21 including descriptive statistics, normality test, *t*-test, and regression analysis. Descriptive statistics were used to describe the data regarding respondent demographic profile, *t*-test to compare the awareness and knowledge on *halal* cosmetic products between selected towns, and regression analysis to determine the relationship between awareness and knowledge of Muslim retailers toward *halal* cosmetic product.

A total of 74 respondents constituted the sample which consists of 10 respondents from Bandar Tun Abdul Razak Jengka, 11 from Maran, 35 from Jerantut, and another 18 from Temerloh. By gender, 21.60 % of respondents were male retailers and 78.40 % were female retailers. It shows that there were more female retailers in *halal* cosmetic products compared to male retailers. This reflects the general notion that the business of cosmetic product is dominated by the females. In addition, by looking at their experience as entrepreneur, the majority of respondents have been working as entrepreneur for more than 5 years (63.51 %) with 59.57 % of them with experience more than 10 years in cosmetic product.

Table 44.1 Retailers' awareness and knowledge on *halal* cosmetic product

Items	Mean	Standard deviation
Awareness on *halal* cosmetic product	3.3243	0.4274
Bandar Tun Abdul Razak Jengka	3.2800	0.7193
Maran	3.0909	0.2072
Jerantut	3.3714	0.3699
Temerloh	3.4000	0.4058
Knowledge on *halal* cosmetic product	3.3581	0.3772
Bandar Tun Abdul Razak Jengka	3.4750	0.4480
Maran	3.1364	0.2051
Jerantut	3.3429	0.3693
Temerloh	3.4583	0.3953

Five criteria were constructed in this questionnaire to verify the retailers' level in awareness and four criteria to verify their knowledge toward *halal* cosmetic product. Table 44.1 shows details on retailers' response with the result that revealed more than a mean value of 3.00, which indicated that retailers agreed they have achieved awareness and knowledge, a level toward *halal* cosmetic product.

In general, Table 44.1 shows that the retailers in all selected towns agreed that they are aware and have enough knowledge on the concept of *halal* cosmetic product. Research conducted by [7] supported this result and mentioned that knowledge influences the purchase intention and if there were little knowledge, it would lead to ignorance. By comparing each town, the highest retailers' awareness is from Temerloh followed by Jerantut, Bandar Tun Abdul Razak Jengka, and Maran. For retailers' knowledge, the first rank is Bandar Tun Abdul Razak Jengka, followed by Temerloh, Jerantut, and finally Maran.

From normality test, the data collected was normally distributed. In addition to the result of the mean value, *t*-test analysis was conducted to determine the comparison between each town regarding their awareness and knowledge toward *halal* cosmetic product. Table 44.2 indicates that there is a significant difference between Maran and Jerantut retailers and also between Maran and Temerloh retailers toward awareness on *halal* cosmetic product. The result of *t*-test also indicated that there is a significant difference between Maran retailers and the other three selected towns toward knowledge on *halal* cosmetic product.

A regression analysis indicated that the model was significant ($F = 35.383$, *p*-value = 0.000) and shows that there is *a* linear relationship between awareness and knowledge. The total variance was 33.00 % which indicated that the retailers' awareness is explained by their knowledge, while the other 67.00 % is explained by other factors. In addition, the correlation value shows that there exists a moderate positive relationship between awareness and knowledge toward *halal* cosmetic product with 0.574. This finding was consistent with the study conducted by [5] who agreed that the decision to choose *halal* cosmetic product is determined by knowledge regarding *halal* products.

Table 44.2 Comparison between retailers toward awareness and knowledge on *halal* cosmetic product

Items	*t*-value	*p*-value
Awareness on *halal* cosmetic product		
Bandar Tun Abdul Razak Jengka ~ Maran	0.802	0.441
Bandar Tun Abdul Razak Jengka ~ Jerantut	−0.388	0.706
Bandar Tun Abdul Razak Jengka ~ Temerloh	−0.568	0.575
Maran ~ Jerantut	−3.174	0.003*
Maran ~ Temerloh	−2.706	0.012*
Jerantut ~ Temerloh	−0.258	0.798
Knowledge on *halal* cosmetic product		
Bandar Tun Abdul Razak Jengka ~ Maran	2.191	0.048*
Bandar Tun Abdul Razak Jengka ~ Jerantut	0.952	0.346
Bandar Tun Abdul Razak Jengka ~ Temerloh	0.102	0.920
Maran ~ Jerantut	−2.350	0.025*
Maran ~ Temerloh	−2.879	0.008*
Jerantut ~ Temerloh	−1.053	0.297

*Significant level at *p*-value < 0.05

Conclusion and Recommendation

It can be concluded that there is significant level of awareness and knowledge on the subject of *halal* cosmetics among Muslim retailers; however, the level of awareness and knowledge differs between the different townships. The study also indicated that the level of awareness among retailers is higher in a bigger township when compared to a smaller township. Although the level of awareness and knowledge on *halal* issues is high, it is still insufficient to ensure that Muslim consumers are provided with a broad range of *halal* products. Agencies such as JAKIM should perform periodical inspections not only to the retailers of cosmetic products but also to the manufacturers and suppliers to ensure that they comply with the *halal* requirements. Information on the brands and companies of the cosmetic products that do not comply with the *halal* requirements should be exposed to the public so that the consumers can make the right choice when selecting cosmetic products for consumption.

In addition, the authorized agencies should aggressively embark on initiatives to provide information regarding the concept of *halal* to the public specifically to the Muslim consumers. All methods of communication should not be overlooked. They should not only rely on official websites or personal blogs to disseminate information to consumers and retailers but should also collaborate with the local media such as newspapers, magazines, and radio stations. Relying on official websites and personal blogs to provide information to the public may not be sufficient to reach a wide range of consumers. This medium of communication may be suitable for consumers from the urban and suburban areas where Internet access is easily available, but it may not be the case for consumers from the rural areas where Internet access is limited.

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Chapter 45
Islamic Jurisprudence on Reproductive Technology: A Methodological Appraisal

Sayed Sikandar Shah Haneef

Introduction

Ever since the birth of Louise Brown in the UK, 1978, via in vitro fertilization, and the success story of intracytoplasmic sperm injection (ICSI) in Belgium in 1992 (Inhorn, n.d.), biomedical technologies have made great strides in assisting not only the infertile couples but even gays and lesbians to have children. Societal responses to this technological advancement by and large have been one of radical support and cautious acceptance. For instance, Western feminists celebrated it as "freeing the Western civilization from the prejudice of morality" (p. 119); Christian Theologies received it with mixed reaction due to a host of moral hazards that it entails for integrity of family and lineage clarity. In the Muslim world, Shi'ah gave it a blanket approval, but the Sunni jurists received it with some caveat. The divergent legal scenario, at microlevel, proves attractive for common Muslims due to a number of anthropological variables such as fulfillment of a barren male fervent desire for children as a proof of his virility, bringing pride to an infertile wife for proving as reproductive, making polygamy redundant in the case of profoundly in love monogamous couples, etc. (p. 120). At the macro level, however, the dilemma is one of striking a balance between pragmatic consideration of overcoming the problem of infertility and the core principles of sexual purity and lineage clarity within the paradigmatic framework of Muslim family law. Accordingly, this paper proposes to critically review Muslim juridical responses with the purpose of proposing some methodological points for further deliberations.

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Muslim Responses to Reproductive Technology

Infertility refers to fertility impairment where the couple in spite of being able of coitus cannot have children. It may be caused by some pathological conditions or birth defects. Some of the known causes of infertility attributed to men are low sperm counts, poor sperm movements, damaged testes, abnormality of the veins surrounding the testes, damaged testicles, a birth defect, blocked ducts, male ejaculation in the reverse direction on account of severe diabetes, neurological disease, or prostatic surgery (Ebrahim 1988). In the case of women on the other hand, the causes are absence or blockage of fallopian tube, closure of tubes due to sexually transmitted diseases or pelvic surgery, failure to ovulate, allergic to the protein contained in the sperm, or born without uterus (p. 94).

To overcome male infertility, the applicable reproductive technology is internal artificial insemination (Ebrahim 1988). The process involves the injection of the sperm into the woman's uterus [1]. The sperm either may be procured from the husband or may come from a third party (a donor). On the legitimacy of using this technology, juristic opinion is divided. The Sunni allows only the first method provided it involves the gametes of the married couple; it is not done posthumously or after the couples' separation. The Shi'ah, however, approved both the posthumous use of this technology as well its being sourced by semen donors [2, 3]. The reasons for cautious approach adopted by the Sunni are threefold: (1) biological clarity of the relationship of children to their de jure parents is immutable, "It is He Who has created man from water, and has appointed for him kindred by blood, and kindred by marriage. And your Lord is Ever All Power to do what He wills" (Qur'an, 25:54), "The child is for the marriage bed and for the adulterer is stoning" (Al-Bukhari [4], Vol. 12, p. 2); (2) decency of sexual behavior cannot be compromised, "Who abstain from sex, except with those joined to them in marriage bond, or (the captive) whom their right hands possess – for (in their case) they are free from blame? But those whose desires exceed those limits are transgressors" (Qur'an, 23: 5–7), "If any woman establishes sexual relationship with people other than her lawful husband, God would prohibit her admission into paradise," "It is not permissible for a man who believes in God and the Hereafter to irrigate with his own sperm the crop sown by another" (Al-Bukhari [4] Vol. 12, p. 3); (3) medicinal treatment (Mishkat al-Masabih, (1994) Vol. 2, p. 942) through illicit means is only allowed as lifesaving last resort when the donor's egg or posthumous egg transfer does not qualify. The Shi'ah's compromised view on sexual purity which allows *mut'ah* sees no problem with the third-party involvement in the process. For instance, Ali Khamenei, sanctioned asexual impregnation of a woman with the donor's sperm as it does not involve intercourse although the child's paternity cannot be attributed to the husband. This compromise of the Islamic sexual purity can be challenged on other legal prohibitions such as the law of intimacy between non-related members in the family in the case of a female child as she would be stranger to the husband. Being aware of this anomaly, they prefer the donor to be a near relative. Likewise, Khamenei held that frozen gametes of a husband can be used to impregnate his wife posthumously even if she has remarried ([2]: 122).

Female infertility in the case of women who have the uterus, on the other hand, among others, can be treated via external artificial insemination (*al-talqih al-istina'i al-kahriji*), known as in vitro fertilization or test tube baby. *It involves six-step processes, namely, ovulation induction, egg retrieval, insemination, fertilization, embryo transfer, and pregnancy testing*. The working of the process involves first, injecting the woman with some medications to stimulate egg development; second, retrieval of the woman's eggs from her ovaries; third, mixing of the healthy eggs with the sperm; fourth, monitoring (culturing) the mixture of eggs and sperm for 2–3 days so as to ensure its fertilization; lastly, transferring the embryo into the woman's uterus (implantation) or doing it so after 5 days of culturing in which stage the embryo is called blastocyst and healthy embryos are easier to choose. The additional embryos may be frozen at the request of the patient for ulterior IVF treatment if the extant ones do not succeed (Ebrahim 1988).

Being oblivious of its proven clinical risks and moral hazards,[1] the Sunni allows it provided it does not involve third party (gamete donors); it is not used for fetal gender selection and embryo trading on the same ground of sexual purity and genealogical exactitude ([3, 6]; Bernard, n.d; [7, 8]); and it adheres to the principle of leaving the determination of the sex of the baby to God, "To God belongs the dominion of heavens and earth. He creates what He wills. He bestows females upon whom He wills and bestows the males upon whom He wills. Or He couples them in males and females and He leaves barren that He wills. For He is All-Knowledgeable All-Powerful" (Qur'an, 42: 49–50). The Shi'ah, on the contrary, sees no problem with the donor's gamete due to their permissive approach to sexual purity in the Shi'ah paradigm. For instance, Khamenei held that in case the wife cannot have ova, the donor's egg can be used in spite of biogenetic connectedness of the child to the receiver, but if the husband performs *mut'ah* with the donor, the hurdle will be overcome ([2]: p. 123).

Surrogate motherhood is yet another reproductive technique for treating female infertility – due to the absence of uterus. The process involves leasing another woman's uterus (surrogate mother) to bear, beget, and give the baby to the biological parents in lieu of receiving some agreed sum of money as remuneration [1–3, 7].

This procedure of female infertility treatment is declared ultra vires of the Shari'ah by the Sunni because it (1) involves third party in the process of human procreation; (2) commodifies human reproductive organ; (3) splits motherhood – bifurcation of

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[1] The clinical risks involved in the process are the following: first, medical conditions, such as superovulation, ovarian hyperstimulation syndrome (HSS), and retrieval of the oocytes; second, not all cases of embryo implantation may lead to pregnancy sometimes due to inexplicable reasons; third, for the success of pregnancy, more than one embryo are implanted into the uterus which results in multiple births (10–25 % give birth to twin); lastly, risk of babies born with malformations is 9 % compared to 6 % for naturally conceived pregnancies (Bernard (n.d), p. 338, [5]). The ethical evil ensuing from it may be gender planning by choosing the embryo of the desired gender ([3], p. 111; [6]: p. 197), trafficking in of the surplus embryos or their destruction which in accordance with pro-life view adopted by scholars like Imam Al-Ghazali is an offense in the Islamic view, or in the case of multiple pregnancies, the couple may resort to abortion of some with its attendant complications which is *haram* as well ([1], pp. 152–153).

a mother into gestational and biological ones; and (4) trading in sexuality/indecency ([1–3, 7]; Al-Qaradawi 1995; Shaltut (n.d); [9, 10]). The reasons are firstly, to Shaltut, this type of insemination is akin to *zina* (adulterous union) because its essence and consequences are the same as adultery, in view of the fact that it is placing the sperm of a man in the womb of a woman between whom there is no bond of marriage; thus, the ruling on this type of conduct is one of adultery as prohibited by the *Shari'ah* ([11], p. 328). Secondly, the human uterus cannot be bartered as it is not amenable to sale nor human baby can be the subject of sale as a matter of principle in Islamic law of contract ([12], Vol. 5, pp. 744–750). Thirdly, to Al-Qaradawi (1985), in Islam there is no any place for separation between the genetic mother and the gestational one. In fact *walidah* (the one giving birth to the child) is the term for mother which cannot be split, "And we have enjoined on man (to be good) to his parents (his *walidayn*), in travail upon travail did his mother bear him and in years twain was his weaning… (Hear the command): Show gratitude to me and to your parents (your *walidayn*). To Me is your final goal" (Qur'an, 31:14); "None can be their mothers except those who gave them birth" (Qur'an, 58: 2); "The mothers (*walidat*) shall give suck to their offspring" (Qur'an 2: 223). To top it all, it involves the ugliest form of exploitation of women where the surrogate mother is not compensated for psychological and emotional agony, which she suffers during the whole process. Likewise, it tempts affluent women to resort to such techniques in order to relieve themselves of the pangs of pregnancy and child birth. This is against the notion of marriage in Islam, i.e., if childbearing is regarded as a burden instead of a test and blessing from Allah ([13], Vol.28 (2), pp. 109–120). Conversely, the Shi'ah concedes it as their concepts of sexuality do not restrict third-party involvement in the process of human reproduction [2]. Marginal voices even among the Sunni do not view it objectionable if the surrogate is one of the co-wives merely because it does not involve the resemblance of illicit sexual intercourse [10].

The creation of human embryo outside the womb has moved one step farther via cloning technology. Within a plethora of cloning, reproductive cloning also has emerged as another technique for infertility treatment. By definition cloning means: "the production of two or more beings that are complete genetic copies of one another." There are two types of cloning: (1) *cloning by induced identical twinning. As the fertilized egg splits into two cells*, *each of them is then induced to make a fresh start and behave as if it were the original fertilized egg. Each half would then grow into a separate fetus*, *and having come from the same fertilized egg*, *they both would be carrying exactly identical genetic components*; *(2) ordinary cloning*, *which is achieved by injecting a nucleus from a somatic cell of an adult animal into an egg whose nucleus had been removed. The cell would then grow into a fetus that would be a true genetic copy of the adult living animal from which the somatic cell nucleus was taken* (9th Fiqh-Medical Seminar 1988; Musa n.d).

The positions of Islam on the above procedures in sum are the following: the first type which is similar to the natural splitting of the fertilized egg at the womb and resulting in the birth of identical twins is permissible provided it is used as one of the ways to treat infertility. However, this will be valid if all juridical stipulations which apply to test tube baby are satisfied. Other than that, it is ultra vires of the law

of procreation, tampering with God's intention of diversity of human race and the consequent breakdown of familial system as prescribed by the *Shari'ah* (Al-Qaradaghi 2006; Humaysh 2007). The second type, on the contrary, is invalid ab initio as it cannot be reconciled with many principles of human reproductions as recognized in Islamic law, including *infringement on the individuality and identity of the person*, *undermining the stability of the social order*, *and the destruction of the bases of blood relationships and established age-old family ties*, *as the foundation of the family and of social order* (9th Fiqh-Medical Seminar 1988; Kasule n.d; Al-Aqeel n.d; Musa n.d). For instance, Kasule is of the view that to clone humans by this procedure is still part of speculative fiqh, and even if it is successful, a cloned human as such will only be a biological living being with no *ruh* (soul) as humans cannot give to it except God (paragraph 2, Internet version). Joining him, Al-Aqeel also maintains that "Cloning for reproductive reason is only permissible if it were the only way for couples with fertility difficulties or a genetic disorder to have a healthy genetically related child" (paragraph 5, Internet version). To Dr. Musa even in the scientific community with the exception of a small minority of "rogue cloners," there is a universal agreement against reproductive cloning of human beings. Policy wise as well, USA and Costa Rica in the Policy on UN Cloning Treaty 2003 advocated a full ban on both reproductive and therapeutic cloning while the rest opposed the first type but supported the second one (paragraph 6, Internet version).

Methodological Appraisal

The forgoing discussion reveals that jurists overzealously sanctioned biotechnological inventions as a remedy for infertility within the parameters of Islamic law mainly on two grounds: (1) it helps married couples to fulfill the set social vision of marriage, thus is justified on ground of *maslahah* (public good); (2) infertility is a kind of disease, hence justified by reason of medical necessity as established by virtue of the prophetic tradition in Islam. However, they omitted to address the following larger ethical issues and theological concerns consistent with deontological (principle-based biomedical ethics) notion of Islam, the most obvious among which are the following:

1. Marriage is recommended primarily for preserving human sexual propriety; procreation is its natural outcome if willed by God, hence, and for lack of it, a human could not be faulted or be regarded as less a Muslim. Accordingly, it is not mandatory to undertake fertility treatment even at the cost of violating sexual purity, i.e., to go through invasive superovulation for the purpose of in vitro fertilization or masturbate for artificial insemination to have children.
2. It cannot be justified on ground of medical necessity as fertility impairment, which may be caused by pathological conditions, in itself is not a disease. The acute affliction and anguish that result from childlessness do not classify it as an ailment (Bernard 2009: p. 334).

3. Artificial insemination, even if we go by restrictive religiosity view, also raises the ethical dilemma of attaining sexual stimulation to ejaculate if done outside the marriage bed. Unless it borders necessity where the prohibition will be waived is akin to the prohibition of masturbation in Islam ([3]: p. 110).
4. The fate of surplus embryos in IVF in terms of being trafficked and destroyed raises the questions of trading with human person according to the pro-life view of the embryo and its destruction, or the consequent abortion of some of IVF-induced pregnancies by reason of fetal selection or mere convenience is a larger ethical concern with which juridical pronouncements need to methodologically address – even if we go by cautious position adopted by the Sunni *fiqh*. The reason that they are created outside the womb does not render them less protectable.
5. Surrogate motherhood not only splits motherhood (genetic and gestational), compromises Islamic notion of sexual purity, commodifies sex, and encourages child trafficking in addition to contravening the basic right of children to untainted genealogy. Pragmatically also it fails to bond the child with the genetic mother as testified by the genetic mothers in the West ([2]: p. 134).
6. Reproductive cloning can be objected on the same grounds as that of IVF and due to all other moral hazards of fetal sex selection for which it provides another opportunity ([14], Vol. 3 (1), pp. 19–22; Musa (n.d), paragraph 7, Internet version).

Conclusion

In light of the above, it can be concluded that to address the ethical challenges that reproductive technologies pose, one needs to address them in light of two cardinal principles that govern sexuality and human reproduction from Islamic perspective, namely, propriety of sexual acts and the Islamic concept of genealogical rectitude. They represent the nonnegotiable law of marriage and kinship as established by unimpeachable evidences of the Qur'an and the Sunnah and found expression in the *fiqhi* maxim, *al-aslu fi al-furuj hurmatun – the basic law in relation to human genital is prohibition*. If conceptualized and evaluated accordingly, the permissive views which compromise them by conflating ovum gametes with polygamy and surrogate's womb with seeding ground for human sexual fluid will not bewilder committed Muslims. This implies that recourse to permissible means of overcoming fertility should be confined to genuine cases of infertility, thus stamping out the avenues of abuse of gametes and surplus embryos, and committing abortion in the name of gender family planning even if no surrogates or donors are involved. This is necessary not only as a matter of principle but for the psychological well-being of the test tube babies who may become suspicious of their lineage purity due to mushrooming of commercialized donors' gametes and embryos in the pervasive reproductive technological landscape. Such religious sensitivities need to be taken into account when formulating fertility licensing act of any sort which Farouk, the former president of the Obstetrical and Gynecological Society of Malaysia, proposes (Sunday Star, 23 September 2012, Column 3).

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Part II
Sciences and Technology

Chapter 46
Predictions of Relative Risks for Dengue Disease Mapping in Malaysia Based on Stochastic SIR-SI Vector-Borne Infectious Disease Transmission Model

Nor Azah Samat and David F. Percy

Introduction

This paper is an extension of our work on the study of vector-borne infectious disease mapping as published in [1]. In this paper, we describe and evaluate methods for predicting relative risk for future time periods based on the discrete time-space stochastic SIR-SI vector-borne infectious disease transmission models. Predictions are important in the study of disease mapping as they represent forecasts that could contribute to the development of control and prevention strategies for infectious diseases. For instance, in the study of dengue disease, people at risk might be more responsive to government advice when there is scientific evidence to support claims that they have high probabilities of contracting dengue in the near future. In the subsequent sections of this paper, we discuss the posterior predictive distributions and the predictive relative risk estimation equations that are used to generate forecasts of relative risk. This is followed by the results of the application of this procedure to dengue data of Malaysia which are presented in graph, table and map.

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Posterior Predictive Distribution

In Bayesian analysis, the posterior distribution summarises our understanding about the unknown model parameters given the available observed data. Summaries of this posterior distribution are called Bayes estimates and include quantities such as the posterior mean, median or mode. Complementing the estimation of parameters, another useful inferential tool involves the prediction of unobserved random variables, whether they are (i) already realised but unknown or (ii) not yet realised. The former might be regarded as fitting a model or interpolating the observed data, whereas the latter represents forecasting from a model or extrapolating the observed data.

Bayesian analysis generates posterior predictive distributions to represent available knowledge about random variables, and summaries of this distribution can be taken as point predictions or point estimates as required. In our context, the quantity of interest is the relative risk. This is a parameter that is also a function of a random variable (population size), and we now investigate how to forecast future values of relative risk using posterior predictive distributions.

Define a new observation or the predictive observation of $\Im$ as $\dot{\Im}$. Thus, the predictive of $\dot{\Im}$ is defined as

$$P\left(\dot{\Im}|\Im\right) = \int_{-\infty}^{\infty} p\left(\dot{\Im}|\Im, \Psi\right) p\left(\Psi|\Im\right) d\Psi \qquad (46.1)$$

where

$\Im$ denotes the observed new infective cases,
$\dot{\Im}$ denotes the predictive new infective cases, and
Ψ denotes the parameter of the posterior distribution.

In situations where $\dot{\Im}$ is conditionally independent of $\Im$ given Ψ, the distribution reduces to

$$P\left(\dot{\Im}|\Im\right) = \int_{-\infty}^{\infty} p\left(\dot{\Im}|\Psi\right) p\left(\Psi|\Im\right) d\Psi. \qquad (46.2)$$

Simulation of the posterior predictive distribution can be achieved by generating pseudorandom values from the posterior distribution of the parameter and substituting into the sampling distribution for the random variable. There are two steps involved in this simulation process, which are as follows:

1. Simulate Ψ_i from $\Psi|\Im$; $i = 1, 2, \ldots, n$.
2. Simulate $\dot{\Im}_i$ from $\dot{\Im}|\Psi_i$; $i = 1, 2, \ldots, n$.

The pairs $\left(\Psi_i, \dot{\Im}_i\right)$ represent pseudorandom draws from the joint posterior distribution for $\Psi, \dot{\Im}|\Im$. Therefore, the $\dot{\Im}_i$ represent marginal pseudorandom values from the required posterior predictive distribution for $\dot{\Im}|\Im$. In other words, this

approach uses the distribution of the data given the observed sample, integrated over the possible values of the parameters [2]. Thus, from Eq. (46.2), a sample of $\dot{\mathfrak{I}}$ values could be obtained, and these could be compared to the observed data $\mathfrak{I}$. Gelman et al. in [3] advocated this approach for the purpose of model goodness-of-fit assessment.

There are three common techniques used for checking the forecasting accuracy of models: first, by comparing subsequently observed data with the corresponding posterior predictive expected values generated by the model based on previously available data; second, by fitting the model using only a subset of the observed data and comparing the remaining observed data to the posterior predictive expected values generated by the model after fitting to this training sample; and third, by using qualitative analysis based upon the perceived robustness of model assumptions as verified by independent goodness-of-fit tests. Point predictions and point estimates may be accompanied by standard errors and highest posterior density intervals for further clarification.

In our research, the first technique cannot be employed due to the unavailability of data subsequent to the initial periods of observation. For the second technique, new cases of dengue have significant seasonal variation during the course of a year, but we only have data for a single year. Consequently, this seasonal variation cannot fully be estimated from a subsample of the data, and this technique is equally unsuitable. As a result, we are only able to offer qualitative analysis of each model's forecasting accuracy in this paper. We base our assumed robustness of these models upon the results of corresponding goodness-of-fit tests that are presented in [1].

Predictive Relative Risk Estimation Equations

The predictive relative risk estimation equations proposed in this section are based on the equations for relative risk estimation that are discussed in [1]. Therefore, the posterior predictive expected relative risk can subsequently be approximated using

$$\dot{\tilde{\theta}}_{ij}^{(h)} = \frac{\dot{\tilde{\lambda}}_{ij}^{(h)}}{\dot{\tilde{e}}_{ij}^{(h)}}$$

where

$\dot{\tilde{\lambda}}_{ij}^{(h)}$ denotes the posterior predictive expected mean number of new infective cases and $\dot{\tilde{e}}_{ij}^{(h)}$ denotes the posterior predictive expected number of new infective cases.

Prediction of Relative Risks for Dengue Disease in Malaysia

In this section, we investigate how current new incidence data can be propagated to extrapolate beyond the period of observation in order to forecast future relative risks. This involves the prediction and estimation of relative risk for discrete time incidence data in discrete space, corresponding to 16 states within Malaysia. Data used in this study were provided by the Ministry of Health, the Institute for Medical Research and the Department of Statistics, all in Malaysia. Method presented here is applied to dengue data in the form of counts of cases within the states of Malaysia for epidemiology weeks 1–53 during a 1-year period spanning 2008–2009. The forecasting of relative risk explained here is based on our discrete time, discrete space, and stochastic SIR-SI vector-borne infectious disease transmission model with the default assumption that the population of infective mosquitoes is constant over time as discussed in [1].

Figure 46.1 shows a time series plot of the posterior predictive expected relative risks for epidemiology weeks 1–53 spanning 2009–2010 across 16 states in Malaysia. To clarify matters, this is the 1-year period following on immediately after the 1-year period of observed data to which the model was fitted. From this plot, it can be seen that the posterior predictive expected relative risks have a similar pattern as the posterior expected relative risks shown in [1], which correspond to fitted values during the period of observation. There are actually slight changes in the values of posterior predictive expected relative risk compared with the corresponding values of posterior expected relative risk, which indicates that forecasting is essentially a stationary process, apart from the cyclical seasonal behaviour, due to the stationary assumption made about the mosquito population.
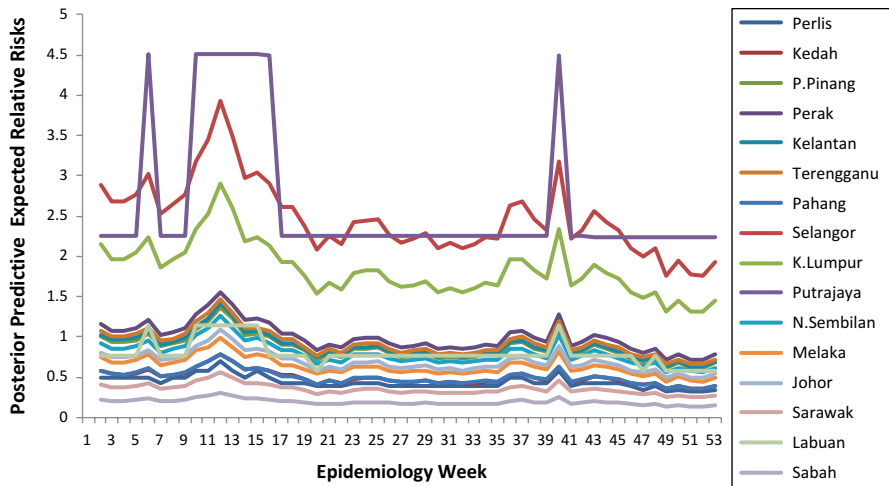

Fig. 46.1 Time series plot for the posterior predictive expected relative risks in epidemiology weeks 1–53 spanning 2009–2010 for 16 states in Malaysia

Table 46.1 Comparison between the posterior expected relative risks and posterior predictive expected relative risks for epidemiology week 53

State	Posterior expected relative risk	Posterior predictive expected relative risk
1. Perlis	0.3471	0.3463
2. Kedah	0.3881	0.3883
3. Pulau Pinang	0.6753	0.6755
4. Perak	0.7790	0.7790
5. Kelantan	0.6972	0.6965
6. Terengganu	0.7176	0.7172
7. Pahang	0.3891	0.3892
8. Selangor	1.9350	1.9340
9. Kuala Lumpur	1.4450	1.4450
10. Putrajaya	2.2420	2.2400
11. Negeri Sembilan	0.6184	0.6183
12. Melaka	0.4911	0.4911
13. Johor	0.5444	0.5445
14. Sarawak	0.2766	0.2763
15. Labuan	0.5723	0.5721
16. Sabah	0.1532	0.1531

In addition, Table 46.1 presents the comparison between the posterior expected relative risks for epidemiology week 53 spanning 2008–2009 and the posterior predictive expected relative risks for epidemiology week 53 spanning 2009–2010 for all 16 states in Malaysia. The purpose of this is merely to demonstrate the consistency of forecasts under these assumptions. In practice, one would never rely upon forecasts one year in advance as reliable indicators of what to expect, but would generate only short-term forecasts that can be updated continually as further data are observed, weekly in this case. The comparisons in Table 46.1 show that there are slight, but negligible, differences between the fitted values at the end of the period of observation and the predicted values at the end of the 1-year ahead forecast period, thus demonstrating considerable seasonal stationarity of forecasting here.

These values of posterior predictive expected relative risk are then illustrated in a map to show the high-low risk areas of dengue disease occurrences. Figure 46.2 displays a disease risk map of posterior predictive expected relative risks based on our discrete time, discrete space, and stochastic SIR-SI vector-borne infectious disease transmission model for epidemiology week 53 in the year 2009–2010, corresponding to one year beyond the range of observed data.

Due to the similarities noted above, this predictive map shows the same risk distribution as the observed map. Therefore, it leads to similar conclusions that people in the states of Putrajaya and Selangor have high forecast risk for contracting dengue, with no state classified as very high forecast risk. This is followed by the state of Kuala Lumpur with medium forecast risk. Most of the states have low forecast risk, including Pulau Pinang, Perak, Kelantan, Terengganu, Negeri Sembilan, Melaka, Johor and Labuan. The only states that have very low forecast risk are Perlis, Kedah, Pahang, Sarawak and Sabah.
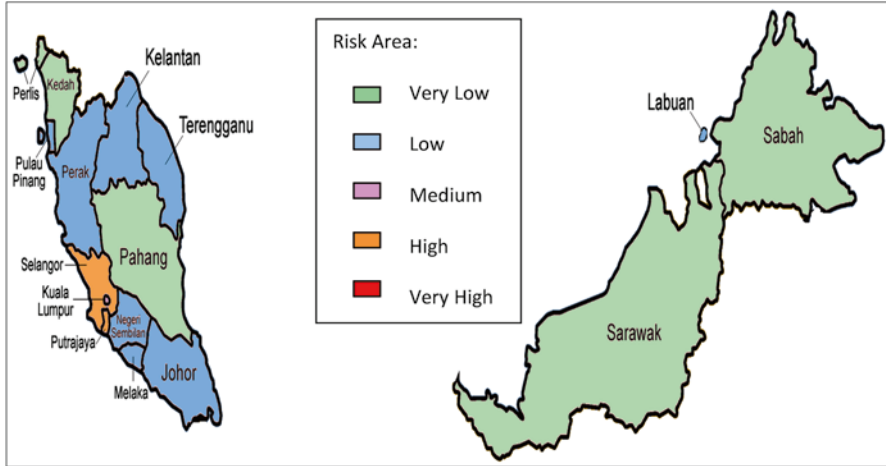
Fig. 46.2 Disease map of posterior predictive expected relative risks based on the discrete time, discrete space, stochastic SIR-SI model for epidemiology week 53

Conclusion

The use of our stochastic models to forecast relative risks and disease maps that are suggested in this paper provides an important approach to assessing future risk. For example, the high-low risk areas for dengue disease occurrences can be identified from the disease risk map. This knowledge could contribute to the control and prevention strategies of dengue disease. It is expected that people will identify future high-low risk areas from predictive maps such as those presented here and that people at risk will be more responsive to government advice when they are aware of clear scientific evidence that warns of relatively high probabilities of contracting dengue in the future.

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Chapter 47
The Effects of Caffeine on Archery Performance: A Randomized, Double-Blind, Placebo-Controlled Study

Adam Linoby, Azmi Nias, Nazratul Husna, and Anuar Suun

Introduction

Caffeine is now widely accepted as being an ergogenic aid and has been demonstrated to increase endurance [1–4], sprint speed, strength [5, 6], and alertness [7–10]. Caffeine at sufficiently high levels was initially a banned drug by the World Anti-Doping Agency (WADA). However, in January 2004, the agency decided to remove caffeine from the Prohibited Substance List and allowed its use in athletic games [11].

The advantages of caffeine to act as an ergogenic medium particularly in endurance activity have extensively been investigated. There is, however, a scarcity of field-based studies in actual sporting environments that assesses caffeine's effect on performance, as highlighted in a recent review [5]. The majority of evidence for caffeine's performance enhancing potential comes from laboratory studies under well-standardized conditions. Furthermore, only a few studies on caffeine's effect on precision performance task such as archery and shooting had been carried out. This field-based study attempts to address this void.

Caffeine's effect on cognition in well-rested subjects has been extensively investigated in endurance. It was found to reduce drowsiness, increase reaction times [9, 12], and improve visual vigilance [13]. Reaction times are especially relevant to archery because the longer an archer spends at full draw, the more tired and unsteady he or she will become. When an archer has successfully used the sight to line the arrow up with the center of the target, he or she needs to release it quickly. Caffeine ergogenic effect in increasing reaction time may help archers to release the arrow at the appropriate time.

The aim of this study is to investigate the effect of caffeine on archery performance. The factors that may affect archery performance (i.e., archery score, heart rate, and cognition) were measured. This field-based research was administered with elite archers in the traditional recurve style used in the Olympic Games.

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Methods

Participants

This study was approved by the Human Ethics Committee at Universiti Teknologi MARA. Nine elite university-level archers (mean age 20.8 years, $s = 8.1$, stature 164.83 m, $s = 1.98$, body mass 71.9 kg, $s = 8.2$) from traditional recurve style bow discipline were selected for this study. All recruited archers scored an arbitrary cutoff of 1,100, which approximately represents the top third of maximum score point of 1,440 points in 2010 season. All recruited archers provided consent to participate in the experiments.

Experimental Design and Procedures

The measurements taken in this study were archery scores over 12 arrows from 18 m, heart rate every minute, mean blood pressure, and 4-choice reaction time as a measure of cognitive accuracy and speed. All the testing sessions were done within indoor venues to exclude environmental factors. The subjects were asked to abstain from alcohol the night before the testing sessions to prevent adverse results from alcohol intoxication. The subjects were also asked to abstain from any caffeinated drinks for 8 h prior to the study session. The half-life of caffeine is known to be around 4 h, and withdrawal effects take at least 8 h to occur [14]. Allowing two half-lives to pass should ensure minimal amounts of residual caffeine in the test subjects, without inducing the effects of withdrawal which could be detrimental to performance.

The caffeine used in the trial was in the form of chewing gum, which has been shown to give more rapid absorption than capsules and equivalent bioavailability. This was a field study and for ease of administration, it was decided to use an absolute dose. Hence, the dosage of 300 mg was chosen as many trials have suggested that a dose of between 3 and 6 mg caffeine $\cdot$ kg $^{-1}$ of caffeine is optimum for ergogenic effects. The two crossover treatment trials were (i) 300 mg StayAlert© caffeinated chewing gums and (ii) placebo gum (glucose) for which the subjects were asked to chew three pieces at once for 5 min on each occasions prior to the trials. The caffeinated and placebo gums were Arctic Mint flavored and manufactured by Koko's Confectionery & Novelty, USA. The gum has been evaluated by the Food and Drug Administration and Committee on Military Nutrition Research (CMNR) in the USA and is on general sale to the public.

Heart rate recording (Polar RS800CX, Kempele, Finland) started at the beginning of the baseline testing session (15 min before chewing the gum) and was stopped at the end of the post-shooting session. The watches were preset to record the heart rate every 60 s. Blood pressure (OMRON, Japan) was also recorded at the baseline testing session and post-gum ingestion (5 min before shooting) for mean arterial pressure data. The testing post-gum ingestion commenced 45 min after taking the

gum, thus allowing enough time for the caffeine to be absorbed. The archers were asked to shoot over 18 m at a standard sized target. They were given 15 minutes for shooting practice prior to the testing sessions. The testing sessions required them to shoot 12 arrows in 2 groups of 6, which is the format of the Olympic final.

After the shooting sessions were completed, the 4-choice reaction time test was conducted using Deary-Liewald reaction time task software (CCACE Software, University of Edinburgh). In this task, four keyboard keys were positioned to correspond with four white squares on the monitor screen. A cross (+) symbol randomly appeared on one of the squares, and the subjects were instructed to respond by pressing the corresponding key on the keyboard as quickly as possible. The program recorded the number of correct or incorrect responses and the time taken to respond to the stimuli. The program also calculated the mean, median, variance, and standard deviation of the response times. Participants also completed a post-caffeine consumption survey form to analyze any side effects experienced.

Statistical Analysis

Normality of distribution was estimated using the Shapiro-Wilks test (used when $n < 50$). Two-way ANOVA was used to determine time, treatment, and interaction effects between the caffeine and placebo testing sessions. A paired t-test (two tailed) was used to compare the mean difference (post-gum minus baseline) values for the placebo and caffeine groups in each of the four measurements: score, heart rate (shooting and non-shooting), blood pressure (shooting and non-shooting), and cognition (accuracy and reaction time). Baseline values were compared using a paired t-test (two tailed) to determine whether baseline values differed between the two testing sessions. All data in text, tables, and figures represent the mean difference (post-gum minus baseline) ± standard deviation. Statistical difference between conditions was accepted at $P < 0.05$.

Results

Performance Accuracy

Figure 47.1 illustrates results of accuracy performance, indicating the number of mean archery score for each testing session. The maximum score possible was 120. The baseline score in the placebo group was 108 and the post-placebo gum score was very similar at 110. The baseline score and the post-caffeine gum scores were at 111 and 110, respectively. There was no significant difference between the baseline scores ($P = 0.182$, $n = 9$) and placebo and caffeine groups' mean difference (post-gum minus baseline) values ($P = 0.893$, $n = 9$). Similarly, no time, treatment, and interaction effects were found between the caffeine and placebo groups ($P < 0.05$).

Fig. 47.1 Baseline and post-gum ingestion performance accuracy
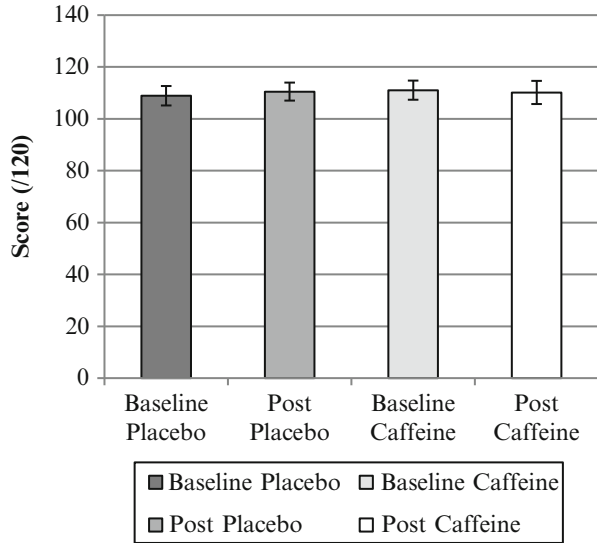
Figure 47.1 shows the mean score of baseline and post-gum ingestion for each archer shooting under caffeine and placebo. University-level (elite) archers ingested either 300 mg caffeinated gum ($n=9$) or placebo (non-caffeinated gum) ($n=9$). Scorer recorded scores for any changes in shooting accuracy (using standard recurve discipline scoring method). The error bars shown represent standard deviation. No time, treatment, and interaction effects were identified between the caffeine and placebo groups ($P<0.05$).

Reaction Time

Figure 47.2 presents mean reaction time results for trial session conducted. Approximately similar reaction time was shown for the baseline placebo (456 ms), post-placebo (454 ms), and baseline caffeine (459 ms) groups. A better reaction time was shown in the post-caffeine (444 ms) group.

Figure 47.2 presents mean reaction time of baseline and post-gum ingestion of caffeine and placebo. University-level archers ingested either 300 mg caffeinated gum ($n=9$) or placebo (non-caffeinated gum) ($n=9$). Reaction time tests were conducted using Deary-Liewald reaction time task software (CCACE Software, University of Edinburgh). The error bars shown represent standard deviation. No time, treatment, and interaction effects were identified between the caffeine and placebo groups ($P<0.05$).

The mean percentage errors in Fig. 47.3 with all study groups indicate a small value ranging from 1.5 % to 1.9 %. There was no significant difference between baseline values in the two groups for percentage of error and reaction time. Similarly, there was no significant difference in mean difference (post-gum minus baseline)

Fig. 47.2 Baseline and post-gum ingestion reaction time
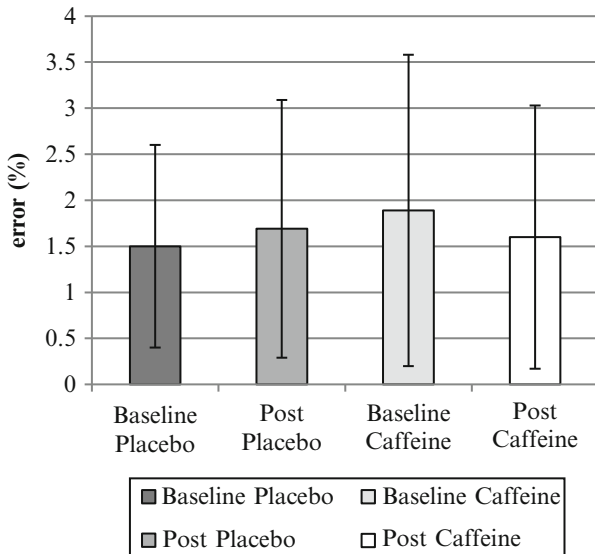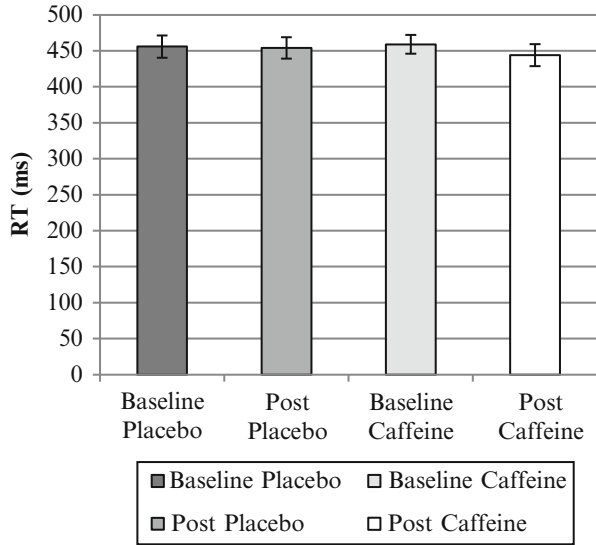
Fig. 47.3 Baseline and post-gum ingestion errors

percent error or the mean difference reaction time between the caffeine and the placebo groups. ANOVA for percentage of error and reaction time revealed no time, treatment, or interaction effects.

Figure 47.3 shows the mean percentage error of pre- and post-gum ingestion of caffeine and placebo. Elite university-level archers ingested either 300 mg caffeinated gum ($n=9$) or placebo (non-caffeinated gum) ($n=9$). The error bars shown represent standard deviation.

Physiological Measure

Caffeine gum ingestion produced no significant difference in resting (non-shooting period) heart rate or arterial pressure (mean) in comparison with placebo trial. Likewise, peak and mean heart rate responses during shooting period did not differ significantly by caffeine gum ingestion.

Discussion

The aim of this study is to determine the effect that 300 mg caffeine ingestion might have on archery performance (i.e., score). The mean weight of the subjects was 72 kg, and this resulted in an average caffeine dose per subject of 300 mg/ 71.9 kg = 4.17 mg·kg^{-1}. Apart from performance variable, this study also set out to determine the effects of caffeine on temporal variables (i.e., reaction time, reaction time, and blood pressure). This study was able to show that 300 mg caffeine gum ingestion produced no beneficial outcomes to the archery score performance. Similarly, no statistical significant variation was found in reaction time, heart rate, and blood pressure across trial sessions conducted. ANOVA analysis revealed that no time, treatment, and interaction effects were found between the caffeine and placebo groups ($P < 0.05$).

There are other similar studies which reported absence of caffeine's benefit on accuracy-based performance. For example, a study exploring the impact of 2 and 4 mg caffeine·kg^{-1} of caffeine and placebo in elite clay pigeon shooters found no difference in shooting performance, reaction times, or times of target tracking [15]. Other studies found no difference in shooting accuracy trial in volunteers in military sentry duty task who consumed caffeine (200 mg) and placebo [16]. Similarly, three different doses of caffeine (100, 200, and 300 mg) had shown lack of beneficial effect on the performance of shooting during marksmanship simulation compared with a placebo trial [14], while 300 mg doses of caffeine in Gillingham et al. (2003) study had also shown no changes in rifle firing accuracy of military reservists in comparison with placebo trial [17]. It appears that despite caffeine beneficial ergogenic potential in other sports, caffeine ingestion failed to improve accuracy-based performance (i.e., shooting, archery).

In contrast to our study, unpublished data by Corey Cunningham mentioned in Share et al. [15] showed an almost 6-point-score improvement over a 72-arrow shoot by ingestion of 2 mg caffeine·kg^{-1} of caffeine. However, this finding is not statistically significant, and Share suggested that this minor improvement is meaningful and practical at upper-class (elite) athletes. Furthermore, the study also showed that relatively high doses of 6 mg caffeine·kg^{-1} produced a 7.7-point decrease in scores [15]. This is supported by other studies of other sports which suggest an "inverted U dose-response curve," that is, at some point the side effects of caffeine start to outweigh the ergogenic benefits [18].

Reaction time is the component of cognition that is expected to improve archery performance. Although the result was not statistically significant, the current study found little improvement (14 ms) in reaction time after 300 mg caffeine gum ingestion trial. In contrast to our study, much of the literature suggests reaction time is improved with caffeine [19]. A 10 min test of vigilance, for example, showed improved reaction times for 4 h after a 200 mg dose of caffeine [12]. Other components such as vigilance or reduced drowsiness are unlikely to be important factors in archery as the target is stationary and the archers are not sleep deprived as is often the case in military studies. As our study did not show an improved reaction time, it is not surprising that there was no improvement in score. In the current study, there was very little difference in percentage error at baseline and post-gum in either the placebo or caffeine tests.

The ability to control heart rate may influence the accuracy of shooting-based performance such as archery and shooting sport [20, 21]. This study found no effect of caffeine on heart rate and mean blood pressure either in resting or shooting period where the concentration of plasma caffeine would be at the greatest level (45 min after caffeine gum ingestion) [22]. Despite the commonly held perception that caffeine increases heart rate, the result of the current study is in agreement with the majority of the literature that has found no change in heart rate [23]. James (1991) suggested that caffeine may elevate cardiovascular responses (i.e., mean arterial pressure and heart rate) [24]. However, increased heart rates have only been witnessed in caffeine overdoses [25]. In accordance with our data, Horst and Jenkins [26] also found no changes following 2 and 4.5 mg caffeine·kg^{-1} in heart rate responses [26]. Thus, the current study result which shows no improvement in archery score after caffeine ingestion appears not to be attributed by any changes in cardiovascular responses.

Finally, post-caffeine consumption survey revealed usual side effects such as mild headache and anxiety (jittery) among the archers tested. This is in accordance to the symptoms reported in similar earlier studies [1, 15]. The current study also reported tremor in majority (7 out of 9) of the archers post-caffeine trial. The tremor side effects of caffeine have been discussed in several other studies with some studies reporting that caffeine causes tremor and some shows no effect. A study of 24 subjects who ingested 300 mg of caffeine found that motor steadiness was significantly poorer [27]. Similarly, a study conducted by Jacobson and Edgley [28] reported arm tremor post 300–600 mg caffeine ingestion trial [28]. However, another study reported no increased physiological, essential, or Parkinsonian tremor after 325 mg caffeine ingestion [29]. If caffeine can really induce tremor, the absence of caffeine ergogenic effect may be explained by reduced hand steadiness which is known to be an important performance factor for accuracy tasks such as archery or shooting.

In conclusion, an absolute dose of 300 mg caffeine provided no ergogenic benefit to shooting accuracy and reaction time in traditional archery recurve bow discipline. For future improvement, a larger field study sample and the use of weight-adjusted doses of caffeine, for example, 2 mg caffeine·kg^{-1} and 4 mg caffeine·kg^{-1}, rather than an absolute dose are required to produce more reliable results than the current study. As the current study only used questionnaire as a means to report tremor incidence, an accurate tremor detection device may produce more convincing results.

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Chapter 48
Characteristics of RDF Produced from Paper and Plastic Wastes and the Potential of Rice Straw as a Binder

Z. Othman, M.L. Kamal, N.H. Hashim, and F.N. Clement

Introduction

Waste management is one of the ways to control the production of waste. It includes six strategies which are rethink, refuse, reuse, replace, recycle, and remove to pursue an environmentally sustainable development area. The lack of solid waste management will contribute to environmental pollution such as air pollution, water pollution, and soil pollution and thus will affect the ecosystem in the world. Refuse-derived fuel (RDF) is a new and alternative way of managing waste besides the incineration process. Compared to the other ways of solid waste management, RDF is more preferable. Besides that, RDF can also be used in several types of industries, such as the cement industries, as a supplementary fuel.

Refuse-Derived Fuel (RDF)

Refuse-derived fuel is produced by processing solid waste to enhance the value of such material waste. This process will involve removing all materials that are incombustible such as glass, metals, and dirt and very wet organic. Once the incombustible materials are removed, the size of RDF will be made more consistent than

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the raw solid waste. RDF covers a wide range of waste materials which have been processed to fulfill guideline, regulatory, or industry specifications mainly to achieve a high calorific value. Waste-derived fuels include residues from municipal solid waste recycling, industrial/trade waste, sewage sludge, industrial hazardous waste, and biomass waste [1]. RDF is a well-known alternative fuel produced from the combustibles in municipal solid wastes which are composed of plastic waste and other materials such as textiles, wood, and soil. The compatibility of these wastes as RDF exists for several reasons related to economic, environmental, political, and social aspects [2]. In producing densified RDF from plastic wastes, it is difficult to obtain a briquette with good physical strength for its delivery off the site by using only a screw compactor. Usually, other binding agents must be mixed with plastic wastes before briquette formation. Well-known agents are molasses, fibrous and oily organic wastes, sawdust, bitumen, pitch, sulfite liquor, starch, limestone, dolomite, etc. [3]. Besides, another different way of RDF utilization, gasification technology, has been applied to the production of energy from solid wastes [4]. This thermochemical process converts a solid carbon-based material into a combustible gaseous product containing CO_2, CO, H_2, CH_4, and other trace gases [5].

Rice Straw

Rice straw is the residue and the excesses of production of rice that was not utilized [6]. Among the available biomass wastes, rice straw is one of the favorable waste sources of bioenergy, because it is the residue from the end use of the biomass products. The reutilization of rice straw not only saves the cost of disposal but also produces valuable bioenergy, achieving the goal of resource recovery and reuse [7]. Rice straw lignin has an excellent potential as a renewable biomass fuel source for energy production in utility or small industrial boilers [8]. As open-field burning of rice straw is being phased out in California, rice growers and government agencies are looking for new rice straw uses. Rice straw was supplied as agriculture wastes from the field at harvest time. The amount of rice straw that may be available as a feedstock ranges from 1.0 to 1.4 million per year [9]. In Malaysia, the production of waste by-products from harvesting activities such as rice straw, leaves and stems, rice husk and dust, and other wastes was estimated to reach 120–140 mt each year [10]. At harvest, the moisture content of straw is usually more than 60 % on a wet basis; however, in dry weather, straw can quickly dry down to its equilibrium moisture content of around 10–12 %. Rice straw has a high ash content (up to 22 %) and low protein content. The main carbohydrate components of rice straw are hemicellulose, cellulose, and lignin. For every tonne of grain harvested, about 1.35 tonnes of rice straw remains in the field. Rice straw has a high potential as a source of lignocellulosic biomass because of the high yield of rice straw per hectare [9].

Materials and Methods

Production of RDF Briquettes

The plastic and paper wastes were shredded separately before being mixed together with a ratio of 1:1. Rice straw was crushed and turned into paste by adding water before mixing with the waste mixture. The weight ratios of the waste mixture and rice straw varied at 3:1 (ratio 1), 3:1.5 (ratio 2), and 3:2 (ratio 3). The total weight of each briquette is 500 g. The formation of briquette was conducted at room temperature using a 5-hp screw compactor at 15 MPa of compression. After the production process, they were stored under ambient conditions for 5 days before utilization. Triplicate samples of the RDF produced were tested in the laboratory typically for moisture content, carbon content, calorific value, and sulfur and chloride analysis.

Determination of Moisture Content

The initial weight of the samples was determined and the samples were dried at a temperature of 77 °C for 24 h. Then, the final weight of the samples was determined after the drying process.

Determination of Carbon Content

The empty ceramic crucible was weighed. The sample was put in the empty ceramic crucible. The crucible with the sample was weighed and the weight was recorded. The crucible was placed into a furnace at room temperature, and the crucible was heated for 15 min at 600 °C. The crucible in the desiccators was cooled before weighing the crucible with the sample. The differences between the initial and the final weight in the amount of volatile solid.

Determination of Energy Content

The determination of energy content was conducted by using a bomb calorimeter. Ten grams of samples was picked and put into the bomb calorimeter. The result of the process could then be observed from the display monitor.

Determination of Chloride Content

Quantitatively, the chloride solution was transferred into a 250-ml Erlenmeyer flask. 10 ml of HNO_3 was added while stirring gently during the acid addition. Then, 20 ml of standard $AgNO_3$ solution was added. Stopper, mix, and let the solution stand in the dark for 15 min and cool at room temperature. 5 to 10 ml of nitrobenzene was added and shook for 1 min. Eight to ten drops of $FeNH_4(SO_4)_2$ were added to the solution and titrated with standard KCNS solution against white background. The end point of the determination was reached when the solution becomes faintly orange pink in color.

Determination of Sulfur Content

5.0 g of sample was weighed in a ceramic crucible. The sample was mixed well with 10.0 g of Eschka mixture. Another 5.0 g of mixture was added to cover the mixture. The crucible and its content were placed in a muffle furnace. The temperature was raised gradually to 815 °C within 1 h. Then, heating was continued at this temperature for another one and a half hours. The crucible was removed from the furnace and all its contents were emptied into a 500-ml beaker. 100 ml of hot distilled water and 15 ml of concentrated hydrochloric acid were added. The solution was stirred occasionally for 30–45 min. The solution was filtered through a Whatman filter paper into a 500-ml beaker and washed 5 times with hot distilled water. The filtered solution was collected in a 250-ml beaker. Three to four drops of methyl orange were added to the filtrate. The filtrate was neutralized with 1:1 ammonia solution until gel was formed. 1:1 hydrochloric acid was added until the solution becomes pink. 10 ml of hot barium chloride was added and stirred. The solution was boiled for 15 min and was allowed to stand at room temperature overnight. The solution was filtered through a Whatman filter paper and washed for 6 times with hot distilled water. The filter paper was placed in the ceramic crucible and the weight was recorded, W_1, and it was dried in the oven. Then, the filter paper was ignited in the furnace at 1,000 °C for 45 min. The crucible was cooled in the desiccators before weighing. The crucible was weighed, W_2.

Result and Discussion

Carbon Content

From the experiment, the results obtained were shown in Fig. 48.1. Based on the results, the sample with ratio 1 (3:1) shows the highest carbon content which is 50.9 % and the lowest is given by ratio 3 (3:2) with 38.6 %. To obtain a good fuel,
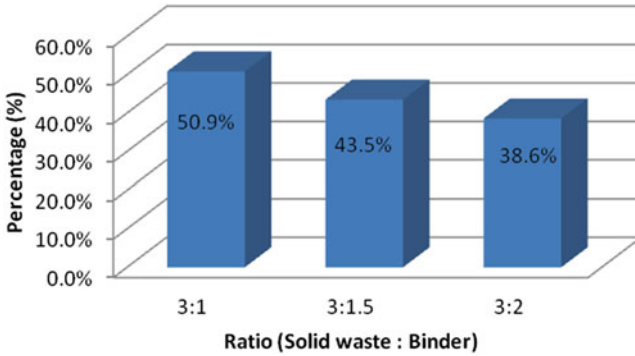
Fig. 48.1 Percentage of carbon content of RDF
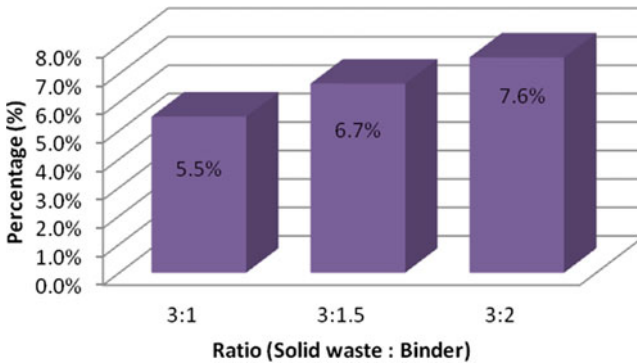
Fig. 48.2 Percentage of moisture content of RDF

the carbon content must be high. Carbon is present in every hydrocarbon fuel and is released as carbon dioxide (CO_2). CO_2 is a heat-trapping greenhouse gas and a higher amount of CO_2 will lead to global warming. From the result above, it shows that wastes that contain binders will give a low reading of carbon content.

Moisture Content

Figure 48.2 represents the percentage of moisture gained from the experiment that has been done. The result varies from 5.5 to 7.6 %. Ratio 1 showed the lowest moisture content which is 5.5 %. The highest rank goes to ratio 3 with a value of 7.6 %. The standard quality of RDF in Finland shows the moisture content reading of 25–35 % [1]. From Fig. 48.2, the result shows that as the contents of binder increase, the moisture content will also increase. This trend of results shows that the moisture content of the binder which is rice straw is relatively high.

Table 48.1 Chlorine and sulfur content of RDF

Sample	Wastes (papers and plastics): binder weight ratio		Chlorine content (%)	Sulfur content (%)
1	3.75	1.25	0.0049	2.08
2	3.33	1.67	0.0146	2.22
3	3.0	2.0	0.0668	2.66

Chlorine and Sulfur Content

Table 48.1 illustrates the percentage of chlorine and sulfur in the composition of wastes and rice straw which acts as the binder. Based on Table 48.1, the percentage of chlorine varies from 0.0049 to 0.0668 %. Ratio 1 gives the lowest reading of 0.0049 %, whereas ratio 3 contains the highest amount of chlorine, 0.0668 %. Similarly with percentages of sulfur content, the sample ratio 1 indicates the lowest value, while the ratio 3 gives the highest value. High chlorine and sulfur can lead to higher emission of acidic gaseous pollutants such as HCl, SO_X, and organic chlorinated compounds, for example, PCCDs and PCDFs, in the incineration process [11]. With these limitations, it is suggested that the preparation of plastic wastes should be blended with other low-chlorine-containing materials before being used as RDF in order to comply with the specified limit [5].

Energy Content

Figure 48.3 shows the reading that was obtained from the energy content determination experiment. Based on the results, sample 1 with a ratio of 3:1 got the highest value which is 29 MJ/kg. From the results obtained, ratio 3 shows the lowest reading that is 20.40 MJ/kg. In the study done by Chiemchaisri et al. (2010), the calorific value obtained was 27.5 MJ/kg to 38.5 MJ/kg. Besides, the typical value for plastic wastes is 28 MJ/kg to 37 MJ/kg reported in [12]. An analysis was done by [13], and the result indicated that the calorific value was 21.4 MJ/kg for olive refuse, while it was 13.0 MJ/kg for paper mill waste.

Conclusion and Recommendation

This study conducted a relative analysis on the relationships of RDF and the characteristics. Paper and plastic wastes with the presence of rice straw as the binder can be used in the production of RDF. From the data and analysis obtained, it is clear that the use of agricultural residues, for example, rice straw, will indicate a different reading in moisture content, carbon content, sulfur content, chlorine content, and calorific value at different ratios. Therefore, these abundant and cheap samples can be used as an alternative energy resource.
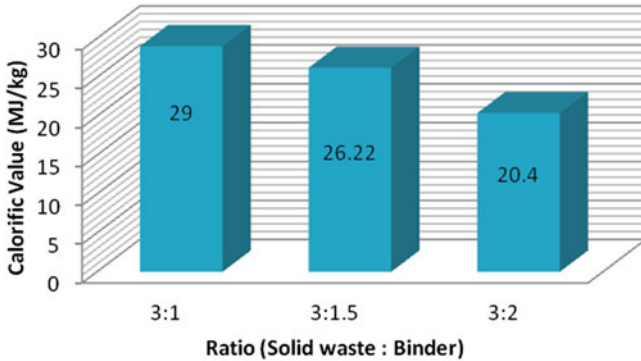
Fig. 48.3 Energy content determination of RDF

Based on the readings for each characteristic obtained, the sample with ratio 1 shows the optimum ratio. This review shows that the carbon content in that ratio gives the best result with a higher percentage of carbon content. Moreover, the calorific value obtained also gives the highest reading among sample ratios 2 and 3. The characteristic of energy content is important because it shows the ability of a material to be combustible and to produce energy. Besides, for the chlorine reading, ratio 1 is the lowest compared with the other ratios, while the sulfur content is 2.08 % which is lesser than ratio 2 and ratio 3. Hence, this sample ratio has a great potential to produce refuse-derived fuel (RDF) for application purposes.

For further study, plastic waste should be classified based on its types, for example, PVC, PET, HDPE, and LDPE. Different types of plastics may produce different amounts of RDF characteristics. Other than that, a special machine is required to convert the plastic and paper wastes to dust, which ensures a good combination between the wastes and the binder.

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Chapter 49
Artificial Pollination on Pepper (*Piper nigrum* L.): Development of *A New Procedure of Applicability Analysis on Self-Pollination Elimination Techniques*

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Introduction

Pepper (*Piper nigrum* L.) belongs to Piperaceae, is originated from the tropical evergreen forests of the Western Ghats in India [8]. In Malaysia, black pepper is one of the important agricultural commodities of the country [10]. However, since the late 1990s, black pepper was in short supply by approximately 26,100 tonnes every year [2]. Constant decrease in the number of pepper growers from year to year is a phenomenon that causes concern as this would seriously hamper black pepper industry in Malaysia in the long run. It was believed that high cost of production and occurrence of pests and diseases are the main factors that discourage farmers to plant black pepper. To overcome this, improved varieties of pepper with high-yielding and disease-resistant trait are needed.

However, the reliability of artificial pollination has become a constraint for the success of breeding due to intricacy of pepper flower. The flowers are catkin type, borne on the vine, at the node opposite the leaves, commonly called spikes [8]. The florets are usually hermaphrodite but may be unisexual, with staminate and pistillate flowers on the same plant or on separate plants [4]. McGregor [7] stated that pollination was the result of gravity possibly aided by rain or wind. Geitonogamy is a mechanism to encourage self-pollination in pepper which involves gravitational descending of pollen grains combined with action of rainwater or dew drops [1, 3, 5].

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Sasikumar et al. [9] and Martin and Gregory [6] also viewed that selfing or self-pollination was the predominant form of fertilization in cultivated bisexual pepper. Preventing the self-pollination has become the challenge in achieving reliable artificial pollination.

Thus, there is a need to develop a highly efficient procedure of artificial pollination to ensure reliable outcome. This project mainly enlightened the development of procedures to prevent self-pollination and also provided useful guidelines to ensure reliability of methods used in prevention of self-pollination.

Materials and Methods

Materials

All of the plant materials used in this project was obtained from Semongok Agriculture Research Centre, Kuching, Sarawak, and partially from Malaysian Pepper Board, Sarawak. A total of 100 potted pepper plants, propagated and grown inside a plant house under about 60–70 % overhead shading condition, were used for this project.

Designed Self-Pollination Elimination Techniques

Technique 1: Bagging of inflorescence (Fig. 49.1a)

The flower spike was bagged before the emergence of stigma. This is to avoid self-pollination assisted by pollination agent like insect. Isolation bag made of stiff nylon sheer was used to bag the inflorescence. The opening end of the bag was tied to the branch with twist tie together with the label.
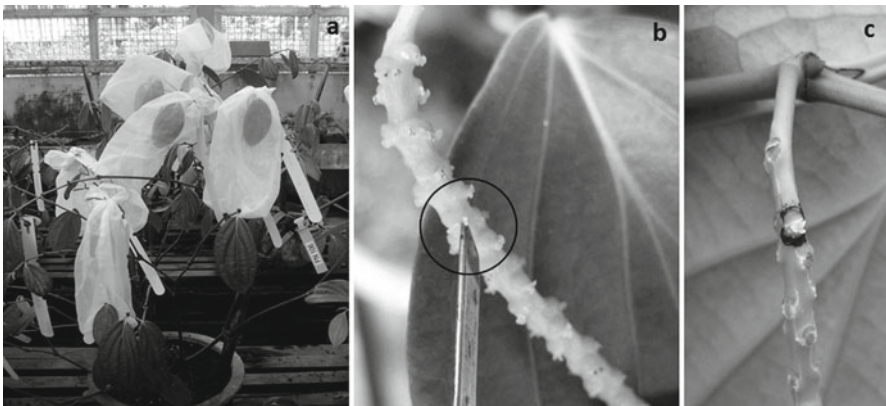
Fig. 49.1 (**a**) Manually removing all flowers and by leaving only one flower per inflorescence. (**b**) Physical emasculation. (**c**) Bagging of inflorescence

Technique 2: Emasculation (Fig. 49.1b)

Even though artificial pollination in *P. nigrum* can be carried out by taking advantages of protogynous nature and acropetal pattern of stigma emergence, emasculation is still necessary due to lack of uniformity in anther emergence. Emasculation is carried out by using dissecting needle with very fine pointed end.

Technique 3: Use of a single flower per inflorescence (Fig. 49.1c)

This method is implemented mainly to reduce tediousness in checking anther emergence and intricacy in emasculation. By using a single flower, emasculation only focuses on one flower. So, it is easier to ensure elimination of self-pollination. Using only one single flower per inflorescence for the study can be achieved through the two methods described below.

(a) Manually removing all flowers by using scalpel except one on an inflorescence
(b) Applying a layer of lanolin paste to all flowers except one flower on an inflorescence

Results and Discussions

Concepts of "**Procedure of Applicability Analysis on Self-Pollination Elimination Techniques**"

There is a need to verify the reliability of methods and techniques used in preventing self-pollination via (1) sampling of single flower per inflorescence by manually removing all flowers and by leaving only one flower per inflorescence, (2) bagging of inflorescence, and (3) emasculation of anther. Thus, a guideline has been developed (Figs. 49.2, 49.3, 49.4, and 49.5). The data obtained from different combinations (Table 49.1) will enlighten the applicability of each designed self-pollination elimination techniques. In other words, data from each combination could generate information which is essential in devising applicable methods to eliminate self-pollination or natural pollination. A total of 30 replicates for each of the manipulation combinations (Combination 1–5) were sampled randomly from the same pepper vine. For each of the combination type, percent of fruit set was calculated and statistically analyzed using one-way analysis of variance (ANOVA). This systematic approach was named *procedure of applicability analysis on self-pollination elimination techniques*.

Refer to Table 49.1 for the types of combination and Figs. 49.2, 49.3, 49.4, and 49.5 for the flow of guideline. Combination 1, in which the inflorescence was not bagged, anthers were not emasculated, and there was no manual removal of flowers, represented pollination under the natural condition, as a general control for this experiment. Combination 2 was carried out to investigate susceptibility of inflorescence to the operation of manual removal of flowers. The data if compared to the

Combination 1 (C1):

Percent fruit set was calculated from naturally pollinated inflorescence.

Treatment: Inflorescence not bagged; anthers not emasculated; all flowers on an inflorescence were used.

Significance of the data: To verify the percentage of fruit set under the natural conditions for a selected cultivar. This also serves as the control for Step 2.

Test 1: Comparing data C1 and C2

Combination 2 (C2):

Percent fruit set was calculated from the formula i.e. (successful fruit set / number of single sampled flower) x 100%.

Treatment: Inflorescence not bagged; anthers not emasculated; only one flower per inflorescence was used.

Significance of the data: To verify theseverity or effect of the operation of manual removal of flower. This also serves as the control for Step 3.

Possible outcome

Fruit set in C1 but no fruit set in C2.

Cannot proceed to the next step because manual removal of flowers is extremely damaging to the inflorescence.

Very low fruit set in C2 compare to C1. Proved that sampled of single flower per inflorescence through manual removal of flower can achieved fruit set but caused adverse effect on fruit set to certain extent. However, this considered as positive result.

No significant difference in percent fruit set between the two combinations. Proved that sampled of single flower per inflorescence through manual removal of flower do not cause significant damage on fruit set. Positive result obtained.

Proceed to **Combination 3**

Symbols definition:

→ Comparing data
→ Proceed
-- Possible outcome

Fig. 49.2 Procedure of applicability analysis on self-pollination elimination techniques (part I)

control, i.e., combination 1, could generate information on the spike damaging level due to manual removal of flowers. At the same time, data from combination 2 if compared to combination 3, i.e., with inflorescence bagged and anthers not emasculated, could determine the effect of bagging on the fruit set. Combination 3 also acts as a control for combination 4 whereby inflorescence bagged and anthers emasculated, to verify reliability of the method of eliminating self-pollination. Besides, combination 4 also acts as the control for combination 5, i.e., induced self-pollination with inflorescence bagged and anthers emasculated. Data obtained from combination 4 and 5 if compared will enlighten applicability of physical emasculation.

Combination 3 (C3):

Percent fruit set was calculated from the formula i.e. (successful fruit set /number of single sampled flower) x 100%.

Treatment: Inflorescence bagged; anthers not emasculated; only a single flower per inflorescence was used.

Test 2:
Comparing data
C2 and C3

C2

Possible outcome

Significant difference in percent fruit set between C2 and C3. If C3 had higher percent of fruit set, it proved that bagging of inflorescence do not caused adverse effect at all on fruit set. Positive result obtained.

No significant difference in percent fruit set between the two combinations it proved that bagging of inflorescence do not caused adverse effect at all on fruit set. Positive result obtained.

Significant difference in percent fruit set between the two combinations. If combination 3 showed lower percent of fruit set, it proved that bagging of inflorescence caused adverse effect on fruit set. Negative result obtained.

Proceed to **C4**

Cannot proceed to next step because bagging of inflorescence is too damaging to the inflorescence.

Symbols definition:

→ Comparing data
⇒ Proceed
‐ ‐ Possible outcome

Fig. 49.3 Procedure of applicability analysis on self-pollination elimination techniques (part II)

Two important assumptions for the *procedure of applicability analysis on self-pollination elimination techniques* are as follows: (1) The single sampled flower of pepper, without emasculation, can still achieve normal fruit set in natural pollination type 2, type 3, and type 4. The view was in agreement with earlier researchers, i.e., Anadan [1] and Martin and Gregory [6]. They emphasized that the flower most probably pollinated by pollen from the same flower itself. (2) The pollen of *P. nigrum* collected for the artificial hybridization must be at the viable stage, while the stigma
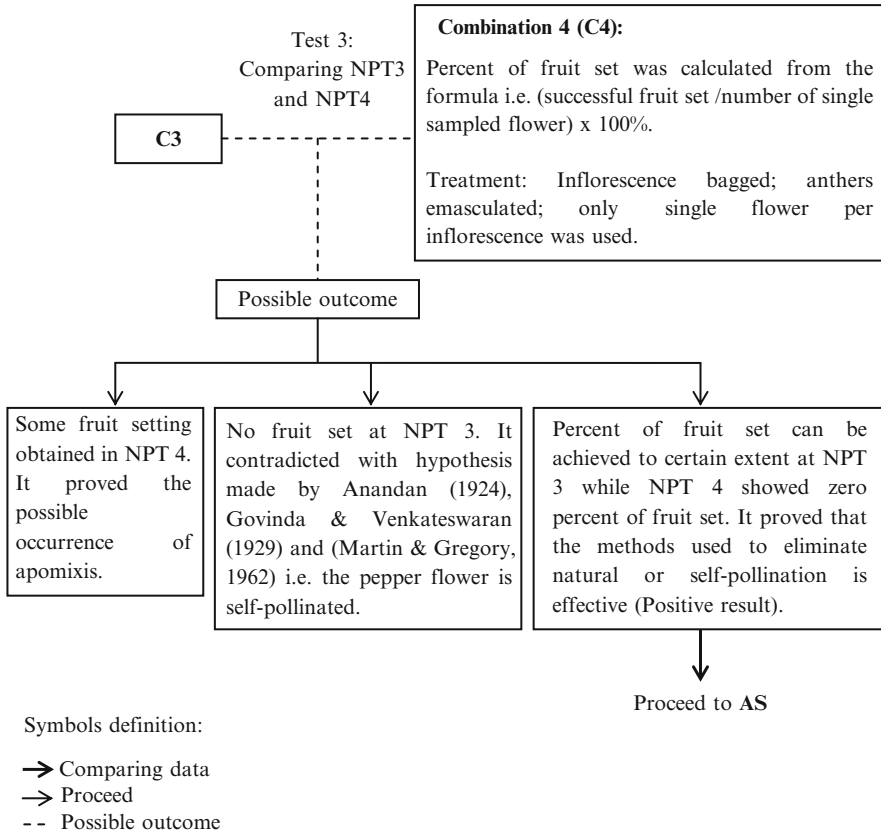
Test 3:
Comparing NPT3
and NPT4

Combination 4 (C4):

Percent of fruit set was calculated from the formula i.e. (successful fruit set /number of single sampled flower) x 100%.

Treatment: Inflorescence bagged; anthers emasculated; only single flower per inflorescence was used.

C3

Possible outcome

Some fruit setting obtained in NPT 4. It proved the possible occurrence of apomixis.

No fruit set at NPT 3. It contradicted with hypothesis made by Anandan (1924), Govinda & Venkateswaran (1929) and (Martin & Gregory, 1962) i.e. the pepper flower is self-pollinated.

Percent of fruit set can be achieved to certain extent at NPT 3 while NPT 4 showed zero percent of fruit set. It proved that the methods used to eliminate natural or self-pollination is effective (Positive result).

Proceed to **AS**

Symbols definition:

→ Comparing data
⇒ Proceed
-- Possible outcome

Fig. 49.4 Procedure of applicability analysis on self-pollination elimination techniques (part III)

selected must be at the receptive stage. De Waard and Zevan [3] reported that in Sarawak, anthesis usually took place between 12.00 pm and 2.00 pm during daytime when relative humidity of 60% is attained and at a temperature of 32 °C. This was the most appropriate time for collecting pollen grains at viable stage. Stigma of *P. nigrum* was proved most receptive at stage 1, i.e., first emergence of stigmata, and stage 3, i.e., complete emergence and wide spreading of stigmata as described by Sim [11].

Implementation of "Procedure of Applicability Analysis on Self-Pollination Elimination Techniques"

An experiment was carried out by implementing the *procedure of applicability analysis on self-pollination elimination techniques* to verify applicability of the self-pollination elimination techniques in artificial pollination of pepper, i.e., bagging
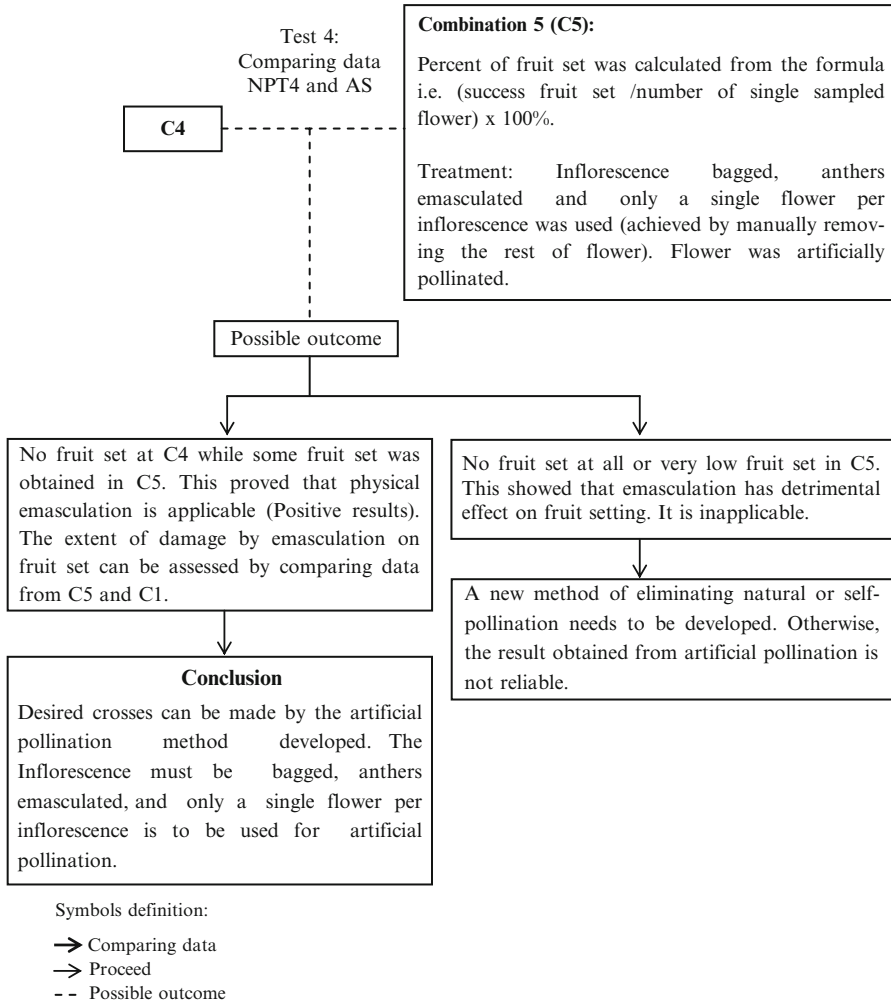
Test 4:
Comparing data
NPT4 and AS

C4

Combination 5 (C5):

Percent of fruit set was calculated from the formula i.e. (success fruit set /number of single sampled flower) x 100%.

Treatment: Inflorescence bagged, anthers emasculated and only a single flower per inflorescence was used (achieved by manually removing the rest of flower). Flower was artificially pollinated.

Possible outcome

No fruit set at C4 while some fruit set was obtained in C5. This proved that physical emasculation is applicable (Positive results). The extent of damage by emasculation on fruit set can be assessed by comparing data from C5 and C1.

No fruit set at all or very low fruit set in C5. This showed that emasculation has detrimental effect on fruit setting. It is inapplicable.

A new method of eliminating natural or self-pollination needs to be developed. Otherwise, the result obtained from artificial pollination is not reliable.

Conclusion

Desired crosses can be made by the artificial pollination method developed. The Inflorescence must be bagged, anthers emasculated, and only a single flower per inflorescence is to be used for artificial pollination.

Symbols definition:
→ Comparing data
→ Proceed
-- Possible outcome

Fig. 49.5 Procedure of applicability analysis on self-pollination elimination techniques (part IV)

of inflorescence, emasculation, and the use of a single flower per inflorescence by either manually removing or applying lanoline paste to all flowers except one on an inflorescence.

Referring to Table 49.2, data from five different combinations were collected. Combination 1 in which inflorescence was not bagged and anthers not emasculated (data collected from all flowers per inflorescence) played an important role as the general control for this experiment. Percent berry set was obtained from the open or naturally pollinated inflorescence. Result showed 88.00 % fruit set could be achieved.

Table 49.1 Five combination types with different manipulations

Combinations	Manipulations
Combination 1	Inflorescence not bagged, anthers not emasculated (No manual removal of flowers. Data collected from randomly selected fruit spike)
Combination 2	Inflorescence not bagged, anthers not emasculated (only single flower per inflorescence was used by manually removing of all flowers except one by use of a scalpel)
Combination 3	Inflorescence bagged, anthers not emasculated (only single flower per inflorescence was used by manually removing of all flowers except one by use of a scalpel)
Combination 4	Inflorescence bagged, anthers emasculated (only single flower per inflorescence was used by manually removing of all flowers except one by use of a scalpel)
Combination 5	Induced self-pollination with inflorescence bagged and anthers emasculated (only single flower per inflorescence was used by manually removing of all flowers except one by use of a scalpel)

Table 49.2 Percent fruit set in different manipulation combinations

Combinations*	Percent berry set (mean ± SE)
Combination 1	88.00 ± 3.00[b]
Combination 2	10.67 ± 3.18[a]
Combination 2	10.67 ± 3.18[a]
Combination 3	8.13 ± 2.15[a]
Combination 3	8.13 ± 2.15[a]
Combination 4	0.00
Combination 4	0.00
Combination 5	11.67 ± 2.54[a]

Means followed by the same superscript letter in the same column are not significantly different at $P = 0.05$ using DMRT

*Refer to Table 49.1 for details of manipulations combination

Combination 2, in which the inflorescence was not bagged and anthers were not emasculated but only a single flower per inflorescence was sampled, was carried out to investigate the susceptibility of inflorescence to manual removal of flowers. Result showed only 10.67 % of successful fruit set, which was achieved from this type of pollination. It showed a reduction of approximately 75 % successful fruit set when compared to the control, i.e., combination 1. Most inflorescences were found abscised after the manipulation. This proved that the inflorescence was very susceptible to the process of flower removal. However, removal of all other flowers leaving only a single flower per inflorescence is necessary to ensure reliable outcome from the assisted pollination. The results indicated that the method of sampling single flower per inflorescence by manually removing the rest of the flowers was applicable but with adverse effect on fruit set to certain extent.

Combination 3, with inflorescence bagged and anthers not emasculated has achieved 8.13 % in successful fruit set. Results gathered from this pollination type when compared to combination 2 (inflorescence not bagged and anthers not emasculated) would reflect the effect of bagging on the fruit set. ANOVA showed that percent fruit set from both pollination types did not differ significantly. This suggested that bagging of inflorescence with nylon sheer did not have any adverse effect on fruit set of pepper. At the same time, combination 3 also acts as a control for combination 4 in which the inflorescence was bagged and anthers emasculated to verify the reliability of the methods of eliminating self-pollination. Zero percent of fruit set was obtained in combination 4. This indicated that the methods of eliminating self-pollination or natural pollination are very effective.

In combination 5, selfing was carried out artificially with inflorescence bagged and anthers emasculated 11.67 % successful berry set was obtained. Data comparison between combination 4 and combination 5 proved that physical emasculation was applicable. This was concluded by judging on 11.67 % of berry set achieved in combination 5. However, the method of emasculation used has an adverse effect on fruit set. Comparing 88.00 % fruit set obtained in combination 1 with 11.67 % fruit set in combination 5, there was a decrease of about 76 %. This means the fruit set of artificially crossed flower was reduced to approximately 76 % when compared with the naturally pollinated flower of *P. nigrum*.

Procedure of applicability analysis on self-pollination elimination techniques indicated that the techniques designed to prevent self-pollination in artificial pollination of pepper is applicable but with adverse effect on fruit set to certain extent, particularly manually removing the flowers for sampled of single flower. The concept of *procedure of applicability analysis on self-pollination elimination techniques* that has been developed in this project is useful in ensuring reliability of self-pollination elimination techniques for conventional breeding.

Conclusions

The aim of this project is to develop a reliable procedure of artificial pollination on *Piper nigrum* L. The *procedure of applicability analysis on self-pollination elimination techniques* that has been developed in this project play the roles to determine the applicability of the techniques used to prevent self-pollination. In pepper breeding, the technique that has been designed, i.e., (1) emasculation, (2) bagging of inflorescence, and (3) use of only a single flower per inflorescence, was proved reliable to control self-pollination via the implementation of *procedure of applicability analysis on self-pollination elimination techniques*. This guideline could be recommended to other crop breeders particularly in developing reliable techniques to prevent self-pollination.

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Chapter 50
Daylighting Tropical Building Interiors from Skylight: The Case for Separating Heat from Useful Visible Light

K.M. Al-Obaidi, M. Ismail, and A.M. Abdul Rahman

Introduction

Daylight normally enters the building from different openings such as window glazing, roof lights, atria, light pipes, and light ducts in roofs. However, the amount of natural light that enters varies according to climate, latitude, locations, and air quality that affects the intensity and duration of daylight [1]. The zone between Tropic of Cancer and Tropic of Capricorn receives high amount of solar radiation and more intense nearer to the equator. Malaysia is at 3°N and has tropical climatic with hot and humid characteristics. It has high temperatures, high humidity, and plenty of rainfall throughout the year. At its peak, the Malaysian sun is very strong and biting. Malaysians normally spend up to 90 % of their lifetime indoors. Without mechanical aids, the impact of external condition generates high indoor temperatures that exceed the Malaysian thermal comfort. This is known as the greenhouse effect. Good daylight design in tropic requires special consideration of sky to identify the amount of energy that comes from the sun. According to Zain-Ahmed [2], the Malaysian sky is classified as intermediate mean sky and overcast sky with illumination between 60,000 and 80,000 lx at the noon during the months when solar radiation is highest. This amount is more than the required for effective day-to-day living.

Daylighting has a thermal impact in building interiors. Glazing area has a strong influence on the use, comfort, and productivity of the people in building. According to Jinghua Yu [3], heat gain through the exterior window accounts for 25–28 % of the total heat gain, and adding to the infiltration, also it reaches to 40 % in hot weather.

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Proper glazing and frame in skylight design can enhance the daylight and energy performance. A single layer of clear float glass facing the sun will capture most of the visible solar radiation, some of the infrared radiation, and very little ultraviolet radiation. This type of glass has a problem of highest heat gain and loss from the inside to the outside. Clear glass does not diffuse light and create hot spots in greenhouses. It is also heavy and requires a robust foolproof frame. Polycarbonate is a strong plastic that has the ability to diffuse the light and is very simple to install. Clear polycarbonate has an excellent transparency, durability, and high refractive index [4].

This paper examines the possibility of brightening up building interiors by installing roof lights without the effect of weather change and also reduces internal heat. It is hoped to solve the problem of the high influence of natural light that leads to heat buildup by reducing this impact so as the useful and visible light benefits the occupants. In addition, it explores the roof light strategy as the light being casted over a space in a more uniform way and is unlikely to be obstructed either internally.

Methodology

The basic and minimum size of a standard room was to be used for this test with dimensions considered slightly bigger than the minimum. Firstly, the test would be with skylight to measure illumination and air temperature at workable plane, set at 800 mm from ground level as average height of a typical office desk. The modeled building and its elements will determine the method of calculation using computer simulation for initial study; the testing requires this type of method to set some relevant parameters before any attempt for a full-scale experiment. Integrated environmental solutions is a software that allows measuring virtual environment, and it considers the latest development of dynamic building energy simulation software that can analyze daylight and thermal behavior [5].

There are two types of benchmarking in Malaysia that are complementary to one another, namely, the Green Building Index (GBI) and the Malaysia Uniform Building By-Law (UBBL) of 1984. The GBI [6] uses a point-scoring approach so that anything that gets measured is easily managed but not necessarily mandatorily imposed on buildings. The UBBL [7] of Malaysia is a mandatory requirement for any building approvals. Both emphasize eliminating glare from all direct sun penetration and keep the horizontal workspace luminance level below 2,000 lx.

Building Parameters

1. Fixed items:

A building space of W4m×L5m and H3m with 1 m height from ceiling level to the roof ridge and a roof pitch of 30°. Other building materials used are clay brick,

Table 50.1 Glazing material specifications

Glass materials	Materials	Thickness [m]	Visible light transmittance	Total (SC)	U value
Single glass	Clear glass	0.0060	0.88	0.9419	6.8653
Double glass	Clear glass	0.0060	0.36	0.4000	3.2256
	Cavity	0.0120			
	Clear glass	0.0060			
Double polycarbonate	Thermoclear polycarbonate	0.0080	0.76	0.2569	4.1650
	Cavity	0.0120			
	Thermoclear polycarbonate	0.0080			
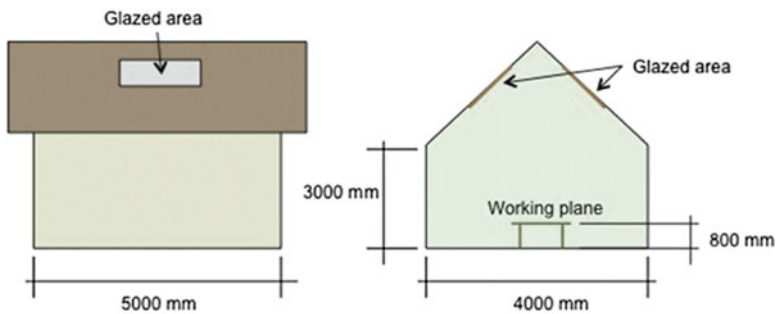
Fig. 50.1 Building dimensions

plasterboard, and aluminum sheets. The daylight illumination at the point of entry is set at 50,000 lx due to software limitation. Both the gable ends face the sun path, meaning that the longer facade faces the north-south direction. The test bed has no opening from the walls so as not to influence the illumination patterns coming from the roof. Measurements of environmental data are taken on March 15, the day considered as one of the hottest of a typical year.

2. Variable measurement parameters:

   A. Material selections: Different types of glazing materials used in the simulation are tested as shown in Table 50.1. Without ceiling and with ceiling, roof light size is fixed (1 m long × 0. 5 m wide) and ceiling glaze area is fixed (4 m long × 2 m wide).
   B. Size of opening: The size of a glazed roof that allows sunlight to enter is 2 m long × 1 m wide and 1 m long × 0.5 m wide on both sides of the roof. The ceiling glazed area is measured at 4 m long × 2 m wide and 4 m long × 1 m wide.

Simulations will give comparisons with a design of six different models with and without attic that have different material types and different opening sizes. Technical dimensions of room are shown in Fig. 50.1.

Discussion and Results Analysis

Computer Modeling: Material Selections

The daylight performance was tested for the abovementioned specifications. The testing selected four different hours from 12.00 noon, 1.00, 2.00, and 3.00 pm due to intense solar radiation as worst-case condition high in illumination. Six designs were observed to compare the daylight factor, uniformity, diversity, contrasting illumination, and room temperature. The comparison is between the skylight without and with ceiling light (Fig. 50.2). The results in Table 50.2 indicated that model RC3 has the most appropriate daylight factor due to the comparison between RC3 and other models which scores a value near to actual requirement 3.5 %. However, N3 has scored the value 3.5 %, but its values in minimum and average are lower than RC3. Also in uniformity and diversity RC3 scores, an optimum level among other models even RC1 perform better but its results in daylight factors are acceptable. Therefore, the results of comparing RC3 with other models in lux and temperature difference would be as follows: (i) N1-RC3 = max 71.06 lx – min −26.55 lx (7.47 °C); (ii) N2-RC3 = max −415.85 lx, min −81.51 lx (7.02 °C); (iii) N3-RC3 = max −44.25 lx, min −39.79 lx (6.93 °C); (iv) RC1-RC3 = max 77.76 lx, min 45.33 lx (1.21 °C); and (v) RC2-RC3 = max −396.73 lx, min – 64 lx (0.16 °C). This confirms that model RC3 (double polycarbonate for roof and ceiling, blackbody, and reflective material) has recorded better performance than others. RC3 proves that double polycarbonate with blackbody on the inner side of the pitch roof and reflective
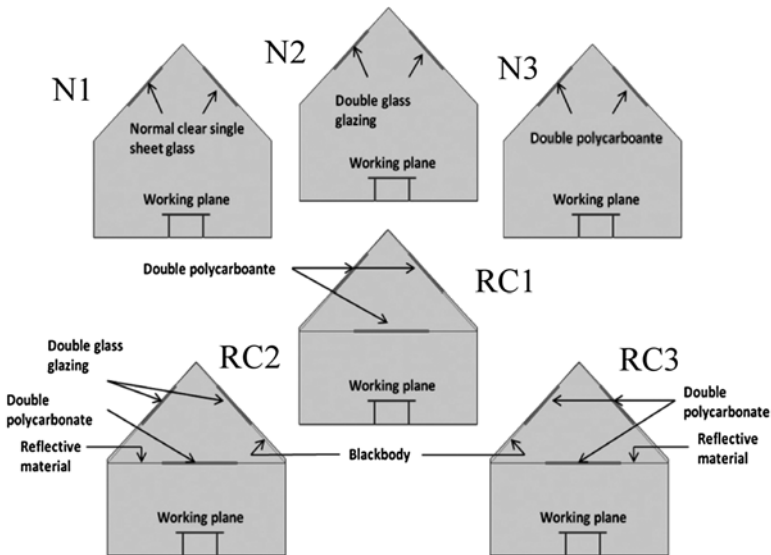

Fig. 50.2 Model types

Table 50.2 Daylight factor for six designs between 1 pm and 1:30 pm

Model	Maximum (%)	Average (%)	Minimum (%)
N1	4.00	1.80	0.50
N2	1.70	0.70	0.20
N3	3.50	1.60	0.40
RC1	4.10	2.10	0.80
RC2	1.80	0.80	0.30
RC3	3.70	1.80	0.60

Table 50.3 Daylight uniformity and diversity for six designs between 1 pm and 1:30 pm

Model	Uniformity	Diversity
N1	0.25	0.11
N2	0.25	0.11
N3	0.25	0.11
RC1	0.38	0.20
RC2	0.32	0.15
RC3	0.33	0.16

Table 50.4 Room temperature for six designs between 1 pm and 1:30 pm

Model	Ave. temp [°C]
N1	40.59
N2	40.14
N3	40.05
RC1	34.33
RC2	33.28
RC3	33.12

materials at the top part of the ceiling provide ample daylighting and lowest heat gain from the tropical sun. With this concoction glare is achieved at below 2,000 lx. And all of these rely only on the passive design elements, meaning that there are no mechanical aids or opened windows to cool the air temperature (Tables 50.3 and 50.4).

Computer Modeling: Opening Size

To identify the best opening size in the roof light and ceiling light, this part tested RC3 model condition, which proofed its efficiency in part A. The study measured two sizes of roof light (RL) (2 m long × 1 m wide, 1 m long × 0.5 wide) and two sizes of ceiling light (CL) (4 m long × 2 m wide, 4 m long × 1 m wide) to estimate the quality of illuminance, uniformity, diversity, and room temperature. The results in Table 50.5 indicate that sizes of roof light and ceiling light in RC3 model play an important role for providing different levels of natural light inside a space; the comparison of sizes show that there are no much difference in temperature, but there

Table 50.5 Behavior of three different opening sizes (roof light and ceiling light) between 1 pm and 1:30 pm

Size no.	Model RC3	Daylight illuminance values					Ave. temp [°C]	
		Max [lux]	Ave [lux]	Min [lux]	Diversity	Uniformity	Room	Attic
A	RL=(2*1 m)							
	CL=(4*2 m)	1,765.22	900.03	390.11	0.22	0.43	33.44	43.93
B	RL=(1*0.5 m)							
	CL=(4*2 m)	757.97	367.03	119.41	0.16	0.33	33.12	42.81
C	RL=(2*1 m)							
	CL=(4*1 m)	837.86	425.02	192.21	0.23	0.45	33.6	43.67
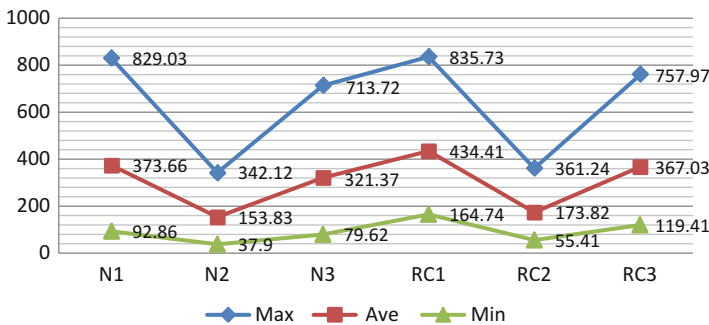
Fig. 50.3 Illuminance distribution [lx] in 6 different models

are various amounts of light that can enter a space. Also the size controls the behavior of illumination (uniformity, diversity). Size A with bigger roof light shows more uniformity and diversity, but size B shows the lowest, both of which have fixed roof ceiling size. The results show slight difference between sizes A and C that have fixed roof light size, which means the size of roof light plays more important role than the size of ceiling light. The results proved that size B is the most appropriate size which scores closer to the requirements of a daylight factor of 3.5 % as in Green Building Index; provides better performance, which meets the requirement of Malaysia Uniform Building By-Laws Part III that opening has to have a total area of not less than 10 % of the clear floor area; and has less glare effect and acceptable illuminance value. In addition, the room temperature recorded the lowest value with 33.12 °C.

Conclusion

This research supports the concept of skylight in the tropics after critical issues restrained its application. It is now possible to get abundant and uniform amount of daylight from the top light as in buildings from the temperate climates but with
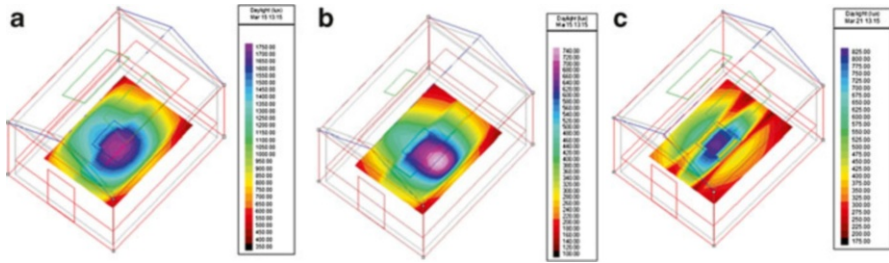
Fig. 50.4 Comparison of daylight illuminance values in 3 different opening sizes, time between 1 pm and 1:30 pm

some modifications on the glazing materials, roof construction system, and ceiling and opening sizes. This finding exposes new design avenues to redefine future tropical buildings. Also the finding showed the ability of RC3 model to control the heat gain and increase the ability to transfer more natural light with less penetration of heat which satisfied the aim of this study.

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Chapter 51
Kinetic Modelling for Hydrogen Reduction of Ferric Oxide Using MATLAB

Tan Weng Giap, Sivakumar Ramakrishnan, Sheikh Abdul Rezan, Abdul Hamid, Reza Alizadeh, and Parham Roohi

Introduction

Reduction of ferric oxide is one of the most important studied topics. This is because of the importance of iron and steel in the advancement of technologies. There are huge amount of CO_2 are generated for production of iron metal, and everyone knows that CO_2 will increase the greenhouse effect and this is not good for our environment. For the industrial point of view, direct reduction of iron ores with H_2 could have few technical advantages, such as:

(a) Replacement of the coke as reducing agent
(b) Production of low carbon content product
(c) Production of H_2O in the reduction which can be recycled back for H_2 production

The reduction of iron ores with H_2 leads to compact iron layers and consequently could slow down their reduction rate. Besides that, the cost of hydrogen production is currently high.

The chemical reaction for hydrogen reduction of ferric oxide is as follows:

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$$1/3 \ Fe_2O_{3(s)} + H_{2(g)} = 2/3 \ Fe_{(s)} + H_2O_{(g)} \qquad (51.1)$$
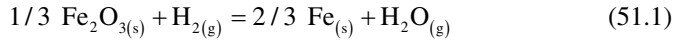
In this chemical reaction, Fe_2O_3 becomes the metallic compound, H_2 becomes the reactant gas, Fe becomes the solid reaction product, and H_2O becomes the gaseous product.

This paper focuses on hydrogen reduction of ferric oxides at different porosities at 700 and 800 °C. This is because this reaction involved two or three stages. For temperature higher than 570 °C, ferric oxide is first transformed into magnetite and then into wustite and finally into metallic iron [1, 2]. For temperature below 570°C, magnetite is directly transformed into iron since wustite is not thermodynamically stable [3]. Morphological study confirms that the formation of compact iron layer generated during the reduction of Fe_2O_3 by H_2 at high temperature. This will decrease the activation energy. With the low activation energy, the reaction becomes fast.

Methodology for Kinetic Model

A kinetic model is developed to investigate the isothermal for hydrogen reduction of ferric oxide. The model was developed by using the prediction reaction rate from known temperature and prediction temperature from known reaction rate.

Figure 51.1 shows the appearance of the reacting pellet of ferric oxide at some time during the reaction. The pellet consists of two phases separated by a sharp reaction interface. The inner phase is the initial solid reactant. It is assumed that
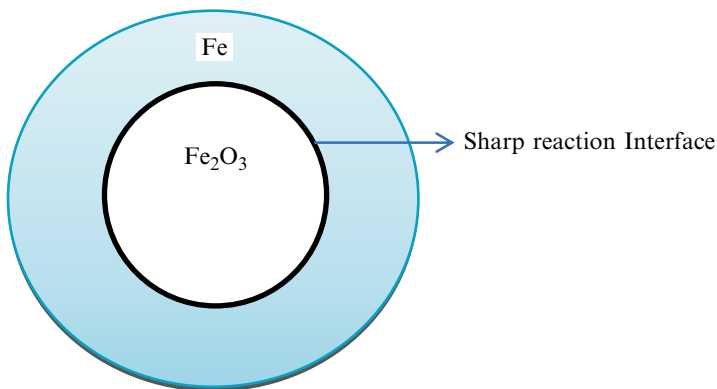

Fig. 51.1 Appearance of the typical pellet during reaction

this phase undergoes no changes until being consumed by chemical reaction. Then the outer phase is the porous solid reaction product. It is assumed to be free of cracks and to have uniform porosity and pore structure throughout. The porosity and pore structure measured at the completion of the chemical reaction are assumed to have existed unchanged throughout the reaction [1]. Pore size and porosity definitely change during reaction if sintering occurs. Besides that, the pores close to the reaction interface may be very fine and differ appreciably from the pores further from the interface. The reaction interface is assumed to be infinitely thin and to retain the shape of the reactant solid where the radial symmetry exists for the reaction interface [4]. The assumption of topochemical behaviour has been verified for most experimental systems, while the infinitely thin reaction zone is consistent with transport control of the reaction. In the shrinkage core model [5], gaseous transport through the gas boundary layer and the solid reactant product is assumed to be very rapid. The interfacial reaction between the gas and solid is assumed to be far removed from equilibrium, and to be infinitely thin to retain the shape of the solid reactant where the radial symmetry exists for the reaction interface. Therefore the reaction rate is proportional to interfacial area [3]. By noting that reaction often was limited to a sharp interface which retained the shape of the reacting solid, the following equation can be derived by assuming that the reaction rate was proportional to the interfacial area.

This equation is used to predict the transport-limited reaction rate for hydrogen reduction of ferric oxide:

$$R_0 \rho_c = \left[1 - \left(1 - R' \right)^{1/3} \right] = Kt \tag{51.2}$$

where

R^o = initial radius of the reacting sphere
ρ_c = molar density of the solid reactants
R' = fractional reaction (instantaneous weight of the pellet/initial weight of the pellet)
K = constant
t = time

$$R' = \left(M_o - M_t \right) / \left(M_o - M_f \right) \tag{51.3}$$

where

M_o = initial weight of pellet (Fe_2O_3)
M_t = weight of pellet at time t (Fe_2O_3 + Fe)
M_f = final weight of pellet (Fe)

A mass balance of H_2O gas is performed on the layer of the accumulated Fe during the time increment Δt when the shell of the Fe_2O_3 of the thickness reacts

Table 51.1 Experimentally measured quantities for the hydrogen reduction of ferric oxide

	Curve for Fe_2O_3 with 20 % porosity at 700 °C	Curve for Fe_2O_3 with 40 % porosity at 700 °C	Curve for Fe_2O_3 with 20 % porosity at 800 °C	Curve for Fe_2O_3 with 40 % porosity at 800 °C
Bulk gas phase				
Composition	100 % H_2			
Pressure	1 atm			
Temperature	700 °C		800 °C	
Flow rate	1 l/min			
Pellet				
Size	1.3 cm in diameter			
Porosity of reactant	0.20	0.40	0.20	0.40
Porosity of product	0.62	0.67	0.63	0.69
Pore tortuosity	2.0			

completely. During this increment the position of the reaction interface remains constant, and no H_2O gas accumulates in the product layer according to the pseudo-steady-state assumption.

Experimentally Measured Quantities for the Hydrogen Reduction of Ferric Oxide (Table 51.1)

Comparison and Discussion of both Predicted and Experimental Results of Hydrogen Reduction of Ferric Oxide

Predicted transport-limited reaction rate was a reaction rate derived from kinetic model by using the MATLAB software. Experimentally measured rate was a reaction rate yielded from experiments.

The comparison fitting between experimental and predicted results in the Figs. 51.1 and 51.2 are not well fitted. According to the theory, the experimental and predicted results should have almost the same reaction rate, but in reality this did not take place. The reasons can be, firstly, that the porosity of the reaction product was one of the roots that caused the result to become less accurate. This is because the porosity of the reaction product was approximated from the porosity of the solid reactant since pellet size remains constant and all of the pores were open and available for gas transport. But in the Ronald Charles Gower [6] study, this situation was impossible because the closed pores within the reaction product occur and cannot transport. With this kind of phenomena, it will make the predicted and experimental results not equal and create a gap between them. Therefore, variation of this quantity within reasonable limits offers significant improvement in accuracy result; notation was made of this fact.

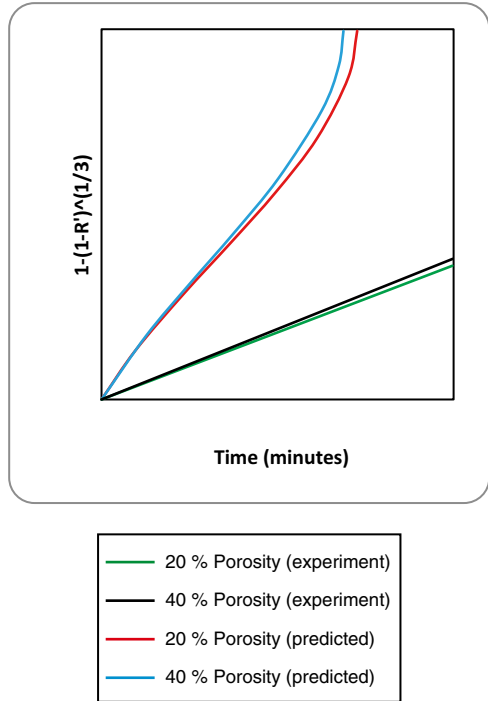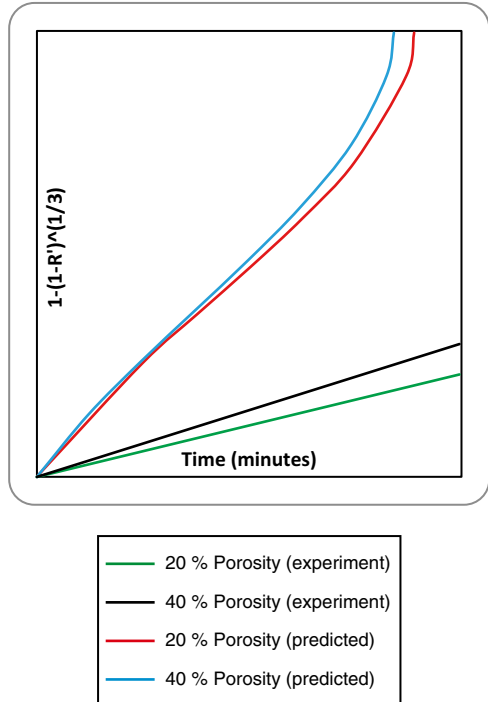**Fig. 51.2** Reduction of ferric oxide at 800 °C

Fig. 51.3 Reduction of ferric oxide at 700 °C

Besides that, during modeling in this prediction model, considerable assumptions were made. Firstly, it was assumed that pellet size is constant before and after reduction. But in actual case, pellet size would not be same as it was before reduction. Besides that, it was also assumed that pellet is spherical before and after reduction. But in actual case, the pellet would be deformed to a spherical shape after reduction. Due to these factors, the predicted result and experimental result become less accurate and formed substantial fitting gap between them.

Furthermore, the flow rate of hydrogen gas can significantly affect the result. In this project, flow rate of hydrogen gas was assumed to be stable and not fluctuate during reaction. But in reality, it was impossible to maintain stability because some fluctuations may take place. For example, the flow rate of hydrogen may not be constant and consistent in terms of flow rate and pressure. The poor flow rate of gas or pressure of hydrogen gas that took place in the furnace may cause or lead to poor results. The inconsistency of fluctuation will cause slight gap between theoretically predicted transport-limited reaction rates and those of experimental work. These factors also will reduce the fitting accuracy significantly. Therefore, to improve the result, these defects must be eliminated and the good operational condition of furnace must be ensured.

The impact of temperature on pellet is one of the root factors that may cause a significant deviation in the predicted and experimental fitting result. In the isothermal shrinkage core model for hydrogen reduction of ferric oxide, the temperature is assumed constant. For this isothermal shrinkage core model the temperature of all the inner shell will remain constant. But in actual hydrogen reduction, the temperature of pellet is not constant for each shell. It is impossible to sustain the temperature constancy for each shell during reaction in the furnace. Therefore, when temperature was assumed constant for pellet, it made the predicted result greatly and inaccurately differ from the experimental result. This may generate a big gap between predicted and experimental results.

Although there were differences between the predicted result and experimental result, the model is still working effectively by indicating the transport-limited reaction rate trend similarity for both hydrogen reduction of ferric oxide. According to literature [1, 7], the reaction rate will increase as the temperature and porosity of reactant is increased. This means that the predicted model complies with the theoretical demand and indicates the trend of homogeneity with experimental results for hydrogen reduction of ferric oxide. In hydrogen reduction of ferric oxide, it also can be concluded that the reaction rate will increase as the temperature and porosity of reactants increase.

Conclusion

Although the experimentally observed reaction rate was significantly slower than the predicted transport-limited rate, the kinetic model has indicated the good trend of behavioural similarity for experimentally observed hydrogen reduction of ferric oxide.

The kinetic model also has provided an optimal fitting trend for the experimental hydrogen reduction of ferric oxide to progress in this research.

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Chapter 52
Factors Influencing Starch Digestibility

Takahiro Noda and Md. Zaidul Islam Sarker

Introduction

Starch is the major source of available energy-producing carbohydrate in the human diet. Starch that avoids digestion by amylases in the small intestine and passes to the large bowel for fermentation is defined as resistant starch (RS). RS appears to be desirable in human health, as it has functional properties similar to fermentable dietary fibers. The amount of RS is related to the rate of starch digestion by amylases. Enzymatic digestibility of starch is largely ascribed to the plant source and is dependent on the physicochemical properties of the starch. Furthermore, it is also influenced by the processing and storage conditions. As most starchy foods are cooked before consumption, the enzymatic digestibility of gelatinized starch is a critical property in the food industry. The digestibility of raw starch is also an important factor for the manufacture of value-added food products, because raw or nearly raw starch is sometimes utilized in food processing.

Investigations regarding in vitro hydrolysis by amylolytic enzymes have indicated extremely low digestibility in raw potato starch having larger granule size [1]. Tuber and root starches contain small amount of covalently bound phosphate. Potato starch has a manifestly higher concentration of phosphate than the other tuber and root starches [2]. Starch-bound phosphate is an important factor that affects pasting properties of the starch [3, 4]. Amylolytic enzymes are incapable of bypassing the phosphorylated glucosyl residue [5, 6]. It is likely that enhanced level of starch

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phosphate might decrease enzymatic digestibility of starch. The potato starch properties, including the granule size, phosphorus content, and pasting properties, differ to some extent according to the cultivars and environmental factors [3, 4]. However, experimental data on starch digestibility are not available using many types of potato starches.

The objective of this study was to assess the variation in the enzymatic digestibility of different potato starches. Isolated potato starches varying widely in granule size, phosphorus content, and RVA (rapid visco-analyzer) pasting properties, as well as other representative tuber and root starches, were selected for the evaluation of the enzymatic digestibility of raw and gelatinized starches. Additionally, the effect of the starch quality parameters, median granule size, phosphorus content, and RVA pasting properties on enzymatic digestibility was determined.

Materials and Methods

Starch Samples

Twenty-six potato starches prepared from potato tubers grown in Japan were used in this study. In addition, three sweet potato starches extracted from sweet potato tubers grown in Japan, one cassava starch isolated from cassava tubers grown in Thailand, and one yam starch isolated from yam tubers grown in Japan were also used.

Starch Analysis

Several starch characteristics, namely, the phosphorus content, granule size distribution, and RVA paste viscosity parameters, peak viscosity, and breakdown, at 4 % starch suspension, were determined as previously reported [4]. The hydrolysis rate (HR) of raw and gelatinized starches by amylolytic enzymes was determined by the modified method of Englyst et al. [1].

Statistical Analysis

The phosphorus content, granule size distribution, RVA analysis, and enzymatic digestibility were determined in duplicate. Each value is the mean of duplicate measurements. The correlation coefficients between the enzymatic digestibility and three parameters of other properties were calculated in 26 potato starches as well as for all the 31 tuber and root starches combined.

Results and Discussion

The starch quality parameters, phosphorus content, and median granule size, as well as the peak viscosity and breakdown as analyzed by RVA in potato, sweet potato, and cassava starches, are provided in Table 52.1. The phosphorus content ranged from 416 to 1,118 ppm for the 26 potato starches, the average value being 770 ppm, while manifestly small values (97–231 ppm) were found in other tuber and root starches. The data for the median granule size reflected a large difference (14.0–44.7 μm) among potato starches and a small difference (15.7–22.8 μm) among other tuber and root starches. The RVA data using a 4.0 % starch concentration indicated that all potato starches exhibited manifestly higher peak viscosity (157–423 RVU) than other tuber and root starches (40–87 RVU). Similarly, a definitely higher breakdown was observed in all potato starches (63–295 RVU) than in other tuber and root starches (2–12 RVU). The HR was calculated from the extent of digestion after 2 h at 37 °C by amylolytic enzymes using raw and gelatinized starches isolated from potato, sweet potato, cassava, and yam (Table 52.1). In general, the HR for raw potato starches was lower, ranging from 0.9 % to 9.8 %. Raw yam starch also had a lower HR (3.9 %), while sweet potato raw starches had higher HRs (16.8–24.5 %). Among the raw starch samples used, the highest HR (36.2 %) was found for cassava starch. Following gelatinization, the HR increased dramatically for all starch samples used. Gelatinized potato, cassava, and yam starches contained HRs of 53.3–67.4 %, 60.6 %, and 61.6 %, respectively, whereas slightly higher HRs (66.3–74.9 %) were recorded for gelatinized sweet potato starches.

This study revealed that the enzymatic digestibility in both raw and gelatinized starches varied when 26 potato starches, 3 sweet potato starches, 1 cassava starch, and 1 yam starch were used. To assess the factors determining enzymatic digestibility, the correlation coefficients were calculated to examine the relationship between the starch quality parameters, such as median granule size, phosphorus content, and RVA pasting properties, and the HR for the 31 tuber and root starches (Table 52.2). The results for the HR of both raw and gelatinized starches were included. The HR for raw starch was significantly and negatively correlated with all starch quality parameters, phosphorus content ($r=0.650$, $P<0.01$), median

Table 52.1 Phosphorus content, median granule size, peak viscosity, breakdown, and HR of tuber and root starches

	Potato starch ($n=26$)	Sweet potato starch ($n=3$)	Cassava starch ($n=1$)	Yam starch ($n=1$)
Phosphorus content [ppm]	416–1,118	113–231	97	166
Median granule size [μm]	14.0–44.7	16.0–19.4	15.7	22.8
Peak viscosity [RVU]	157–423	40–48	45	87
Breakdown [RVU]	63–295	2–6	12	4
HR in raw starch [%]	0.9–9.8	16.8–24.5	36.2	3.9
HR in gelatinized starch [%]	53.3–67.4	66.3–74.9	60.6	61.6

Table 52.2 Correlation coefficients between HR and starch quality parameters, phosphorus content, median granule size, peak viscosity, and breakdown

	HR in raw starch		HR in gelatinized starch	
	All ($n=31$)	Only potato ($n=26$)	All ($n=31$)	Only potato ($n=26$)
Phosphorus content	−0.650**	0.121	−0.398*	−0.053
Median granule size	−0.697**	−0.589**	−0.267	0.099
Peak viscosity	−0.791**	−0.633**	−0.450*	−0.069
Breakdown	−0.705**	−0.606**	−0.401*	−0.071

* and ** = $P<0.05$ and 0.01, respectively

granule size ($r=0.697$, $P<0.01$), peak viscosity ($r=0.791$, $P<0.01$), and breakdown ($r=0.705$, $P<0.01$). When gelatinized starch was used, the HR correlated negatively but weakly with the phosphorus content ($r=0.398$, $P<0.05$), peak viscosity ($r=0.450$, $P<0.05$), and breakdown ($r=0.401$, $P<0.05$). However, the HR for gelatinized starch did not correlate with the median granule size. Next, the correlation coefficients were recalculated using a total of 26 potato starches. The HR for raw starch correlated significantly and negatively with the median granule size ($r=0.589$, $P<0.01$), peak viscosity ($r=0.633$, $P<0.01$), and breakdown ($r=0.606$, $P<0.01$), while no correlation of the phosphorus content with the HR in raw starch was found. In the case of gelatinized starch, no correlation coefficients were found between the HR and all starch quality parameters.

The starch granule size is an important factor affecting the digestibility of raw starch by amylase. Large starch granules have a reduced surface area than smaller ones, and the smaller surface area of the substrate in the larger starch granules reduces the chance for amylase to absorb. Thus, several results, including ours, have shown that large starch granules are digested more slowly than smaller granules [7]. In support of these results, we proved that a larger starch granule was associated with a lower HR in raw starch. In addition, we demonstrated with the use of gelatinized starches that there is no relationship between the HR and the median size of the starch granule. It is well known that amylase action is prevented by the esterified phosphate groups attached to the glucosyl residues of starch [5, 6]. Therefore, the complete hydrolysis of starches with phosphate groups yields phosphoryl-oligosaccharides [8]. According to the report of Abe et al. [5], who studied the degree of hydrolysis of three potato starches differing in phosphorus content with purified glucoamylase, the higher the phosphorus content, the lower the HR. In the present report, we determined the relationship between starch digestibility and starch phosphorus content using many starch samples with a large range in phosphorus content. The influence of the phosphorus content on the enzymatic digestibility in raw and gelatinized starches could be confirmed for the composite of potato and other starches, while such trends were not found within potato starches. One explanation for these results may include that the range in phosphorus content for potato starches is narrower (416–1,118 ppm) than that for the composition of potato and other starches (97–1,118 ppm). Another explanation is that the condition for amylase hydrolysis used in the study is not particularly severe.

In food processing, starch is generally gelatinized. However, gelatinization is incomplete when excess water is not used for the manufacture of food. The structure of the starch becoming incompletely gelatinized is a combination of raw starch and gelatinized starch. Moreover, recrystallization and retrogradation would decrease degradability, forming RS. Information regarding the enzymatic digestibility in raw and gelatinized starches is meaningful to the food industry, especially for those divisions that make use of starch.

Summary

Using 26 potato starches, 3 sweet potato starches, 1 cassava starch, and 1 yam starch, we studied some factors influencing the enzymatic digestibility of raw and gelatinized starch. Starches with a larger granule size showed lower digestibility of raw starch, whereas no such trend was found when gelatinized starches were used. Higher values of phosphorus content were generally associated with lower digestibility in raw and gelatinized starches. Our data would provide useful information for the food industries that make use of potato starch.

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Chapter 53
Removal of Reactive Dye by Flat Sheet-Supported Liquid Membrane Using Tridodecylamine as a Carrier

Norlisa Harruddin, Norasikin Othman, Zing Yi Ooi, and Ani Idris

Introduction

One of the most strictest environmental regulations is the treatment and discharging of dye-containing wastewater. It is reported that around 700,000 tons of dye are produced and an estimated 50 % of them are azo dyes [1–3]. Majority of these dyes come from the textile industry and are discharged during dyeing process. Textile dyeing is one of the most environmentally hazardous aspects of the textile industry. During dyeing process, hazardous chemicals such as azo dyes, halogenated benzenes, surfactants, phenols, biocides, and many other additives were discharged [4]. These components cannot be treated simply and need expensive treatment.

Numerous treatment technologies have been applied for dye wastewater treatment ranging from conventional physiochemical and biological treatment. There are many techniques used to treat dye wastewater like oxidation-ozonation [5], adsorption [6, 7], biological treatment [8, 9], coagulation and electrochemical techniques [10, 11], and membrane process. Conventional treatment for handling wastewater dye is proven to be not effective because of the chemical stability of these dyes [12]. Biological process is effective in removal of dyes. However, in some cases it fails to decolorize due to the presence of non-biodegradable organic [13, 14]. In recent years, remarkable increase in the application of liquid membrane for separation process has been

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developed [15, 16]. Liquid membrane technique known as "supported liquid membrane (SLM)" is very competitive for the removal and recovery of desired solute from waste. SLM is known as an effective method since it combines extraction and stripping step in one single process. The single process provides maximum driving force which can facilitate the separation of desired solutes.

The objective of this SLM separation technique is to separate reactive dye from feed phase into a strip phase/recovery phase through a membrane support layer. The recovery of reactive dye ions is very selective since the formulation of liquid membrane only allows targeted solute to pass through the membrane and undesired solute to remain in the feed phase. This method is most attractive compared to other conventional methods due to several advantages such as low energy demand, low operating cost, small amount of carrier, mass transfer in a single step, and possibility in achieving high separation value [4, 17]. To the best of our knowledge, no work has been conducted on the removal and recovery of reactive dyes from an aqueous solution using SLM process. In this study, an attempt was made to remove and recover Red 3BS from an aqueous phase by using SLM process.

Methods and Experiments

Reagents and materials. Red 3BS was used as reactive dye in feed phase. Tridodecylamine (TDA) and salicylic acid (SA) were used as a carrier and co-carrier purchased from Merck (>95 %). Reagent grade kerosene and Sodium hydroxide (NaOH) were used as a diluent and stripping agent were purchased from Merck.

Commercial Membrane. ACCUREL polypropylene membrane with pore size of 0.1 μm and constant thickness of 100 μm was selected as a commercial support for dye transport studies. The membrane is found suitable to be used as a support because of its capability to diffuse the dye ion without the aid of organic liquid.

Membrane support. The liquid membrane was prepared by dissolving TDA and SA in the kerosene. The polypropylene membrane was impregnated in organic solution containing 0.1 M TDA and 0.1 M SA for almost 24 h. After that, filter paper was used to remove away excess organic liquid on the surface membrane before being placed in the membrane cell. The microporous membrane was clamped into a membrane cell.

Supported Liquid Membrane

Experimental Setup. The experiment was carried out in a membrane cell consisting of two bottle compartments and separated by the microporous polypropylene membrane as shown in Fig. 53.1. The feed and strip phases contain 150 ml of 50 ppm Red 3 BS and 150 ml of NaOH solutions in the SLM reactor. The flow rate
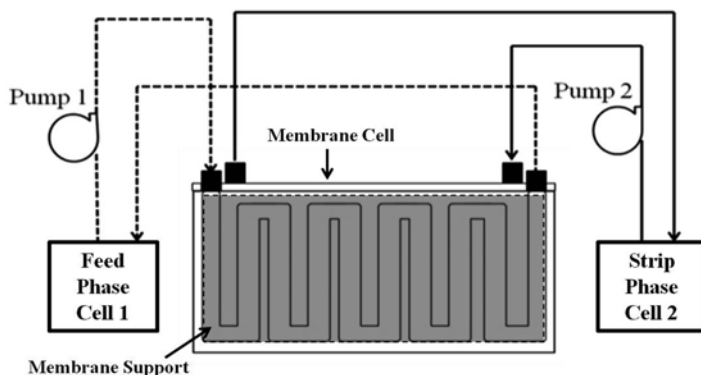
Fig. 53.1 Schematic diagram of SLM extraction

was fixed to 50 ml/min throughout the experiment and controlled by two flow meters. 1.5 ml of sample from both aqueous phases was collected in each 30 min interval for further analysis. The concentration of Red 3BS was measured using Libra S6 Biochrom Spectrophotometer at maximum wavelength, λ_{max}, of 511 nm.

Determination of Transportation Performance. The extraction and recovery performance was calculated using Eqs. 53.1 and 53.2:

$$Removal\ performance = \frac{[Cd]f}{[Cd]fi} \tag{53.1}$$

$$Recovery\ performance = \frac{[Cd]s}{[Cd]fi} \tag{53.2}$$

where $[Cd]_{fi}$ is the initial concentration of dye ions in the feed phase, $[Cd]_f$ is the concentration of dye ions in feed phase at a given time, and $[Cd]s$ is the concentration of dye ions in the strip phase at a given time.

Results and Discussion

Effect of pH Feed Phase. The influence of pH of feed phase on the transportation of Red 3BS is shown in Fig. 53.2. As can be seen, low performance of extraction was obtained at pH 1 and pH 5. This can be attributed to low pH 1 which is a too acidic medium which induces higher ion dissociation, thus causing the accumulation of ion. The result shows that the good transportation of Red 3BS was at pH 2, 3, and 4. However, pH 3 was selected because at this condition, almost 100 % of reactive dye was successfully removed within 270 min of extraction time, whereas the performance of recovery showed that around 80 % of Red 3BS was recovered.
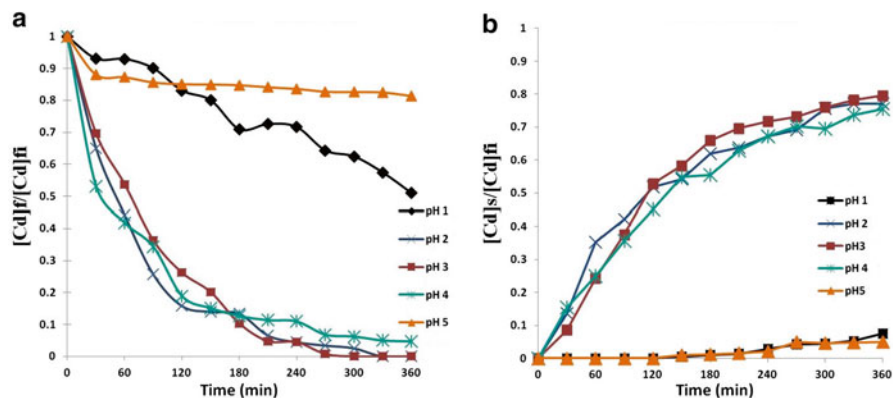
Fig. 53.2 Removal and recovery performance of Red 3BS by varying pH of feed phase (experimental condition: Red 3BS: 50 ppm, tridodecylamine = 0.1 M, salicylic acid = 0.1 M, sodium hydroxide = 0.1 M, flow rate = 50 ml/min). (**a**) Removal of Red 3BS (feed phase). (**b**) Recovery of Red 3BS (strip phase)

This result shows that these pH are adequate for the formation of anionic Red 3BS and complexation between cationic carrier and anionic Red 3BS, thus increasing the extraction efficiency [4]. As pH was further increased to pH 5, the extraction and recovery performance decreased. At this pH, the medium is not acidic enough to enhance the ion formation and is insufficient for the complexation with the carrier.

Effect of Strip Phase Concentration. Strip phase concentration plays a vital role in the separation of reactive dye from feed phase to strip phase. In strip phase, it consists of the stripping agent which is selectively bound with the reactive dye ions. If the dye ion complex is not properly stripped, the membrane phase becomes saturated with dye ions complex and the recovery rate will decrease [18]. The effect of strip phase concentration was investigated by varying the concentration of NaOH in the range of 0.025–0.3 M. Figure 53.3 exhibits the effect of NaOH concentration on transportation of Red 3BS. It was observed that the optimum performance of removal and recovery was achieved at concentration 0.025 M. At this condition, almost 100 % of Red 3BS was removed within 240 min, and around 67 % of Red 3BS was recovered within 360 min. It shows that the presence of NaOH in the stripping phase helps the transport of dye by carrying away the dye ion from the feed phase and recovering it in the strip phase. However, further increase in NaOH concentration had no significant effect on transportation of reactive dye. Therefore, it was concluded that 0.025 M NaOH was sufficient for stripping out dye ions from membrane phase.

Effect of Feed Phase Concentration. The influence of feed phase concentration on the separation of Red 3BS was studied. Figure 53.4 exhibits the effect of feed phase concentration on transportation of reactive dye. As can be seen, the performance of removal and recovery of reactive dye were optimum at low concentration of feed
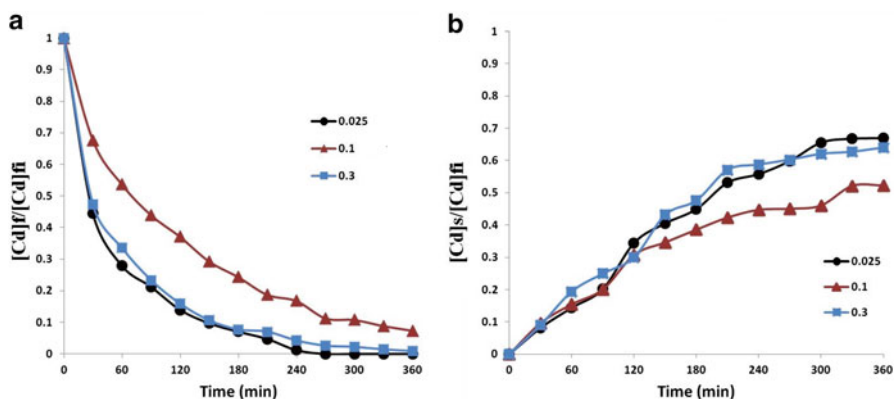
Fig. 53.3 Removal and recovery performance of Red 3BS by varying concentrations of stripping agent (experimental condition: Red 3BS: 50 ppm (pH:3), tridodecylamine = 0.1 M, salicylic acid = 0.1 M, flow rate = 50 ml/min). (**a**) Removal of Red 3BS (feed phase). (**b**) Recovery of Red 3BS (strip phase)
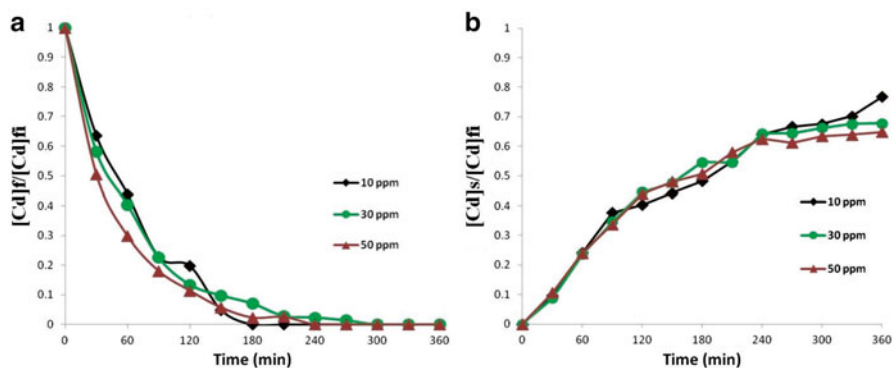

Fig. 53.4 Removal and recovery performance of Red 3BS by varying initial concentrations of feed phase (experimental condition: tridodecylamine = 0.1 M, salicylic acid = 0.1 M, sodium hydroxide = 0.1 M, flow rate = 50 ml/min). (**a**) Removal of Red 3BS (feed phase). (**b**) Recovery of Red 3BS (strip phase)

phase. It was observed that optimum extraction performance was achieved at concentration of 10 ppm with 100 % of removal and 77 % of recovery of Red 3BS. Further increase in the concentration of feed phase decreased the performance of removal and recovery of dye. It might be due to the saturation and deposition of dye-carrier complex at the membrane pore, thus diminishing the effective membrane area. Saturation of the dye ion complex on membrane surface will enhance the retention and deposition of reactive dye ion, thus decreasing the performance of the extraction [18, 19].

Conclusion

Supported liquid membrane containing tridodecylamine (TDA) as carrier can be effectively used for the separation of Red 3BS reactive dye from aqueous solution. The transport efficiency was found to be dependent on the feed phase acidity, and the results show that the maximum recovery of dye was at pH 3. The concentration of carrier and stripping agent was 0.1 M. Under this optimum condition, almost 100 % and 60 % of Red 3BS was successfully removed and recovered from aqueous feed phase. Therefore, it can be concluded that SLM is a promising technique for the removal and recovery of reactive dyes.

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Chapter 54
Extraction of Ionized Nanosilver by Emulsion Liquid Membrane Using Cyanex 302 as a Mobile Carrier

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Introduction

Nanosilver has become one of the most beneficial nanoparticles due to its antibacterial properties which have been widely used in various fields such as food, consumer products, and medical application. About 30 % of nanosilver in paint on building facades is lost within 1-year exposure to the ambient weather conditions, and 1.4 up to 270,000 µg nanosilver ion released from consumer products at home has been reported [1, 2]. Farkas et al. [3] have investigated the release of nanosilver ion from the nanowashing machine during the washing operation via electrolysis process that binds with the other organic substances existing in the water. The release behavior of ionized nanosilver through consumer products has brought the toxicity problem which is detrimental to the terrestrial and aquatic organism life as the toxicity of silver is significantly proportional to the rate of releasing free silver ions [4, 5]. Benn et al. [6] also observed the release behavior of nanosilver from commercial socks where silver ion can easily leak into the wastewater during washing which can disrupt other helpful bacteria used in wastewater treatment, endangering aquatic organisms by inhibiting the bacterial growth and even killing them by destroying the bacterial membrane structure.

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A number of techniques have been introduced for silver ion removal such as electrolysis, ultrafiltration, electrochemical deposition, and solvent extraction but are still subject to some limitations. Ultrafiltration leads to membrane fouling and decomplexation of silver ion, whereas electrodialysis involves higher consumption of energy [7]. The electrochemical method requires high capital investment and expensive electricity supply [8]. Solvent extraction technique provides some advantages which are simple, speedy, and less contaminated but uses a huge quantity of carrier. Liquid membrane technology is highly selective over other conventional techniques and widely applied for heavy metals extraction due to ease of operation, energy saving and employing simultaneous extraction and stripping process [9, 10]. Emulsion liquid membrane (ELM) is one of the configuration liquid membrane technologies that has attracted the attention of a lot of researchers because this technique has demonstrated a great efficiency in metal separation field. This process contributes three-phase dispersion system consisting of stripping phase encapsulated by organic phase, containing carrier in organic diluent together with a surfactant to stabilize the emulsion. The solute present in the feed solution forms a complex with a carrier which then diffuses through organic phase to stripping phase to re-extract.

The carrier will form a complex with the targeted solute and promotes the solute transfer through the membrane via facilitated transport. The performance of emulsion liquid membrane depends on several characteristics of carrier which is highly selective to the solute ions, possess rapid kinetic of complexation and decomplexation in membrane phase, no side reaction and low solubility in aqueous phase. The selectivity of carrier is crucial in the ELM system and can be conducted through solvent extraction or liquid-liquid extraction studies. Sulfur-substituted phosphinic acids such as Cyanex 301 and Cyanex 302 are recognized to be useful for the extraction of transition metal [11]. It is reported that the carrier containing $P=S$ and $P(S)SH$ functional groups strongly extracts the silver in the whole range of hydrochloric acid except for the very high concentration [12]. These properties increase the acidity of the carrier, making them particularly suitable for the extraction of soft Lewis acid metal ions such as Ag(I), Ni (II), and Zn (II) in accordance with the hard-soft acid-base (HSAB) principle. Hard-soft acid-base concept is an extremely useful qualitative theory that enables the predictions of what adducts (addition product) will form in a complex mixture of potential Lewis acid and bases. This theory is simple where hard acid prefers hard base and soft acid prefers soft base. Some examples of soft acids include Cu^+, Hg^{2+}, Au^+, Ag^+, and Pb^{2+}. Soft bases are characterized by a donor atom of intermediate to high electronegativity ranging from 2.1 to 3.0, large size, leading to polarizability. The examples of soft bases are S^{2-}, I^-, and Br^- [13]. In this work, the applicability of ELM technique was carried out to remove silver ions from simulated wash water using Cyanex 302 as a mobile carrier. Three important parameters that affect the performance of the silver ion extraction were studied such as Cyanex 302 concentrations, time of extraction, and agitation speed.

Materials and Methods

Materials

Cyanex 302 as a carrier, Span 80 as a surfactant, and kerosene as a diluent and silver nanopowder were procured from Sigma-Aldrich. Sulfuric acid as a stripping agent solution was purchased from Qrec. All reagents are industrial grade and used as received.

Methods

The experimental steps consisted of two parts. The first part was the formation of emulsion and the second part was the emulsion liquid membrane extraction of ionized nanosilver from simulated wash water containing nanosilver. The emulsion was prepared by emulsifying an aqueous stripping solution of sulfuric acid and organic membrane phase containing Cyanex 302 as a carrier and Span 80 as a surfactant in kerosene as a diluent by homogenizer at 12,000 rpm within 5 min. The fresh milky white solution of emulsion formed was then dispersed into the simulated wash water containing ionized nanosilver as a feed phase. After the extraction process, the mixture of emulsion and feed phase was then poured into the separation funnel for phase separation for half an hour. The aqueous feed phase was separated from the mixture, and the concentration of ionized nanosilver was measured using an atomic absorption spectrometry (AAS). The volume of emulsion before and after extraction process was measured and recorded for swelling study. The percentage of ionized nanosilver extraction and membrane swelling was determined by using Eqs. 54.1 and 54.2:

$$\%Extraction, E = \frac{C_i - C_f}{C_i} \times 100\% \tag{54.1}$$

$$\%Swelling, S = \frac{V_i - V_f}{V_i} \times 100\% \tag{54.2}$$

where C_i is the initial concentration of silver in feed phase, C_f represents the concentration of silver after extraction, V_i is the initial volume of emulsion before extraction, and V_f is the volume of emulsion after extraction.

Results and Discussion

Effect of Cyanex 302 Concentration

Carrier plays an important role in ELM because they form a complex with silver ions and transport the solutes from external phase into the internal phase continuously and reversibly through the membrane phase. Figure 54.1 shows the effect of Cyanex 302 concentrations on the performance of silver ion extraction and swelling percentage. As shown in Fig. 54.1, the extraction efficiency increased from 42 to 70 % when increasing Cyanex 302 concentration from 0.01 to 0.05 M. At 0.01 M, only 42 % was extracted with a higher degree of swelling because the low carrier concentration was insufficient for the complexation of Ag-Cyanex 302 in the membrane phase. With further increase of carrier concentration up to 0.07 M, the extraction efficiency gradually decreased. The high carrier concentration in the membrane phase can lead to the accumulation occurrence of carrier-solute complexes being unstripped into the internal phase. In addition, this condition also increases the membrane thickness with an excessive Cyanex 302 concentration, thus resisting the permeation of silver ions into the stripping phase [9]. It can be observed that the swelling percentage increased as a result of increasing carrier concentration from 0.03 to 0.07 M. It seems possible that these results are due to the surfactant that continuously transports the water molecules into the internal phase [10]. Therefore, 0.05 M of Cyanex 302 is sufficient for the next extraction process with the highest percentage of silver ion extraction.
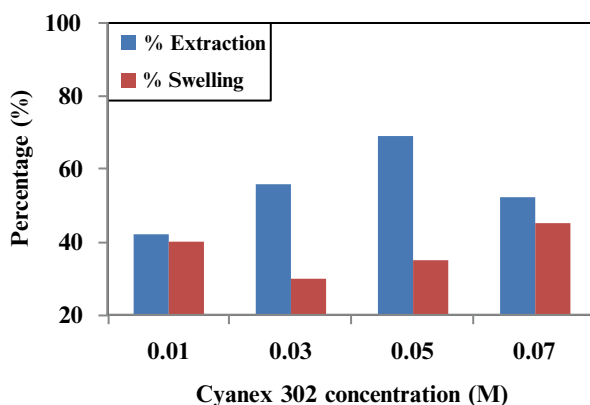

Fig. 54.1 Effect of various concentrations of Cyanex 302 on the performance of silver ion extraction and swelling percentage (experimental conditions: Span 80 = 3 % (w/v), TR = 1:5, agitation speed = 250 rpm, extraction time = 15 min, homogenizer speed = 12,000 rpm, stripping phase = 1 M H_2SO_4, and diluent = kerosene)
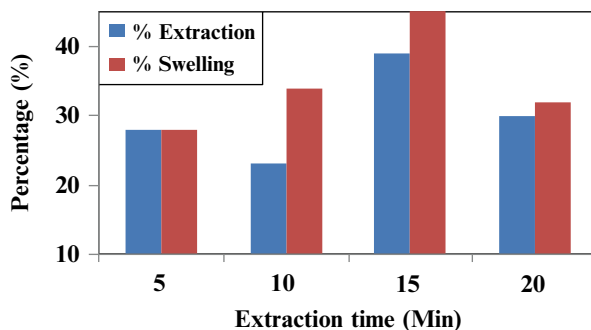
Fig. 54.2 Effect of various extraction times on the performance of silver ion extraction (experimental conditions: Cyanex 302 = 0.05 M, Span 80 = 3 % (w/v), TR = 1:5, agitation speed = 250 rpm, homogenizer speed = 12,000 rpm, stripping phase = 1 M H_2SO_4, and diluent = kerosene)

Effect of Extraction Time

Extraction time is defined as the dispersion time of emulsion to the feed phase. Figure 54.2 represents the effect of various extraction times in the performance of silver ion extraction and swelling percentage. It can be observed that for the first 10 min, the extraction has decreased from 28 % to 23 % and the highest extraction was achieved at 15 min when 39 % of silver ion was extracted even though at this stage higher degree of swelling was observed. With the further increase of the extraction time up to 20 min, the extraction efficiency significantly also decreased to 30 %. Longer extraction time leads to the extended exposure of high shear of speed which results in the emulsion breakage. This is due to the transportation of water molecules consequently diluting the internal phase and decreasing the extraction efficiency [9]. Gasser et al. [14] indicated that the short extraction time leads to the emulsion breakage due to the large size of droplets which are conducive for their coalescence. The mass transfer in ELM system occurs very fast and longer extraction time only enhances the emulsion swelling. Thus, 15 minutes of extraction time was the best condition for this system.

Effect of Agitation Speed

Figure 54.3 demonstrates the effect of agitation speeds on the performance of silver ion extraction and swelling percentage. The result exhibits that the degree of silver ion extraction gradually decreased from 150 to 250 rpm when the reduction in the extraction percentage of silver ions occurred from 57 % to 48 %, respectively. It can be seen that the swelling percentage was 45 % during 150–200 rpm. This is because the higher mixing speed promotes the breakage of the emulsion droplets. At the
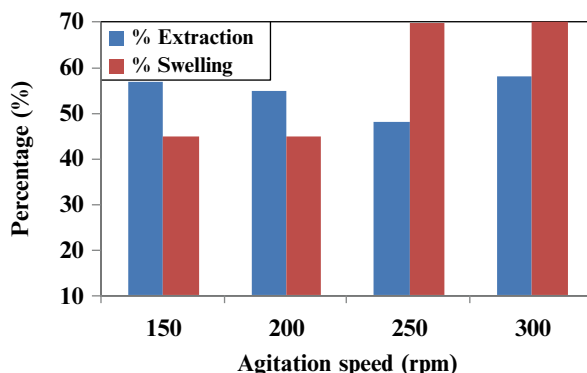
Fig. 54.3 Effect of various agitation speeds on performance of silver ion extraction and swelling percentage (experimental conditions: Cyanex 302 = 0.05 M, Span 80 = 3 % (w/v), TR = 1:5, extraction time = 15 min, homogenizer speed = 12,000 rpm, stripping phase = 1 M H_2SO_4, and diluent = kerosene)

same time, some globules also tend to swell at the same time. Then, there exists a trade-off between these two effects. Beyond 200 rpm, the emulsion seemed to be unstable when the extraction percentage decreased and then slowly increased again with the higher degree of swelling up to 80 %. Basically on increasing the agitation speed, the shear force which acts on the emulsion increases, hence producing smaller globules which give a high interfacial area for the mass transfer of the solute extraction. Nevertheless, the membrane tends to rupture, thus diluting the internal phase [9]. Similar observation was reported by Das et al. [15] where the extraction percentage decreased as the stirring speed was above the optimum rate. It is because the higher stirring speed adversely affects the stability of emulsified globules which lead to the breakage. In this study, the highest extraction of silver ions (57 %) was achieved at 150 rpm with the lowest degree of emulsion swelling.

Conclusion

The removal of ionized nanosilver from simulated wastewater using an emulsion liquid membrane process was carried out in this research. Cyanex 302, which acts as a carrier, showed a good performance as approximately 70 % of ionized nanosilver was extracted. The results showed that optimal conditions for the ELM system were obtained at a concentration of 0.05 M Cyanex 302, a 15 min extraction time, and an agitation speed of 150 rpm.

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Chapter 55
Gasification of Triple Fuel Blends Using Pilot-Scale Fluidised-Bed Gasification Plant

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Introduction

Natural gas resources are heading to depletion by 2020 where else coal resources are sufficient for another 200 years. To replace the natural gas, synthetic gas (syngas) is used as a substitute fuel. Gasification is a manufacturing process that converts solid fuel such as coal, biomass and refinery residues into synthetic gas. Gasification is flexible, reliable and clean energy technology that can help reduce our dependence on natural gas.

An integrated gasification combined cycle (IGCC) power plant combines a gasification system with a modern, highly efficient "combined cycle" electric power system consisting of one or more gas turbines integrated with a steam turbine.

The aim of this study is to identify the suitability of triple fuel (coal, biomass and petroleum coke) to be applied in the pilot-scale gasification plant. This project is expected to promote the utilisation of the clean coal technology (e.g. gasification) in Malaysia.
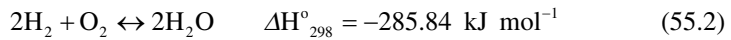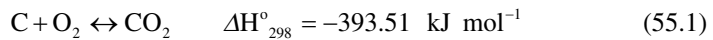
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Theory

Coal gasification essentially comprises of two successive processes: pyrolysis (between 573 and 773 K) and char gasification [1]. Basic reactions of coal gasification processes (Eqs. 55.1, 55.2, 55.3, 55.4 and 55.5) can be divided into two groups: exothermic and endothermic reactions. Main exothermic reactions are reactions of oxygen with carbon and hydrogen from coal and the water-gas shift reaction. Main endothermic reactions are reactions of CO_2 reduction (the Boudouard reaction) and the water-gas reaction.

Reactions of oxygen with carbon and hydrogen from coal supply heat which is necessary for endothermic reactions:

$$C + O_2 \leftrightarrow CO_2 \qquad \Delta H^\circ_{298} = -393.51 \ kJ \ mol^{-1} \qquad (55.1)$$

$$2H_2 + O_2 \leftrightarrow 2H_2O \qquad \Delta H^\circ_{298} = -285.84 \ kJ \ mol^{-1} \qquad (55.2)$$

These reactions proceed to complete the consumption of oxygen. Water-gas shift reaction is a slightly exothermic reaction:

$$H_2O + CO \leftrightarrow H_2 + CO_2 \qquad \Delta H^\circ_{298} = -41.17 \ kJ \ mol^{-1} \qquad (55.3)$$
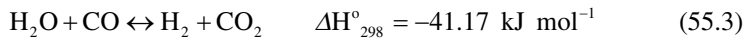
Reaction of CO_2 with carbon is an endothermic reaction:

$$C + CO_2 \leftrightarrow 2C \qquad \Delta H^\circ_{298} = -172.5 \ kJ \ mol^{-1} \qquad (55.4)$$
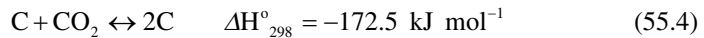
The most intensive change of concentrations occurs in the temperature range from 700 to 1200 K. Above the temperature of 1,200 K, the concentration of CO_2 is almost 0 (vol.%), and the concentration of CO is almost 100 (vol.%) [1]. Water-gas reaction is an endothermic reaction:

$$C + H_2O \leftrightarrow H_2 + CO \qquad \Delta H^\circ_{298} = -131.3 \ kJ \ mol^{-1} \qquad (55.5)$$
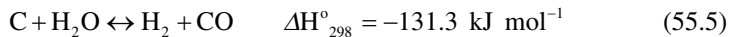
The most intensive decomposition of steam occurs in the temperature range from 600 to 1,100 K. Above the temperature of 1,100 K, the concentration of steam is almost 0 % (vol), while hydrogen and CO concentrations are equal and approach 50 % (vol).

Previously, Fermoso [2] had conducted gasification study of triple fuel using stainless steel tubular reactor 13 mm internal diameter and 305 mm height, while Gomez-Barea et al. [3] gasified blends of two waste feedstocks, orujillo (a by-product from olive oil extraction industry) and meat and bone meal (MBM), using pilot-scale 150 kW$_{th}$ fluidised-bed gasification plant. However, in this study, petroleum coke and biomass are used as the alternative fuels.

Research Methodology

Feedstock Preparation

For this study, Adaro coal (subbituminous) was used for all the gasification tests. Empty fruit bunches (EFB) from oil palm were used as biomass feedstocks. The biomass samples were taken from Szetech Eng. Sdn. Bhd. Petroleum coke used in this analysis is a green type from Petronas refinery. Coal and petroleum coke were grinded and sieved to 600 μm size. The EFB size of 1–2 mm was used for the gasification tests.

Laboratory Analysis

Ultimate analysis is the determination of the elemental composition of organic fractions; it refers to carbon (C), hydrogen (H), nitrogen (N), sulphur (S) and oxygen (O) contents. CHN analysis and S determination were conducted using Leco 3839 and Eltra CS500 instruments, respectively. Oxygen contents were calculated by the difference of the mole fraction.

Proximate analysis is used to measure inherent moisture content (M), volatile matter (VM), fixed carbon (FC) and ash content (A) in the fuels. Pyris 6 TGA was used to determine all of these parameters. Heating value or energy value for these fuels was analysed using Leco automatic calorimeter (AC 350).

Producer gas compositions from the gasification tests were analysed using gas chromatography (GC). The main compositions of the producer gas are hydrogen (H_2), carbon monoxide (CO), methane (CH_4) and other hydrocarbons. Low heating value (LHV) of the producer gas analysis is calculated based on the fraction mole of the gas chromatography (GC) results.

Low heating value for the producer gas analysis was calculated using Eq. 55.6 from Skoulou [4], as follows:

$$LHV_{pg} = \left(30 * CO + 25.7 * H_2 + 85.4 * CH_4 + 151.3 * C_2H_x\right) * 0.0042 \ MJ/Nm^3$$

$$(55.6)$$

Gasification Tests

Gasification tests were conducted using pilot-scale fluidised-bed gasification plant (PSFBGP) (height, 3.1 m, and diameter, 0.35 m) as shown in Fig. 55.1.
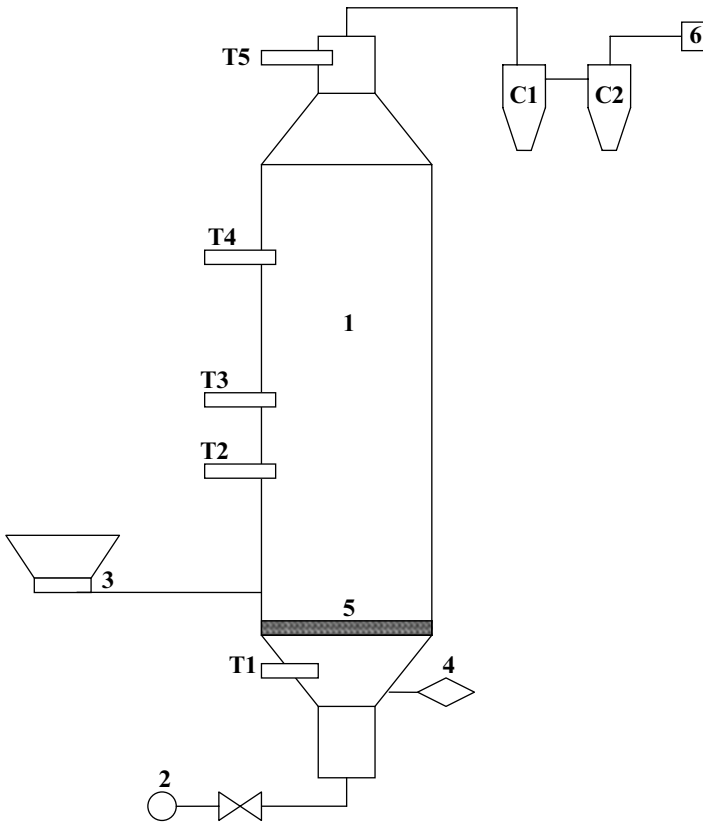
Fig. 55.1 Schematic drawing for pilot-scale fluidised-bed gasification plant, which consists of seven main parts: (*1*) fluidised-bed gasifier, (*2*) air blower, (*3*) screw feeder, (*4*) liquid petroleum gas (LPG) burner, (*5*) distributor plate, (*6*) gas analysis, (C) cyclones and (T) thermocouples

Adaro coal and triple blend of coal/biomass/petroleum coke of 80:10:10, 80:5:15 and 80:15:5 blend ratios were tested using PSFBGP. Gasification tests were conducted at bed temperature of 900 °C and equivalence ratio, ER, of 0.35.

Results and Discussion

Proximate Analysis

Results for moisture content, volatile matter, fixed carbon and ash content for Adaro coal, biomass (EFB) and petroleum coke are shown in Table 55.1.

Adaro coal has the highest moisture content compared to other fuels, and petroleum coke has the lowest moisture content. EFB shows higher volatile matter

Table 55.1 Characterisation results for proximate analysis

Sample	Proximate analysis (%)			
	Moisture	Volatile matter	Fixed carbon	Ash
Adaro coal	8.6	46.5	37.1	7.7
Biomass (EFB)	7.3	80.3	11.5	1.5
Petroleum coke	0.3	10.5	89.1	0.1

Table 55.2 Ultimate analysis of the feedstock

	Ultimate analysis (%)				
Sample	C	H	N	S	O
Adaro coal	68.6	5.2	0.3	0.1	18.0
Biomass (EFB)	49.4	6.6	1.0	0.0	41.5
Petroleum coke	86.3	3.8	1.0	5.9	2.9

(80.3 %), followed by Adaro coal and petroleum coke. Abdullah and Gerhauser [5] also reported higher volatile matter (83.8 %) as in their tested EFB. Volatile matter for petroleum coke is expected to be lower as shown earlier in the previous study conducted by Fermoso [2]. Higher volatile matter content usually will promote higher release of combustible gases (e.g. H_2, CO and CH_4) in producer gas during gasification tests. Low moisture content and high volatile matter are favourable in the gasification process in order to produce higher combustible gases.

Petroleum coke has the highest fixed carbon (FC) content (89.1 %) compared to Adaro coal (37.1 %) and EFB (11.5 %). FC for EFB reported by Abdullah and Gerhauser [5] was 10.8 %. On the other hand, petroleum coke also has the lowest ash content (0.1 %) compared to the other fuel, followed by EFB and Adaro coal. From the literature, ash content for petroleum coke was detected around 0.3 % [2]. It reveals that Malaysian petroleum coke has lower ash content. Low-ash fuel is expected to give less operational problem in gasifier.

Ultimate Analysis

Ultimate analysis for all fuels was analysed for carbon, hydrogen, nitrogen, sulphur and oxygen contents. The results are shown in Table 55.2.

Carbon content in petroleum coke (86.3 %) is higher than Adaro coal (68.6 %). This result was in agreement with the fixed carbon result, which showed petroleum coke has the highest fixed carbon content. In comparison with the reported value, carbon content in petroleum coke was detected (87.6 %) [2]. Hydrogen contents were higher in EFB and coal compared with petroleum coke.

Nitrogen content for Adaro coal was found lowest compared to others. Sulphur and oxygen contents were found low for EFB and petroleum coke, respectively.

Table 55.3 Heating value of the feedstock

Sample	HV	
	(Kcal/kg)	(MJ/kg)
Adaro coal	5,966	24.9
Petroleum coke	8,903	37.2
Biomass (EFB)	4,341	18.2

Lower nitrogen and sulphur contents in the feedstock are expected to give good quality of producer gas. Fermoso [2] reported 6.2 % of sulphur content in their petroleum coke; it reveals that Malaysian petroleum coke has lower sulphur contents.

Heating Value

Heating value analysis was conducted using bomb calorimeter. The feedstock heating value varies from 4,341 to 8,903 Kcal/Kg, in which petroleum coke gives the highest value. In order to compare with other publication, the unit in MJ/Kg was also given in Table 55.3.

Heating value for EFB was found to be the lowest compared to other feedstocks. This may be caused by the lower content of carbon. From the literature, it shows that the heating value for EFB ranges from 17.2 to 19.3 MJ/Kg [5]. Approximately, 10 % of the total blending is the maximum amount that can be used out of other feedstock. This ratio is in line with the reported result by Fermoso [2], with biomass blending ratios of 0, 5 and 10 %.

Heating value for petroleum coke from the literature was found to be about 35 MJ/Kg [2], which is a bit lower compared to the petroleum coke heating value of 37.2 MJ/Kg for this study. From all analysis results of the petroleum coke, it shows that Malaysian petroleum coke has better quality.

Producer Gas Analysis

Producer gas analysis for Adaro coal, petroleum coke and blending fuels is shown in Table 55.4. Hydrogen, H_2, produced for Adaro coal (14.33 mol.%) compared with triple blended fuels. Gasification of triple blended fuel at blend ratio of 80:10:10 gave the highest H_2 content of 12.30 (mol.%). It seems that petroleum coke and EFB had influenced the gasification products based on their fuel properties.

High H_2 contents in all fuels are most probably due to the favourable of water-gas shift reaction (Eq. 55.3) and water-gas reaction (Eq. 55.5). H_2 from the gasification of triple fuel blends (80:10:10) was slightly lower compared to Adaro coal. However, it has the highest H_2 (12.3 mol.%) and LHV (1.33 MJ.Nm^{-3}) among other triple fuel blends. Direct correlation of the producer gas content with the additional of EFB and petroleum coke cannot be achieved. It seems that EFB and petroleum coke properties had balanced up at triple blend ratio of 80:10:10.

Table 55.4 Producer gas analysis for Adaro coal and triple blended fuels

Producer gas	Adaro coal	Coal:EFB:Pet coke	Coal:EFB:Pet coke	Coal:EFB:Pet coke
Compositions (mol.%)	100:0:0	80:15:5	80:10:10	80:5:15
H_2	14.33	5.73	12.30	2.98
O_2	11.79	17.54	7.66	9.84
N_2	64.24	75.08	70.41	78.12
CO_2	8.57	1.64	9.62	8.97
CO	0.92	0.00	0.00	0.07
CH_4	0.11	0.01	0.00	0.01
C_2H_4	0.01	0.00	0.00	0.00
C_2H_6	0.00	0.00	0.00	0.00
C_2H_2	0.02	0.00	0.00	0.00
LHV ($MJ.Nm^{-3}$)	1.72	0.62	1.33	0.34

Conclusions

Gasification of triple fuel blend coal/biomass/petroleum coke (80:10:10) had shown great potential to be utilised in the gasification system.

Further gasification tests using different operating conditions (e.g. ER and bed temperature) will be conducted in the future to achieve the highest quality of syngas for power generation application.

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Chapter 56
Properties of Kelempayan Particleboard in Relation to Particle Size and Type of Resin

Noorshashillawati Azura Binti Mohammad, Mohd Faizal Bin Razali, and Jamaludin Bin Kasim

Introduction

Wooden materials in the building industry have always been popular in many countries as a result of their excellent properties. Due to its use for furniture, architecture, and indoor decoration, wood has always been the largest proportion of material used. With the advance of human civilization, the consumption of wood has increased; in general, the use of this material creates a lot of wastes. Furthermore, wood-based wastes such as flooring, ceiling, and decorations from construction and demolition sites comprise 10 % of the total generated wastes by volume, only exceeded by concrete wastes. These wood-based wastes from construction and demolition sites are usually not included in any recycling lists. They are sent to either combustion facilities or landfills [5].

Recently, wooden wastes are being recycled into other wood products at an increasing rate. The topics of how to recycle wood residues into usable products have been studied for decades. In these reuse products, particleboard has found typical applications as flooring, wall and ceiling panels, office dividers, bulletin boards, furniture, cabinets, counter tops, and desk tops, and it seems that the manufacture of particleboard from recycled wood-based wastes is the most common way to reuse them [5].

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Materials and Methods

Kelempayan (*NeolamarkiaCadamba*) was harvested from HSUiTM Pahang. Leaflets were removed from the log. The log was then chipped to 3–5 cm size. Then, chips were put into ring flakers to produce particles. The size is usually less than 5.0 mm. After being air-dried, the particles were screened to get the desire size of particles: 2 mm, 1 mm and 0.5 mm. The particles were then oven dried at 90 ± 5 °C until the desire moisture contain attained.

Phenol Formaldehyde (PF) and urea formaldehyde (UF) were used as a binder. The resins were supplied by a private company in Klang, Selangor. Particleboard from Kelempayan was fabricated with different type of resin (PF and UF) and particle sizes (2 mm, 1 mm and 0.5 mm). The target density is 700 kg/m^3. The dried particles were then put in the mixer together with the resin.

The mould used was 340 mm × 340 mm. The mats were compressed in a computer controlled hot press at a temperature of 165 °C for 6 min. Pressed panels were cut into test samples based on BS standard [1–3] after they had been conditioned in a climate chamber at a temperature of 20 °C and a relative humidity of 65 %.

Results and Discussions

Modulus of Rupture (MOR) and Modulus of Elasticity (MOE)

Figures 56.1 and 56.2 show the bending strength (modulus of rupture (MOR) and modulus of elasticity (MOE)) of particleboard from Kelempayan. The results showed that MOR and MOE value for panels bonded using 0.5 mm was higher
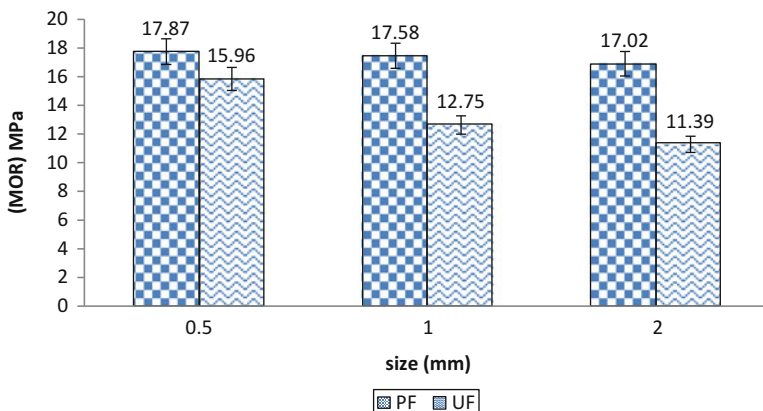
Fig. 56.1 Modulus of rupture (*MOR*) of particleboard from Kelempayan using different types of resin and particle size
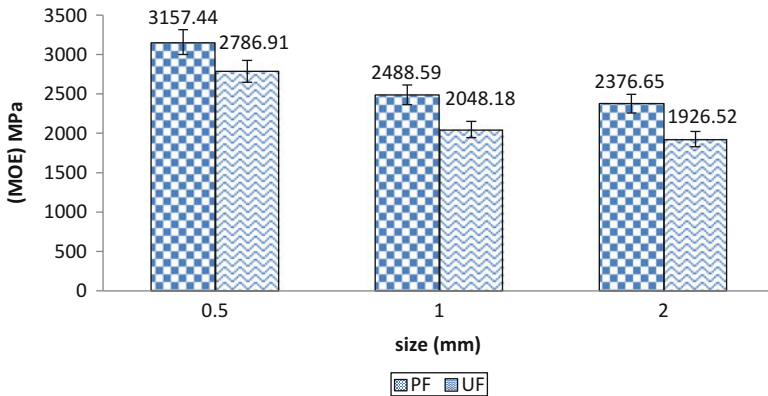
Fig. 56.2 Modulus of elasticity (*MOE*) of particleboard from Kelempayan using different types of resin and particle size
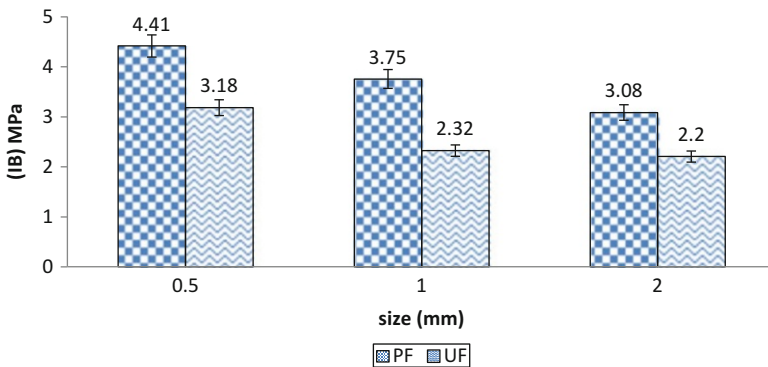
Fig. 56.3 Internal bonding strength of particleboard from Kelempayan using different types of resin and particle size

compared to panels bonded using 1.0 mm and 2.0 mm for both type of resins, PF and UF. Due to smaller particle size (0.5 mm), the strength and stiffness of the particleboard improve compared to bigger particle size (1.0 mm and 2.0 mm). In addition, phenol formaldehyde exhibits higher value of MOR and MOE compared to urea formaldehyde resin.

Internal Bonding (IB) Strength

Figure 56.3 shows the effects of particle size and resin on internal bonding (IB). It shows that 0.5 mm size of particles had the highest internal bonding strength (4.41 MPa) followed by 1.0 mm size of particles (3.75 MPa) and 2.0 mm (3.08 MPa). The presence of phenol formaldehyde increased the internal bonding of the particleboard.
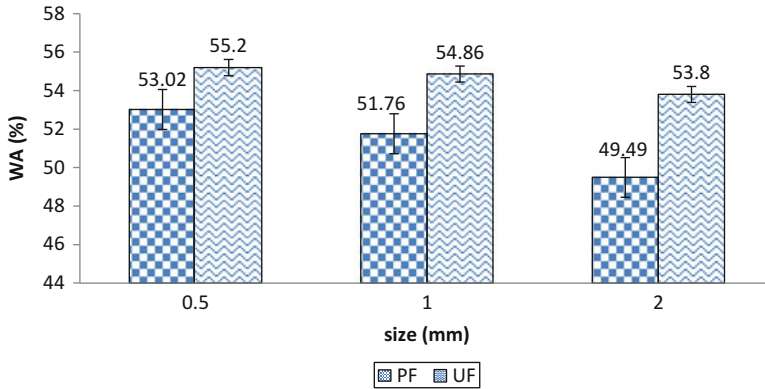
Fig. 56.4 Water absorption of particleboard from Kelempayan using different types of resin and particle size

Water Absorption

Figure 56.4 shows the effects of different particle size and resin on water absorption (WA). Bigger particle size (2.0 mm) exhibits the lowest value of water absorption as compared to smaller particle size (1.0 mm and 0.5 mm). It was due to the smaller particles size have more ability to absorb water rather than larger particles size, in term of weight per unit volume [4]. In addition, Phenol formaldehyde decreased the rate of water intake as compared to urea formaldehyde. It was due to phenol formaldehyde is a water resistance resin and able to prevent the water absorption.

Thickness Swelling

Figure 56.5 shows the effects of different types of particle sizes and resin on thickness swelling (TS). Similar to water absorption, panels bonded using phenol formaldehyde and bigger particle size decreased the thickness swelling rate compared to panels bonded with urea formaldehyde.

Conclusion

In conclusion, different types of resin and particle size affected the mechanical and physical properties of particleboard manufactured using Kelempayan. Resin type had significant effects on the MOR, MOE, IB strength, WA, and TS, whereas phenol formaldehyde increased the mechanical and physical properties. Panels with smaller size of particles (0.5 mm) give more strength in mechanical properties (MOR, MOE, and IB), however increased the physical properties (WA and TS). As a result, the particleboard produced from Kelempayan met the minimum requirement set by BS standard for general uses.
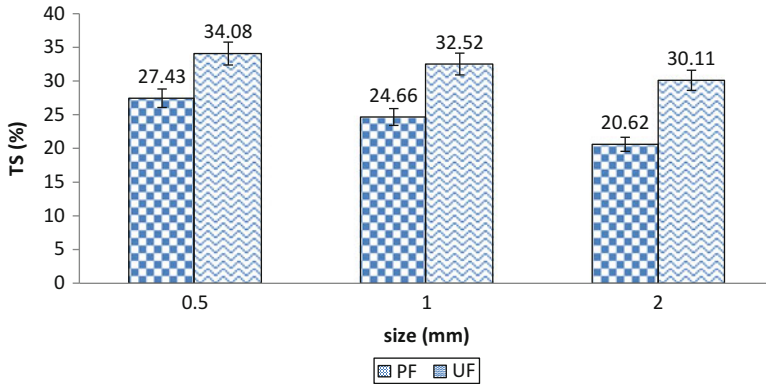
Fig. 56.5 Thickness swelling of particleboard from Kelempayan using different types of resin and particle size

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Chapter 57
Effects of Different Resin Content and Densities on Some Properties of Hybrid Wood Sawdust-*Acacia mangium* Composites

Siti Noorbaini Sarmin, Norhafizah Rosman, Jamaludin Kasim, and Shaikh Abdul Karim Yamani Zakaria

Introduction

Shortage of wood supply in wood-based industry has forced researchers to find alternative materials in order to substitute wood resources generally and fibrous material specifically. The properties of sawdust are expected to be able to solve this problem even by minor proportion.

Increasing the number of timber producers in Malaysia causes an increasing number of wood waste. The sources of wood wastes in Malaysia come from wood residues from logging and wood processing. In wood industry, wood processing can be divided into a few categories such as sawmilling, panel products and composite mill, furniture mill and paper mill. Each subsector produces different types of wood waste [1]. Wood waste has potential to utilize to a value added products in wood based industry. There are many types of potential products that can be utilised from wood waste. The potential utilisation can be divided into three broad categories that include energy production, as secondary raw materials to be used by the wood-based industries and as secondary raw materials to be used by industries outside the wood industry sector [2].

Utilisation of sawdust can be one of the helping factors in adding more types of composite panel product as a new source of material for wood-based industry. Since sawdust is mainly composed of small contaminant of cellulose fibre and inorganic materials, there will be wide commercial application and development prospects for sawdust as a new kind of filler in wood composites [3]. Sawdust can be utilised to produce various types of value-added products which mean the resources of the substitute's material on wood-based industry. Sawdust have been modified and

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processed to produce isotactic poly(propylene)/wood sawdust composite [4]. Efforts have been undertaken on the production of composites, making this abundant, inexpensive and renewable raw material suitable in the production of polypropylene-sawdust composites [5]. In this study, we emphasise on the mechanical properties of hybrid three-layered hybrid composites from sawdust and wild *Acacia mangium*.

Materials and Method

Mixed sawdust was obtained from Wood Composite Lab, UiTM Jengka, Pahang. After air-drying, the sawdust was screened to remove the fine sawdust. Wild *Acacia mangium* was chipped to 3–5 cm size. Next, the chips were put into the ring flakers to produce particles. The size is usually less than 5.0 mm. After air-drying, the particles were screened to get the desired size of particles, 2 mm. The sawdust and *Acacia mangium* particles were then oven dried at 90 ± 5 °C until the desired moisture content is achieved. Urea formaldehyde (UF) was used as a binder. UF was supplied from MAC, Shah Alam, Selangor. UF was used with addition of wax. Three-layered hybrid composites from sawdust and *Acacia mangium* were fabricated with different resin content and density within the face/back (sawdust) and core (*Acacia mangium* particles*).*

Two different resin contents, 8:10:8 and 12:10:12, were used with 500, 600 and 700 kg/m³ board densities. The dried particles were put in the mixer. The amount of resin based on the board requirement was calculated before being mixed in the mixer. The mould used was 350 mm × 350 mm. The mat was prepressed at 150 psi for 2 min. The mats were placed in the hot press, a process accommodating one sheet at a time. The temperature used was set at 185 °C for 6 min. Next, the panels were exposed to the environment temperature about 4–6 min before placing them in the conditioning room. The dimensional stability properties were investigated including the dimensional changes associated with changes in relative humidity of 30–90 %, hysteresis over a range of 30–90 % and durability against biological attack through soil burial test. The properties of bending strength (MOR and MOE), shear strength, internal bonding (IB), thickness swelling (TS) and water absorption (WA) were evaluated based on Japanese Industrial Standard, JIS A 5908:2003 Particleboard (2003).

Result and Discussion

Bending Strength

Table 57.1 shows the modulus of rupture (MOR) and modulus of elasticity (MOE) of hybrid particleboard with 8:10:8 and 12:10:12 resin content at 500, 600 and 700 kg/m³.

Table 57.1 MOR and MOE of hybrid particleboard at 500, 600 and 700 kg/m^3 densities with 8:10:8 and 12:10:12 resin content

Resin content	8:10:8		12:10:12	
Density (kg/m^3)	MOR (MPa)	MOE (MPa)	MOR (MPa)	MOE (MPa)
500	3.23 (0.53)	4.59 (0.62)	571.09 (96.77)	832.46 (107.57)
600	6.10 (0.72)	6.55 (0.82)	1,024.35 (118.26)	1,242.12 (191.30)
700	11.27 (1.74)	13.08 (0.96)	1,908.49 (183.09)	2,229.27 (157.65)

Values in *parenthesis* indicated the standard deviations
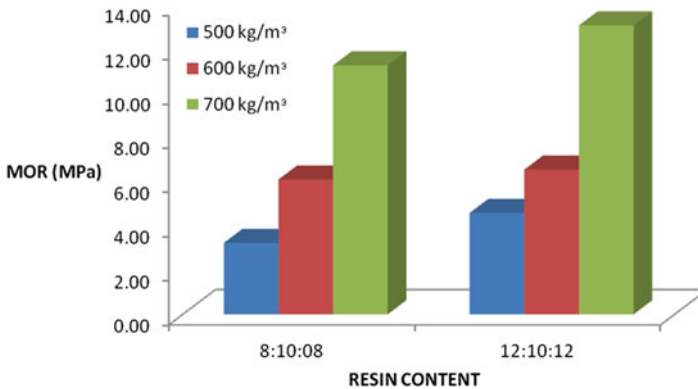
Fig. 57.1 MOR of hybrid particleboard at 500, 600 and 700 kg/m^3 densities with 8:10:8 and 12:10:12 resin content

Bending strength test was carried out in order to determine the modulus of rupture (MOR) and modulus of elasticity (MOE) of hybrid particleboard. From the result obtained, it showed that when the density of the panel increased, the MOR and MOE values were increased. It showed that the density was affected by the strength properties of the panel. Density was one of the parameters that indicated the properties of the wood-based panel composite. Density is directly related to other properties and, therefore, is important as an index of wood quality [6]. The result obtained indicated that MOR and MOE values produced using 12:10:12 resin content were higher compared to 8:10:8. This might be due to the percentage amount of the resin content itself. Amount of adhesive used in forming wood-to-wood bonds is an important parameter that indicates the mechanical properties of the wood products (Figs. 57.1 and 57.2).

One-way analysis of variance (ANOVA) was conducted for MOR and MOE values between the density and resin content. The interaction between factors was statistically identical at $p \leq 0.05$ level of probability. From the ANOVA analysis, the 'model-F values' of 119.942 for MOR and 138.879 for MOE imply that the model was significant with p-values 0.000 and 0.000, respectively.

Fig. 57.2 MOE of hybrid particleboard at 500, 600 and 700 kg/m^3 densities with 8:10:8 and 12:10:12 resin content

Table 57.2 Internal bond strength of hybrid particleboard at 500, 600 and 700 kg/m^3 densities with 8:10:8 and 12:10:12 resin content

Resin content	IB (MPa)	
Density (kg/m^3)	8:10:12	12:10:12
500	0.48 (0.29)	0.94 (0.47)
600	1.25 (0.47)	1.32 (0.62)
700	2.17 (0.73)	2.14 (0.96)

Values in *parenthesis* indicated the standard deviations

Internal Bond (IB) Strength

Table 57.2 shows the IB strength of hybrid particleboard at 500, 600 and 700 kg/m^3 densities with 8:10:8 and 12:10:12 of resin content.

Table 57.2 and Fig. 57.3 show that the IB value produced using 12:10:12 resin content was higher compared to 8:10:8. The amount of resin used affected the internal bond strength of the panel. Within the densities, when the density of hybrid particleboard increased, the IB values were increased too. It was proving that the density affected directly the strength properties of the panel.

One-way analysis of variance (ANOVA) was conducted for IB values between the density and resin content. The interaction between factors was statistically identical at $p \leq 0.05$ level of probability. From the ANOVA analysis, the 'model-F values' of 9.044 for IB imply that the model was significant with p-value 0.000.

Thickness Swelling and Water Absorption

Thickness swelling (TS) and water absorption (WA) test were obtained to determine the percentage of swelling and absorption of hybrid part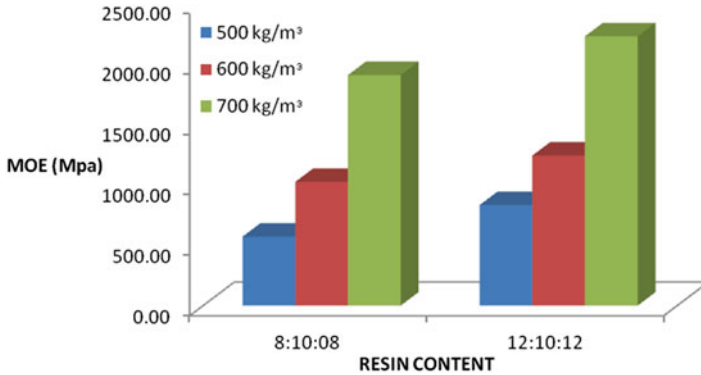icleboard. Figures 57.4 and 57.5 show the result of TS and WA rate of hybrid particleboard at 500, 600 and 700 kg/m^3 densities with 8:10:8 and 12:10:12 resin content.
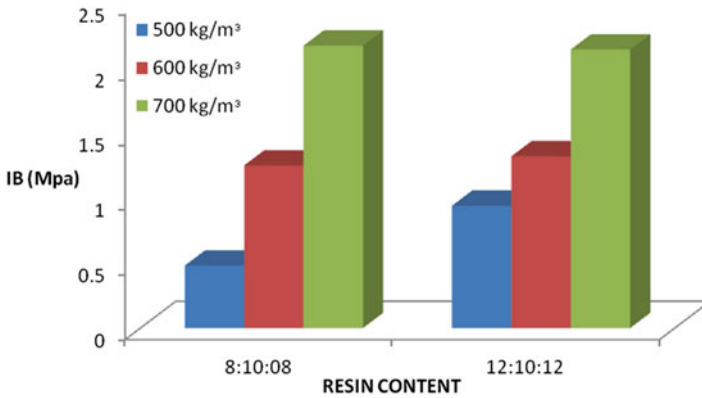
Fig. 57.3 Internal bond strength of hybrid particleboard at 500, 600 and 700 kg/m³ densities with 8:10:8 and 12:10:12 resin content
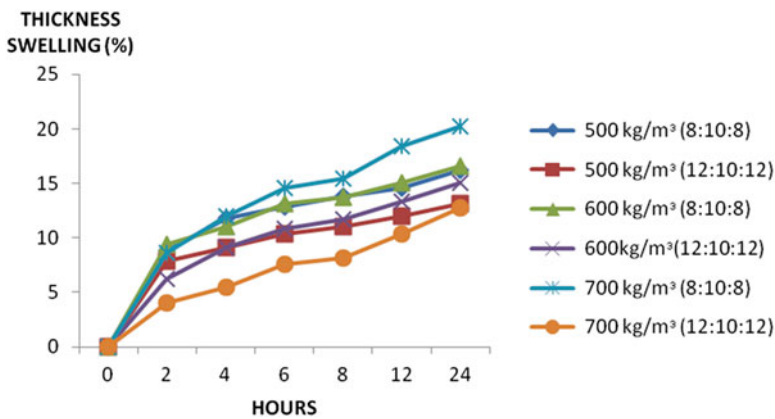
Fig. 57.4 Thickness swelling rate of hybrid particleboard at 500, 600 and 700 kg/m³ densities with 8:10:8 and 12:10:12 resin content

From the result obtained, the percentage of TS and of WA were decreased for the panel bonded with 12:10:12 resin content compared to 8:10:8. This might be due to the properties of the resin which was filled in the void between the particles, which causes the sample to reduce the water uptake.

The result indicated that when the density increases, the WA and TS decrease. The wax content used in the panel itself helped to reduce the water uptake. Furthermore, the bond within the particle during the pressure makes it compact and reduces the rate of the WA and TS. Within the density of the panel, the TS rate for 700 kg/m³ was higher compared to 600 and 500 kg/m³. Sawdust is composed of very fine particles that easily absorb moisture. Besides, wood is a hygroscopic material which responds positively to water.
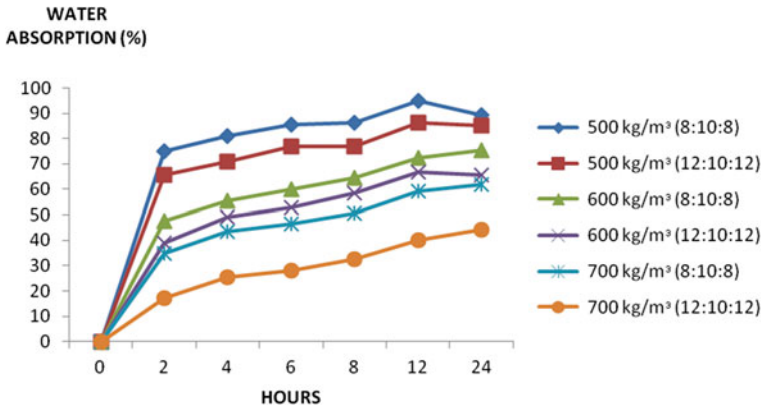
Fig. 57.5 Water absorption rate of hybrid particleboard at 500, 600 and 700 kg/m³ densities with 8:10:8 and 12:10:12 resin content

Conclusion

From this study, it can be concluded that the hybrid particleboard from sawdust and *Acacia mangium* demonstrated improvement in some properties such as bending strength and internal bond. The panels with the resin content 12:10:12 showed better MOR, MOE and internal bonding compared to resin content 8:10:8. The densities 500, 600 and 700 kg/m³ of the panels manufactured using the resin content 12:10:12 were higher compared to using resin content 8:10:8. Thickness swelling and water absorption rate decreased when the resin content increased. Then, when water absorption increased, the density decreased. However, the thickness swelling increased when the density increased. It is recommended that for the future, there is a need to improve the water resistance of hybrid particleboard and sawdust or waste material and low operation cost making this a promising study for technology application.

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Chapter 58
Performance Evaluation of CRP Algorithm for Dense Wireless Sensor Networks

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Introduction

Localization in wireless sensor network (WSN) is a process of determining the position of each sensor node (estimated coordinate) in a network and can be classified in several categories in which are discussed in detail in the literature review section. Determining the locations of these sensor nodes is very crucial for sensor applications, and therefore many researchers are pursuing this research area [1].

This research pursue the combination of anchor-free and range-based categories. It is called an anchor-free localization if none of the sensor nodes is aware of its own location (position coordinate) prior to the localization process. It is called range-based localization if the localization process uses distances (real distances usually measured in centimeter or meter) among sensor nodes.

A combination of anchor-free and range-based localization is feasible to be implemented because the emerging advances in sensor technology and such sensors are readily available like the mica2, micaZ, and cricket motes from Crossbow Technology, Inc. In this paper the experiments are performed by using a simulation

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technique, and the simulator simulates the sensor nodes to mimic the cricket motes. The simulation's details are discussed in the simulation setup section.

The literature of localization shares a common understanding that the locations of anchor nodes give a great impact on the accuracy of the localization process. Placing the anchor nodes at the border of a network will give a greater accuracy when compared to the anchor nodes that are placed at random locations [1, 2]. In localization process, using more anchor nodes also improves the accuracy of localization [3, 4]. Meanwhile, Y. Chen et al. proposed an optimal layout of anchor node placement that contributes to better accuracy [5].

This paper presents the algorithm proposed by Nawaz et al. [3] and will be used as a base work for future improved algorithm. The essence of CRP algorithm is to select anchor nodes that lie at the edges of a network topology because by doing so it produces greater accuracy than anchor nodes that are placed randomly in a network. The simulation results suggest that placing the anchor nodes at the edges of a network topology yields a tolerable accuracy when compared with random anchor placement.

Literature Review

This section discusses some important terminologies and the development of localization in WSN. Let's start with anchor node and non-anchor node. In the literature anchor node or sometimes called *landmark* is a special sensor that is used as a reference for the other sensors (the non-anchor) to localize themselves. Usually these anchor nodes knew their coordinate positions prior to localization process. This can be achieve either by the help of Global Positioning System (GPS) or manually handled by human. For many cases, both approaches are either expensive because sensors need to be equipped with GPS transceiver or impractical if the number of anchors used is too many. On the other hand, a non-anchor node is a sensor node that does not know its location prior to the localization process. To localize this type of sensor, the locations of anchor nodes are used.

Other important terminologies are anchor-free algorithm and anchor-based algorithm. The anchor-free algorithm assumes that prior to localization process, there is no sensor node that knows its own location. In this algorithm, all sensor nodes will collaborate with each other by sharing the distances between themselves, and with some procedures, it will choose the potential sensor to become and anchor nodes. Meanwhile, anchor-based algorithm makes an assumption that there exist some anchors (usually three or more) that knew their position coordinates prior to the localization process. This can be achieved either by the help of GPS or manually handled by human which is not always possible and is favorable to be avoided. It is important to note that anchor-free algorithm is preferred in a large size network because it cancels out the need for human involvement and it uses less expensive hardware.

Next important terminologies are centralized localization algorithm and decentralized localization algorithm. In centralized localization algorithm, the localization process is usually performed by a single base station. Usually the base station is placed in the center of the network topology and has a powerful processing ability and energy. All sensors send their data at the base station, and it uses the received data for calibration for the localization process. On the other hand, a system that implement a decentralized localization algorithm lets the sensor nodes to collaborate to share information (usually distances in centimeters or meters and number of hops) and are capable of localizing themselves. One thing to note is that in centralized localization algorithm, only the base station knows the location of the other sensors, whereas in decentralized localization algorithm each sensor node knows its own location. All the differences between centralized and decentralized serve a variety of advantages and disadvantages to both algorithms.

Next is range-free algorithm and range-based algorithm. When the discussion is about range-free and range-based algorithms, it directly refers to the inputs used in the calculations of localization. Some inputs are in distances (in centimeter or meter) [3] and some are in number of hops [6]. This occurrence happens because of the nature of the sensors (hardware and algorithm) used in the localization process. Some sensors have the capability to "sense" distances of neighboring sensors (using time of arrival and time division of arrival techniques) and some don't. The latter can only gather coarse-grained information which is in number of hops. Anyhow both have their advantages and disadvantages. Range-free algorithm uses simple and cheap sensors and hence sacrifices the accuracy. On the other hand, range-based algorithm uses sensors that must be equipped with additional hardware such as radio frequency (RF) and ultrasound transceivers which makes it a more expensive approach. However, sensors that are equipped with RF and ultrasound transceivers produce more accurate results.

Simulation Setups

The experiments are performed by using a discrete event simulation (DES) technique which carefully impersonates the phases in CRP as proposed by Nawaz et al. The three important phases in CRP are anchor selection, anchor localization, and node localization. The detail of these phases is not the interest of this paper as it is already discussed in [3].

The main purpose of this section is to discuss the simulation setups and performance metric used in the simulations. First we discussed about the simulation setups. The experiments are carried out in two different sizes of topology. The first topology size is a 50×50 m and the second topology size is 75×75 m whereby both topologies are arranged so that they are set up in a squared form. For both experiments, the numbers of sensor nodes are varied starting with 100 nodes to 400 nodes. The experiments are structured in such a way to observe the behavior of CRP

algorithm in sparse and dense networks. The sensor nodes in the simulator impersonate the cricket motes that have the maximum sensing range of 10.5 m.

The performance metric used in the experiments is *average error deviation (Æ)* and is measured in meter. Æ is acquired by finding the deviation between the true coordinate (object) and the estimated coordinate (image) for each sensor and averaging it with the sum of all sensor nodes. True coordinates are the actual coordinates of sensor nodes while image coordinate is estimated coordinates of localization process. The equation of finding Æ is shown below:

$$Æ = \sum_{t=1}^{N} \sqrt{\left(x_t - x_u\right)^2 + \left(y_t - y_u\right)^2} \tag{58.1}$$

where N is the number of sensor nodes used in the simulations, x_t and y_t are the true coordinate, and x_u and y_u are the estimated coordinate of a node.

Results and Discussions

The acquired results are discussed extensively in this section. For the first simulation setup, the CRP algorithm is experimented on a fix 50×50 m topology size. Table 58.1 presents the acquired results from the simulations where each figure in the table represents 50 runs of simulations.

Meanwhile Table 58.2 shows the acquired results of CRP algorithm that is experimented on a fix 75×75 m topology size which is also 50 runs of simulations for each figure in the table.

Figure 58.1 shows the differences between the two different setups in a line chart. Two apparent observations conveyed from the line chart are discussed. In Observation 1, the first setup produces smaller average error in comparison to the second setup on all plots. In Observation 2, for both setups the average error is reduced as the network becomes denser, that is, when the number of nodes are increased in the simulations.

As mentioned in the Simulation Setups section, the performance metric used in this experiment is average error deviation, Æ. The Æ is derived from the deviation

Table 58.1 Topology size of 50×50 m

Number of nodes	100	150	200	250	300	350	400
Ave. error (m)	7.071	1.347	0.574	0.443	0.316	0.222	0.153

Table 58.2 Topology size of 75×75 m

Number of nodes	100	150	200	250	300	350	400
Ave. error (m)	75.177	35.452	10.998	4.46	2.109	1.269	1.096
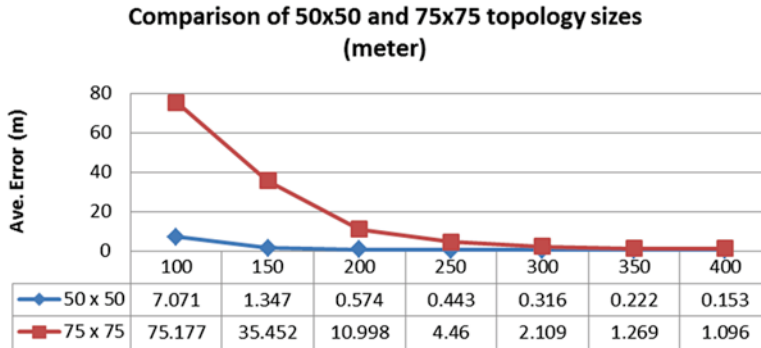
Fig. 58.1 The comparison of both simulation setups

between the true coordinate (object) and the estimated coordinate (image). That means the deviations of all pairs of objects and images are calculated and averaged. In the 50×50 m setups, the Æ between objects and images are 7.071 m when the number of nodes is 100. As the number of nodes increases, the Æ becomes smaller. For example, the Æ for 150, 200, 250, 350, and 400 nodes is 53.45, 10.99, 4.45, 2.11, 1.27, and 1.10, respectively. The same explanation is also true for 75×75 m setups.

The simulations' results suggest that the CRP algorithm produces a smaller average error in a denser network than in a sparse network. This occurrence happened because the overestimation of distances between sensor nodes is minimized in a denser network than in the sparse network.

Conclusion and Future Work

Localization is still extensively researched by many researchers because of the immense importance of accuracy in many applications. The simulator develops the CRP algorithm by using a DES technique. The designed simulator will serve as a base work to enhance the CRP algorithm for future work. Although the CRP algorithm produces a tolerable accuracy for certain applications, there is still room for improvement as there are applications that really need higher accuracy than the one offered by the CRP algorithm.

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Chapter 59
Online Malaysian Bumiputera and Aslian Language Researchers' Database (OMBALRD): Solution for Bumiputera and Aslian Languages Preservation

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Introduction

As the information, communication, and technology (ICT) evolves from day to day, database and information system (IS) played an important role to keep and retrieve all the records within the organization information. IS has been a new trend to public and private sector in order to make their working environment more effective and efficient, as the information technology (IT) can be applied in many areas.

The "inaccessibility of obscure past publication [1, p. 147]" of Malaysian Aslian and Bumiputera languages has leaded to "research overlapping and resources wastage [1, p. 147]" and lack of references to initial researches [2]. Thus, the main idea of developing OMBALRD is to collect all information sources or full text of journal articles, proceeding papers, research theses, book publications, and any information on academic works pertaining to Malaysian Aslian and Bumiputera languages over the past decades locally and internationally which are currently in hardcopy books in libraries all over the world [1, 3].

OMBALRD was developed based on the information system methodology or process called System Development Life Cycle (SDLC). Information system development requires five (5) components which consist of hardware, software, data, user, and procedure. This combination of components can produce a good quality of IS to be delivered to the user [4]. To identify the related components, SDLC methodology will assist the present discussion on developing OMBALRD. Figure 59.1 shows the SDLC process or cycle whereby any programmers or developers need to follow in order to come out with an IS as requested by the user [4].

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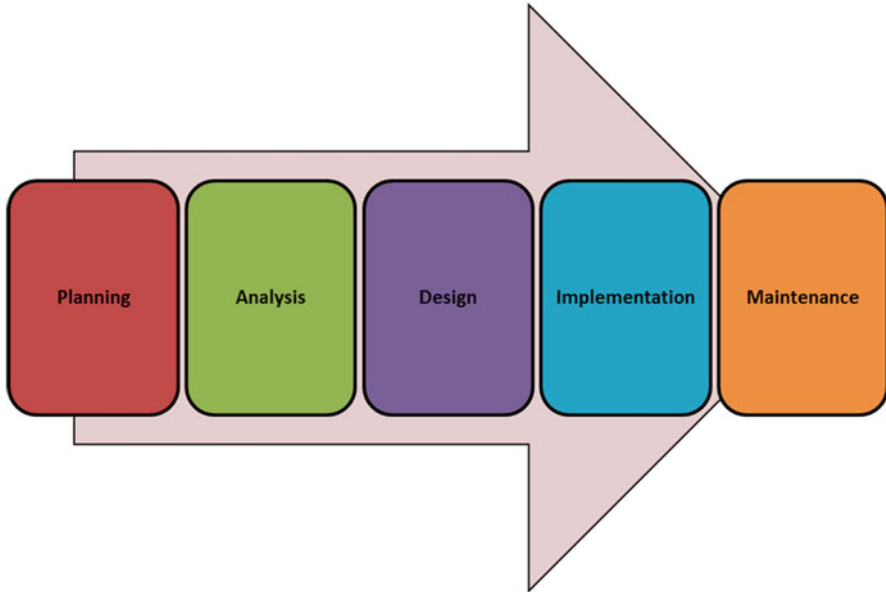
Fig. 59.1 System development life cycle methodology

Each phase in SDLC consists of several steps and requirements which need to be fulfilled before the developer can move to another phase. This is to guarantee that all the user requirements especially what they have requested will be fulfilled and accomplished in the best manner as to prevent inappropriate problem occurring and to reduce any defects during the development of OMBALRD.

As OMBALRD serves as a hub in collecting past and current publications of Bumiputera and Aslian languages, OMBALRD somehow furnishes and encourages any local researchers and interested foreign researchers to do more research and findings based on the Bumiputera and Aslian languages. It shall also regain the research significance of the past and present Malaysian Aslian and Bumiputera publications. Each researcher's areas of interest within the Malaysian Aslian and Bumiputera languages shall be made public, thus acknowledging their expertise. The present paper will explain the processes and steps the developers have gone through in developing OMBALRD for future use.

Planning

Within this phase, the present paper referred to [3] in order to identify the nature and the scope of the OMBALRD development. There are seven (7) known online databases related to the minority languages data and documentation, such as E-MELD, OLAC,
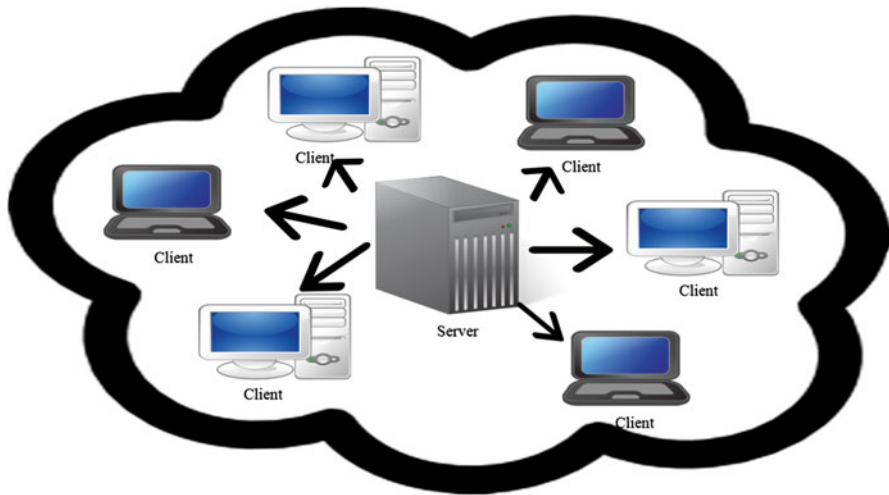
Fig. 59.2 Client-server technology

DoBES, PARADISEC, SEAlang, Mon-Khmer Languages Project, and Ethnologue. Analysis of each database was initially carried out in [3] to offer solution to areas that are not available and overcoming several user-friendliness issues.

Thus, OMBALRD uses the client-server concept of technology. It can be accessed within and outside the organization. OMBALRD allows ubiquitous technology which can be accessed at any place and any time using Internet connection. Figure 59.2 shows a graphic illustration of the concept.

The present study chooses the client-server technology that is based on the working experiences from the past organization. With the rapid application/system development and rapid technology hardware, client-server is a lot easier to add new hardware on supporting new system and technology, has long-term cost benefits for development, and lastly can implement multiple or different vendor software tools for each application [5].

Each online database has different features and layout, whereby the features and layouts are totally focusing on each of the purpose of the development. Reference [3] has shown the differences on target audience, search-keyword usage, web page layout, interface, and strength and weaknesses identified and can be solved with client-server technology.

Analysis

Analysis phase requires developer to identify what are the processes involved in OMBARLD, investigate the business process whereby all the procedures or work-flow of OMBARLD are identified properly, and document what OMBALRD must

Table 59.1 User's scope

Interested public/researcher/tourist	Professional researcher	Administrator
View publication		
	Add publication	
	Upload publication evidence	
	Search publication	
		Update publication status
		Register personal information
		Add administrator
		Update administrator
		View researcher information

perform and justify. According to [3], OMBARLD requires these features as the other seven online databases do not offer them:

1. Professional researchers must be able to search Bumiputera and Aslian languages that have been studied or being studied.
2. OMBARLD must be able to keep all the information about the researchers who have carried out studies on Bumiputera and Aslian languages.
3. Professional researchers must be able to upload their source of publications as evidence of their previous researches as a research authentication.
4. OMBARLD must be able to reduce the time of professional researcher in retrieving information about Bumiputera and Aslian languages as OMBALRD will be the hub of Bumiputera and Aslian languages.

As OMBALRD involves three (3) users, interested public/researcher/tourist, professional researcher, and administrator of OMBALRD, proper scope and ability specification is vital. Table 59.1 shows the user's scope and their ability on using OMBALRD in the future.

As these requirements are fulfilled, OMBALRD will allow the linkages among researchers so that Aslian and Bumiputera language studies are better covered, thus making it narrowed and focused toward the need of local researcher and interested foreign researchers.

Design

Developers and programmers are required to complete the design of the system process, by solving areas which have been a nuisance to users on other databases. Reference [1] findings have suggested these criteria of improvement:

1. Purpose of the online database
2. The targeted audience
3. Search-keyword usage
4. Accessibility
5. Design layouts
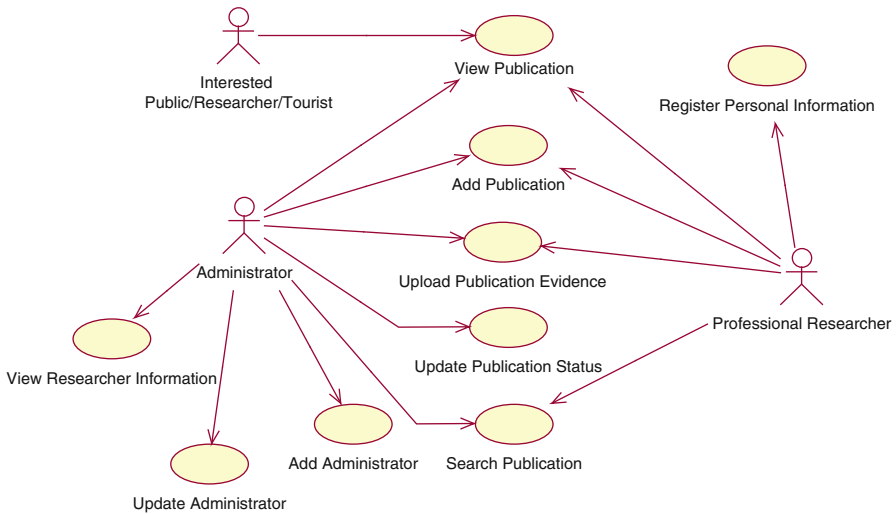
Fig. 59.3 Use case diagram for OMBALRD

The present paper is also focusing on the technical specifications such as screen, menu, reports produced, and the attractiveness of OMBALRD toward users. The developer has produced a logical design which gives the inputs, processes, and outputs involved within OMBALRD to avoid any misunderstanding within OMBALRD team and user involvement. Figure 59.3 shows the logical design called use case diagram drawn using Rational Rose Enterprise software for OMBALRD [6] in order to identify and justify what are process involved in OMBALRD to users.

Before the developer proceeds to the next phase, business process or the flow for OMBALRD is very important to be identified as user's requirement needs to be accomplished without any arising problems. Figure 59.4 shows the workflow of OMBALRD [6].

As referred to Figure 59.4, professional researchers are capable of filling the online research information and uploading any evidence regarding to their researchers. Interested public such as local researchers or foreign researcher and tourists can view all the research information on Aslian and Bumiputera languages in OMBALRD. As an administrator, it is a big responsibility to maintain and evaluate the OMBALRD from time to time in order to make OMBALRD updated with the current technology and issues on Aslian and Bumiputera languages.

Implementation

A new IS called OMBALRD is constructed at this phase. Writing, coding, conversion, and debugging are performed by the programmer in order to produce a quality IS to fulfill the entire user's requirement stated in the planning phase. The final
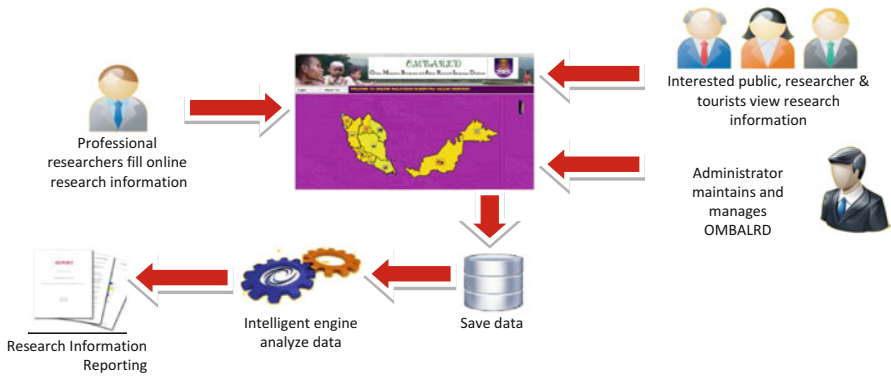
Fig. 59.4 OMBALRD workflow
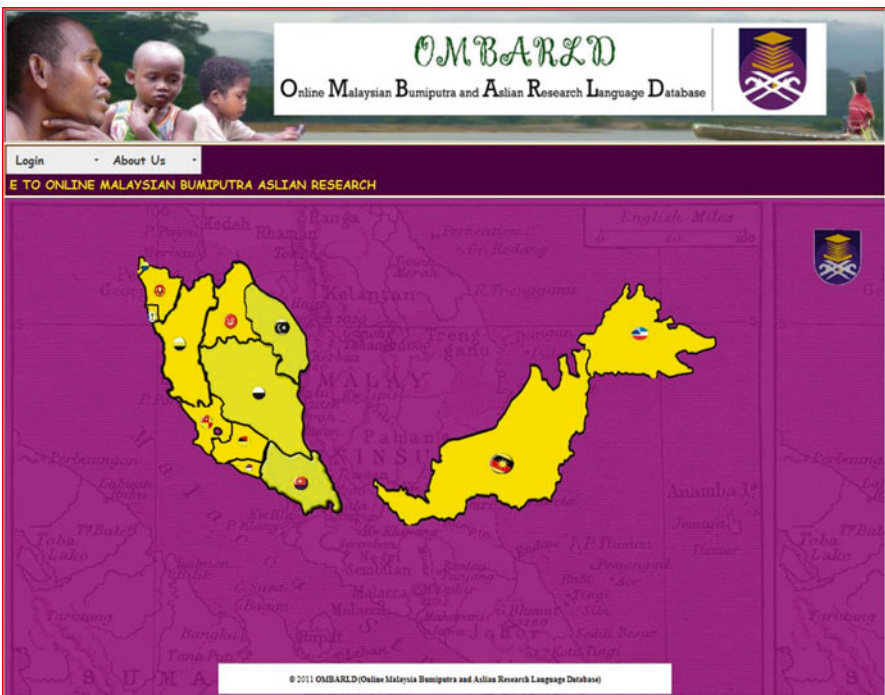
Fig. 59.5 Homepage for OMBALRD

documentation is also produced as evidence that this is a pioneer work done by the developer [6]. Figure 59.5 shows the interface of OMBALRD during the construction.

The OMBALRD system uses open source software (OSS) which is available for free. The system uses PHP (PHP, Hypertext Preprocessor) as the server-side scripting language, Hypertext Markup Language (HTML) as an interface, and MySQL as the database.

After the completion of constructing the OMBALRD, supporting crews will be trained by appropriate person who is in charge of developing the OMBALRD so that they can operate and support the OMBALRD during the operation period. From time to time, OMBALRD will enter the phase called system evaluation to see the acceptance of user toward OMBALRD. This is essential as to ensure OMBALRD shall continuously be relevant to researchers of Aslian and Bumiputera languages or perhaps develop into a world minority languages publication database in the near future.

Significance of OMBALRD

The complexities of data integration, management, and analysis needed by OMBALRD have been well addressed in previous discussion. To overcome the problem, a system which is known as PrODIMA is developed to aid the management level. This system can facilitate in terms of energy saving, efficient data management, user-friendliness, online data entry, produce real-time report, permanent record at specific server, storage savvy, significant time reduction, minimum human resource, automatic analysis, and extended benefit that will be discovered in the future. Thus, the construction of OMBARLD has indirectly produced PrODIMA for management purposes which can be extended to other databases construction.

Maintenance

A well-designed system has the criteria such as security, reliable for any level of user's usage, easy to maintain in different platform of hardware and software, and scalable to be extended or enhanced in the future. Thus, it is vital to ensure such database as OMBARLD too fulfills such requirement.

Corrective maintenance will also be performed during the errors discovered by the users in the working operations. Feedback from user is essential to OMBALRD improvement. Adaptive maintenance may occur due to the changes of purpose requirements or changes of the existence procedures. Any enhancement or replacement of IS will be performed in perfective maintenance as OMBALRD may need a new system or migrate to a new system due to the changes of technology.

Conclusion

The construction of OMBALRD is a solution to difficulties to access literature on Malaysia Aslian and Bumiputera languages [3] and a current situation where there is lack of reference to earlier researches in the present researches on Malaysia

Aslian and Bumiputera languages [2]. Through OMBALRD, Malaysia Aslian and Bumiputera languages publication or information sources of the publication can be uploaded by the authors themselves. With research information sharing by the researchers, they can also have access to all publication or information source of the publication in OMBALRD. As a solution to the construction problems of OMBALRD, it has also managed to introduce PrODIMA which can be used to further development of other databases. In short, the construction of OMBALRD has progressed from a problem to appropriate planning, IS development, problem solution unfolding, and proper maintenance process which in the end potentially produces well-deserving copyrights.

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Chapter 60
Framework Design of Computational Method Using Singular Value Decomposition for Gender Classification in Words Usage

Roslan Sadjirin, Haslinda Noradzan, Kamisah Ariffin, and Noli Maishara Nordin

Introduction

The emergence of computing, networking, communication and Internet technology has created a new way of sharing information across time and space. Whilst improving and enhancing the quality of life in many aspects, they have also opened a new place for criminal activities which is known as cybercrime [1–3]. However, cybercrime is not new. It has existed for some decades [4], and there is still no sign of declining [5–8].

Cybercrime refers to illegal computer-mediated activities which can be conducted through global electronic networks such as the Internet [1]. Many studies have been conducted to identify the authorship of the criminal such as analyses on electronic mail, messages and programmes, websites, Internet newsgroup and Internet chat rooms, just to name a few [3, 8]. It is found that electronic mail is the most commonly used communication medium that results in financial as well as moral loss of the cybercrime victims [2, 3]. Nevertheless, the vagueness and anonymous manner offered by the Internet, in which users usually do not need to provide information with regard to their identity such as name, age, gender and address to participate in cyber activities, has made the process of tracing criminal identity difficult [3, 8].

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Empirical research on communication style has shown that the words usage in communication practice is gender-preferential rather than gender-exclusive. Thus, it may be possible to identify the gender of an author based on the words usage in his/her writing. Therefore, this paper proposes a framework design of latent semantic analysis to help narrow down the process of identifying the identity of the criminal from the gender perspective. Latent semantic analysis is a computational method which applies mathematical technique, namely, singular value decomposition to automatically discover the pattern of relationships between elements in dimensional space. This paper presents the exploratory stage of the study where a corpus of English texts written by different authors was analysed to investigate the possible gender of the authors based on the words usage. The control parameter used to compute the gender-preferential words is foregrounded by the empirical research on stylistic gender differences in communication/conversation.

Male and Female Speech/Communication Styles: An Overview

Differences in communication styles between male and female have been discussed and researched on extensively for decades. Empirical studies have claimed that there are gender differences in the styles of communication and that men and women differ in their linguistic expressions [9–11]. These early studies of gendered-speech/communication styles have provided some important starting points for the study of language and relations between sexes. The studies suggest that language differences between men and women exist due to social experiences and behavioural constructs, that is, in most societies, men and women see themselves as conforming to the typical behaviour of their sex group.

There are ten basic assumptions on what are considered as the characteristics of men's and women's speech style [12]. These ten assumptions were characterized under three main categories: lexical traits, phonological traits and syntactic-pragmatic traits.

Lexical Traits

This category specifies speakers' speech in their use of special lexicon, intensifiers or adjectives and super polite forms. Special lexicon refers to women's elaborated use of vocabulary when defining or describing certain objects or situations. An example of this would be the use of 'purplish blue'. Men, on the other hand, will just use 'blue'. In addition, compared to men, women use more evaluative adjectives such as 'wonderful' and 'gorgeous' and intensifiers such as 'so' and 'very' and adjectives of approximation such as 'about' and 'around' instead of the exact number [13, 14]. As for politeness, differences in men's and women's speech have been observed from three forms of politeness, i.e. formality (the distance between the speakers), deference (reaction) and camaradene (being sympathetic). However, since the present study only focuses on words usage, only adjectives and intensifiers were used as the control parameters.

Phonological Traits

This category refers to the use of hypercorrect grammar and pronunciation in speech. Women are observed as preferring the traditional correct English grammar and clear enunciation whilst men prefer the vernacular form of English [9]. These traits were also not included in the control parameter as it was found that the writers of the sample texts did not have a good grasp of English language grammar. In addition, pronunciation is definitely not evident in the written texts. Thus, to examine these aspects in the sample texts would not be viable.

Syntactic-Pragmatic Traits

This category includes indices at the level of utterance or speech act such as the use of hedges, tag questions and direct quotations. Women are observed as to use more syntactic-pragmatic traits in their speech compared to men. The use of hedges includes the use of modal verbs such as 'could', 'should' and 'may', and other lexical items indicating uncertainty such as 'seems to be', 'probably' and 'more or less'. Another type of hedges often used by women is egocentric sequences such as 'I believe', 'I think' and 'I guess'. The use of tag questions in women's speech is also considered as a hedging device to express uncertainty [12]. In addition, women tend to use direct quotation more than men do [12, 13]. As the present study only examined texts of descriptive writing, only the use of hedges was used as a control parameter to compute the gender-preferential words as found in the corpus.

Methodology

This section presents the framework design of the computational method for computing and classifying the gender of the author, the preprocessing such as term extraction and term-gender-document matrix construction, test collections and the vector space construction as well as example of word gender computation.

Test Collection

The test collection used in this study consists of 200 sample texts in English written by 100 male and 100 female students. Initially, the researchers wanted to collect real and genuine e-mails written by male and female authors. However, this was not possible as collecting e-mails that were written fully in English and, on the same topic, proved to be difficult within the time frame of the study. Thus, building a corpus for the analysis would also be impossible. The topic given was on the importance of financial management. This topic was chosen since it is neutral and is not gender-biased. Any topic that contains gender-biasness may affect the results of the study.

Table 60.1 Samples of text content

Document name	Content
F0027	I totally agree with this statement that financial or money management courses should be made compulsory for all university student because aids the student managing all expenses activities for everyday, all the business using the financial and to show performance for some company
M0085	Money management courses should be made compulsory for all university students. Money is the most important thing to all students when there in the university. I agree for this statement

Table 60.2 List of queries

Q#	Hedges	Adjective	Intensifiers	Miscellaneous
1.	I think	Costly	Very	Money
2.	Really	Wisely	Quite	Financial
3.	I believe	Beautiful	Extremely	Agree
4.	Maybe	Pretty	So much	Ever
5.	Totally	Wrongly	So expensive	Necessity
6.	In my opinion	Truly	Very much	Need
7.	Pretty sure	Good	Seems	Easy

With equal distribution between male and female, 3,041 terms of word were extracted from the 200 sample texts. Sample queries were formed from three different parts of speech: (1) adjectives, (2) hedges and (2) intensifiers. Table 60.1 shows a few samples of the text content, and Table 60.2 illustrates the list of queries.

Term Extraction

Extracting term from the document files is one of the essential processes in creating the vector space of singular value decomposition. In this study, stop words were not removed and no stemming procedure was performed because the researchers believed that the word structure between male and female would be able to distinguish or identify the gender of the writer. The algorithm of word extraction is described as follows (Table 60.3):

Term-Gender-Document Construction

Term-gender-document is a process of constructing the matrix of term and gender-document. The algorithm of term-gender-document is described as follows (Table 60.4):

Table 60.5 shows the matrix representation of term-gender-document vector. Columns represent gender-document, and rows represent term or words, whereas the values represent the number of occurrences of term in a context of gender-document.

Table 60.3 Word-extraction algorithm and example of term vector

Term extraction algorithm	Example of term vector

Repeat
    Read document for corpus
    Repeat
        Extract term of document
        Compare each term with the other extracted term
        If term identical to the extracted term
            Group the term together
        Otherwise
            Set the term as new extracted term
    Until all terms extracted
Until all documents are read
	Abilities, ability, able, about, above, abroad, absolutely, absorb, abuse, academic, accept, acceptable, accessories, accident, accidents, according, account, accountancy, accountant, accountants, accounted, accounting, accounts, accreditation, achieve, achieved, achievement, achieving, acknowledge, acknowledged, acknowledgement, acknowledges, acknowledgment

Table 60.4 Term-gender-document matrix construction algorithm

Repeat
    Read extracted term from 'term_extraction' file
    Compare the occurrence of term from 'term_extraction' file with the term of documents in the corpus
    Count the occurrence of the term of document in the corpus
Until all terms from 'term_extraction' file are read

Table 60.5 Overview of term-gender-document matrix

```
abilities   0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
ability     0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0
able        0 0 0 4 0 0 0 0 0 0 1 0 0 1 0 0 0 2 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3 0 0 0 0 0 0 0 0 0 0 1 2 0 0 0 0 0 0 0 5 0 0 0 0
about       0 2 0 3 1 5 1 8 1 1 3 5 7 0 2 3 0 0 2 1 1 2 3 5 6 0 0 5 6 4 3 1 1 3 5 8 1 4 1 1 2 2 1 1 3 0 2 6 1 2 7 1 2 0 3 4 1 3 2 3 5 2 1 3 3 4
above       0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
abroad      0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
absolutely  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
absorb      0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
abuse       0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
academic    2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
accept      0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

Singular Value Decomposition

Singular value decomposition (SVD) is a set of vector representing the location of each term and document in the vector-dimensional space, and it is closely related to eigenvector decomposition and factor analysis. Assuming Table 60.5 is a matrix A, the steps of the computation of singular decomposition and creating the vector space are described as follows:

(i) Compute the transpose of A and $A^T A$.
(ii) Determine the eigenvalues of $A^T A$ and sort these in descending order, in the absolute sense. Square root these eigenvalues to obtain the singular value of A.

Table 60.6 Overview of vector space of LSA

A	=	U	S				V^T			
0 0 0 4 0 0 0 0 0 0 0 1	=	0.15 -0.14 0.18 -0.20	330.34	0	0	0	0.07	0.02	0.07	0.04
0 0 2 0 3 1 5 1 8 1 1 3		0.00 0.00 0.00 0.00	0	55.39	0	0	0.07	-0.04	0.09	-0.02
5 7 0 0 0 0 0 0 0 0 0 0		0.00 -0.01 -0.00 -0.01	0	0	53.52	0	0.09	0.04	0.09	-0.04
2 0 0 0 0 0 0 0 0 0 0 0		0.01 -0.00 -0.01 -0.00	0	0	0	52.68	0.08	-0.06	0.04	0.00
1 0 0 0 0 3 3 2 2 0 0 0		0.09 0.04 0.08 0.04					0.07	-0.00	-0.05	0.00

(iii) Construct diagonal matrix S by placing singular values in descending order along its diagonal. Compute the inverse of S, which is S^{-1}.

(iv) Use the ordered eigenvalues obtained in (ii) and compute the eigenvectors of $A^T A$. Place these eigenvectors along the column of V and compute its transpose, V^T.

(v) Compute U as $U = AVS^{-1}$.

(vi) Eliminate the corresponding column vectors of U and corresponding row vector of V^T accordingly (for small corpus, the best dimensional space is 4 [9]).

(vii) Recombine vector term U, eigenvector of matrix S and document V^T to form original matrix, $A = USV^T$.

Vector Space of Latent Semantic Analysis

After the three main processes, which were extraction of term, construction of matrix of term-gender-document and computation of reduced singular value decomposition completed, a vector space as shown in Table 60.6 was created. The equation of the vector space is $A = USV^T$, where A is the original matrix (Table 60.5), U is the vector term (Table 60.3), S is the singular value of A (corresponds to the dimensional space) and V^T is the document in the corpus. Table 60.6 illustrates the corresponding of equation $A = USV^T$ to vector space of reduced singular value decomposition of LSA.

Similarity Measurement

The similarity measurement between query against the term vector and gender-document vectors in LSA vector space was computed using cosine similarity. If the cosine is 1, it signifies that the two vectors are considered exactly similar, and cosine -1 means that they are completely dissimilar. In this paper, two computations were employed, which were cosine similarity and probability. The formula of cosine computation is as follows:

$$\text{Similarity}(A,B) = \text{Cosine}\,\theta$$
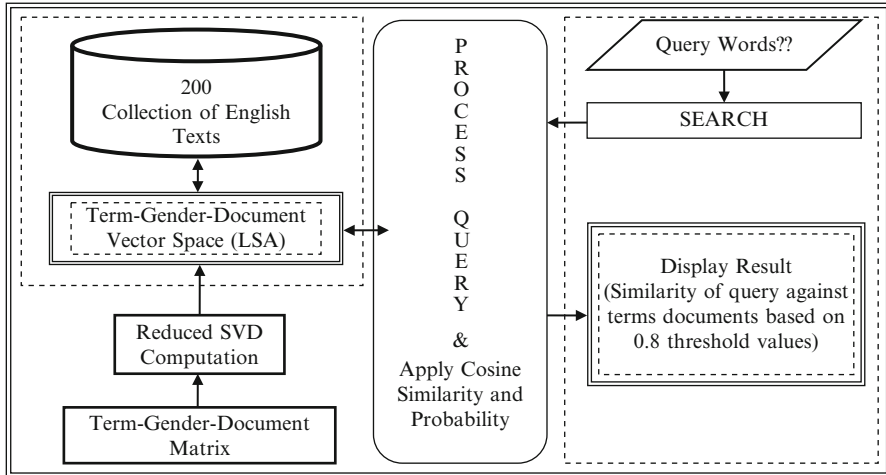$$= A \cdot B / |A| \cdot |B|$$

Fig. 60.1 Framework of the prototype computational method for word gender classification

Framework Overview

Figure 60.1 illustrates the framework of the prototype system for computing the gender classification based on the words usage.

Results and Discussions

This section discusses the results obtained from the experiments. In the experiments, 21 queries from four different parameters, that is, hedges, adjectives, intensifiers and miscellaneous words, were chosen. Table 60.7 illustrates the score of each query and its category of part of speech. Table 60.8 presents the words that are likely to be used by male and female. The results presented here are based on threshold value 0.8 and 4-dimensional space of LSA [15].

The results of the experiment show that the findings support previous studies that words usage and writing style vary between male and female writers. The data clearly illustrates that, except for three queries in the hedges parameter, female writers have the tendency to use more hedges, adjectives and intensifiers than male in their writing.

Hedges

The data show that although there is a slight difference, female writers use more hedges than male writers. Four out of the seven queries show a higher percentage of the use of hedges by female compared to men. One of the reasons for the slight

Table 60.7 Score of gender based on the part of speech

Part of speech	Gender	Score	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Hedges [I think, really, I believe, maybe, totally, in my opinion, pretty sure]	Female	% Relevant	51.38	56.28	50.27	46.28	47.93	44.49	61.35
		% Retrieve	50.98	56.25	50.00	46.57	47.83	44.83	60.71
	Male	% Relevant	48.62	43.72	49.72	53.72	52.07	55.51	38.65
		% Retrieve	49.02	43.75	50.00	53.42	52.17	55.17	39.28
Adjectives [costly, wisely, beautiful, pretty, wrongly, truly, good]	Female	% Relevant	0.00	56.13	61.42	46.68	100.00	51.31	53.03
		% Retrieve	0.00	55.56	61.54	45.95	100.00	50.00	53.42
	Male	% Relevant	0.00	43.87	38.58	53.32	0.00	48.69	46.97
		% Retrieve	0.00	44.44	38.46	54.05	0.00	50.00	46.58
Intensifiers [very, quite, extremely, so much, so expensive, very much, seems]	Female	% Relevant	51.64	80.51	74.13	53.37	50.03	48.69	32.81
		% Retrieve	51.22	80.00	75.00	53.54	50.00	48.44	33.33
	Male	% Relevant	48.36	19.49	25.87	46.63	49.97	51.31	67.19
		% Retrieve	48.78	20.00	25.00	46.46	50.00	51.46	66.67
Miscellaneous [money, financial, agree, ever, necessity, need, easy]	Female	% Relevant	47.00	61.93	48.91	33.25	42.28	56.45	50.74
		% Retrieve	46.67	61.70	48.53	33.33	42.86	56.52	50.77
	Male	% Relevant	53.00	38.07	51.09	66.75	57.72	43.55	49.26
		% Retrieve	53.33	38.30	51.47	66.67	57.14	43.48	49.223

Table 60.8 Words usage based on gender-preferential

Gender	Hedges	Adjective	Intensifiers	Miscellaneous
Female	I think	Wisely	Very	Financial
	Really	Beautiful	Quite	Need
	I believe	Wrongly	Extremely	Easy
	Pretty sure	Truly	So much	
		Good	So expensive	
Male	Maybe	Pretty	Very much	Money
	Totally	Truly	Seems	Agree
	In my opinion			Ever
				Necessity

difference may be due to the fact that hedges like 'I think', 'really', 'I believe', 'maybe', 'totally' and 'in my opinion' are the usual expressions used by both male and female when presenting their ideas and opinion. In fact, students are formally taught these expressions as discourse markers to be used for presenting opinion in their English writing and speaking classes. However, there is a significant difference in the score between male and female for the use of 'pretty sure'. Female writers score 60.71 % whilst male writers only score 39.28 %. The use of the adverb 'pretty' to modify their opinion 'sure' is to heighten the effect of their statement, thus making it stronger, which supports earlier findings of women's preferences in the use of hedging [12, 13].

Adjectives

There is a clear indication that female writers have the tendency to use more adjectives compared to their male counterparts. Except for Queries 4 and 5, it is evident that female writers use more adjectives like 'beautiful' to describe or define the situation. The data also reveal that some topic-related words, in this case financial management words, such as 'costly' and 'wrongly', were not gender-specific words as no significant difference was found on their use between male and female writers. However, although the word 'beautiful' is used more by female, its synonym 'pretty' is used more by male. This suggests that some adjectives may not be exclusively gender-specific.

Intensifiers

The analysis shows an overwhelming use of intensifiers by female writers compared to male writers. As can be seen from Table 60.7, Queries 2 ('quite') and 3 ('extremely') score the highest with 80.5 % and 74.13 % use by female compared to only 20 % and 25 % by male, respectively. Other intensifiers that are used more by female are 'very', 'so much' and 'so expensive'. However, intensifiers like 'very much' and 'seems' record higher usage among the male writers.

Miscellaneous

Some miscellaneous queries were also included to strike the balance between the control parameters and words that are not considered as gender-specific. These words are 'money', 'financial', 'agree', 'ever', 'necessity', 'need' and 'easy'. These words were chosen as they are topic-related and included in the rubric of the text that the writers have to produce. Thus, the writers would have to use these words in their writing. The data show that four of these words, i.e. 'money', 'agree', 'ever' and 'necessity', are used more by the male writers, whilst 'financial', 'need' and 'easy' are more popular among female. Since these words do not belong to any gender-specific word category, it is quite difficult to determine gender preference of words usage here. The analysis shows that these words are used by the writers because they are topic-related and, hence, must be included to complete their argument.

Having discussed the findings, it can be concluded that this study supports the empirical findings that male and female vary in their communication and writing style in terms of their use of words and expressions. The latent semantic analysis method is able to identify the gender of the writer based on the words usage classification.

Table 60.8 summarizes the words/expressions used by both male and female writers. However, there are instances where some words that were initially considered

as gender-specific like hedges, adjectives and intensifiers were used more by the other gender. Thus, care should be taken when making any generalized conclusions about the male or female words usage as they may not reflect the overall communication styles of all male and female.

Conclusion

Empirical research has shown that male/female communication and writing styles vary in terms of their use of words and expressions. The present study, in general, also looks into gender differences in communication. Specifically, it focuses on identifying the gender of a writer based on the words/expressions usage found in the content of his/her writing. However, whilst the significance of the findings of the empirical research mostly lie in the importance of understanding the communication process between male and female, the present study proposes a framework to help identify the gender of the writer using computational technique. The analysis, which is able to identify the gender of the writer through his/her words usage, can contribute to an alternative technique for the forensic linguistic field of study. Specifically it can help to narrow down the scope of investigation by classifying the gender of the perpetrators in online criminal investigation such as ill-messages and threatening messages sent through e-mails.

The experiment carried out on the corpus in this study has shown that the latent semantic analysis method is able to classify word/expression usage of writers based on the characteristics of gendered-speech/communication styles as put forward by empirical studies. However, a larger size of corpus is needed to create the vector space of singular value decomposition so that larger matrix of term and gender-document can be constructed. This would ensure the validity and credibility of the analysis.

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Chapter 61
Flood Frequency Analysis at Ungauged Sites in the Peninsular Malaysia Using Multiple Linear Regressions

Ani Shabri and Nur Shahidah Roselan

Introduction

Human society faces great problems due to extreme environmental events. For example, floods, rainstorms, droughts, and high winds that cause tornadoes and such destroy almost anything that is in their vicinity at the moment of occurrences. Flood, also known as deluge, is a natural disaster that could diminish properties, infrastructures, animals, plants, and even human lives.

In terms of the number of population affected, frequency, area extent, duration, and social economic damage, flooding is the most natural hazard in Malaysia. Malaysia has experienced major floods since 1920. These flood events occurred in various states in Peninsular Malaysia [1].

Flooding occurs when the volume of water exceeds the capacity of the catchment area. Floods are one of the natural disasters that occur not only in Malaysia but also in other parts of the world. It is also the most costly natural hazard due to its ability to destroy human properties and lives. The basic cause of river flooding is the incidence of heavy rainfalls, such as the monsoon season or convection, and the resultant large concentration of runoff, which exceeds river capacity [1].

The study of water-related characteristics and modeling throughout the Earth such as the movement, distribution, resources, hydrologic cycle, and quality of water is called hydrology. By knowing and analyzing statistical properties of hydrologic records and data like rainfall or river flow, hydrologists are able to estimate future hydrologic phenomena.

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Cluster analysis has become a common tool for the marketing researchers. Both the academic researcher and marketing application researchers rely on the technique for developing empirical groupings of persons, products, or occasions which may serve as the basis for further analysis. Despite its frequent use, little is known about the characteristics of available clustering methods or how clustering method should be employed. One indication of this general lack of understanding of clustering methodology is the failure of numerous authors in the marketing literature to specify what clustering method is being used [2].

Multiple Linear Regressions (MLR)

MLR is a method used to model the linear relationship between a dependent variable and one or more independent variables. The dependent variable is sometimes also called the predictand and the independent variables the predictors. MLR is based on least squares: the model is fit such that the sum of squares of differences of observed and predicted values is minimized.

MLR is probably the most widely used method in dendroclimatology for developing models to reconstruct climate variables from tree-ring series. Typically, a climatic variable is defined as the predictand and tree-ring variables from one or more sites are defined as predictors. The model is fit to a period – the calibration period – for which climatic and tree-ring data overlap. In the process of fitting, or estimating, the model, statistics are computed that summarize the accuracy of the regression model for the calibration period.

The performance of the model on the data not used to fit the model is usually checked in some way by a process called validation. Finally, tree-ring data from before the calibration period are substituted into the prediction equation to get a reconstruction of the predictand. The reconstruction is a prediction in the sense that the regression model is applied to generate estimates of the predictand variable outside the period used to fit the data. The uncertainty in the reconstruction is summarized by confidence intervals, which can be computed by various alternative ways.

The model expresses the value of a predictand variable as a linear function of one or more predictor variables and an error term (model 1):

$$y_i = b_0 + b_1 X_{i,1} + b_2 X_{i,2} + \cdots + b_k X_{i,k} + e_i \tag{61.1}$$

The model (61.1) is estimated by least squares, which yields parameter estimates such that the sum of squares of errors is minimized. The resulting prediction equation is (model 61.2)

$$\hat{y}_t = \hat{b}_0 + \hat{b}_1 x_{t,1} + \hat{b}_2 x_{t,2} + \cdots + \hat{b}_k x_{t,k} \tag{61.2}$$

Hierarchical Cluster Analysis (HCA)

Hierarchical clustering is a general approach to cluster analysis in which the object is to group together objects or records that are close to one another. A key component of the analysis is repeated calculation of distance measures between objects and between clusters once objects begin to be grouped into clusters.

The objective of cluster analysis is to assign observations to groups or clusters so that observations within each group are similar to one another with respect to variables or attributes of interest, and the groups themselves stand apart from one another [3].

The outcome is represented graphically as a dendogram. The initial data for the hierarchical cluster analysis of N objects is a set of $N \times (N-1)/2$ object-to-object distances and a linkage function for computation of the cluster-to-cluster distances.

The two main categories of methods for hierarchical cluster analysis are divisive methods and agglomerative methods. In practice, the agglomerative methods are of wider use. On each step, the pair of clusters with the smallest cluster-to-cluster distance is fused into a single cluster. The most common algorithm for hierarchical clustering is average linkage clustering.

Average Linkage Clustering

The average linkage clustering is a method of calculating distance between clusters in hierarchical cluster analysis. The linkage function specifying the distance between two clusters is computed as the average distance between objects from the first cluster and objects from the second cluster. The averaging is performed over all pairs (x, y) of objects, where x is an object from the first cluster and y is an object from the second cluster. Mathematically the linkage function – the distance between clusters X and Y – is described by the following expression (Model 61.3):

$$D\left(X,Y\right) = \frac{1}{N_x \times N_y} \sum_{i=1}^{N_x} \sum_{j=1}^{N_y} d\left(x_{i,} y_j\right);$$

$$(61.3)$$

Data Source

Peninsular Malaysia covers 131,000 km^2 or 39.7 % of the total land of the country. Malaysia's climate is categorized as equatorial, being hot and humid throughout the year. Rainfall occurs throughout the year with the total annual rainfall being within 2,000–4,000 mm. Malaysia faces two monsoon winds seasons – the Southwest Monsoon from late May to September and the Northeast Monsoon from November to March. The Northeast Monsoon brings in more rainfall compared to the Southwest [1].

This research utilizes the data of daily stream flow in Peninsular Malaysia, which are collected from the Department of Irrigation and Drainage, Ministry of Natural Resources and Environment, Malaysia. The analysis of data focuses on estimating the annual maximum flow series that measure the peak of flow discharge for each year. The data that contains n observed years per site has a sample size of n. Basic information of each 70 catchments are the catchment's area (CA), elevation (E), longest drainage path (DP), mean rainfall (MR), and river slope (RS). 56 data are used as training data and another 14 data are used for testing data.

Results and Discussion

MLR Models

The MLR models that are considered in this paper are

$$\hat{y}_1 = a_0 + a_1 CA + a_2 DP + a_3 MR + a_4 E + a_5 RS + \varepsilon$$
$$\hat{y}_2 = a_0 + a_1 CA + a_2 DP + a_3 MR + a_4 E + \varepsilon$$
$$\hat{y}_3 = a_0 + a_1 CA + a_2 DP + a_3 MR + \varepsilon$$
$$\hat{y}_4 = a_0 + a_1 CA + a_2 DP + \varepsilon$$
$$\hat{y}_5 = a_0 + a_1 CA + \varepsilon$$
$$\vdots$$

and the best model for this study is

$$\hat{y} = a_0 + a_1 CA + a_2 DP + a_3 MR + \varepsilon \quad \text{which is}$$

$$\hat{y} = -21.5861 + 0.075209 CA + 4.290698 DP + (-2.68401) MR$$

To analyze these models further, the statistical measurements of the MLR and MLR with HCA are compared. The performances of all the models are in Table 61.1.

The objective of this paper is to assess the performance of the MLR model with HCA in estimating the flood quantiles for ungauged sites in Peninsular Malaysia. The models are developed for 10-, 50-, and 100-year quantiles. The three flood quantiles and the two models used for comparison purposes are applied to the study case database. For MLR and MLR with HCA models, the results obtained is presented in Table 61.1.

The MSE and RMSE of an estimator are the expected value of the square of the error. The error is the amount by which the estimator differs from the quantity to be estimated. The smaller the mean squared error is, the closer the estimator is to the actual data. Small mean squared error means that the randomness reflects the data more accurately than a larger mean squared error. Based on Table 61.1, it shows that MLR with HCA model is performed better compared to the MLR model.

Table 61.1 Forecasting performance indices of models for MLR and MLR with HCA

Quantile	T=10 years		T=50 years		T=100 years	
Models	MLR	MLR with HCA	MLR	MLR with HCA	MLR	MLR with HCA
MSE	3.158313	**1.445402**	3.376043	**1.704397**	3.393319	**1.328771**
MAE	1.541323	**0.941796**	1.588502	**1.075966**	1.560718	**1.001687**
MAPE	4.023795	**4.773954**	4.255211	**5.263682**	4.558945	**5.513084**
RMSE	1.777164	**1.054645**	1.837401	**1.258243**	1.842096	**1.119105**

The MAE is the average over the verification sample of the absolute values of the differences between forecasts and the corresponding observations. The MAE is the linear score which means that all the individual differences are weighted equally in the average. The smaller MAE means that the forecasts' value is closer to the observed value compared to larger MAE. In Table 61.1, the results shows that the MLR with HCA model is performed better compared to MLR.

The MAPE is the measure of accuracy of a method for constructing fitted time series values in statistics, specifically in trend estimation. It usually expresses accuracy as a percentage. The smaller value of MAPE shows that the model is performed better compared to the other model which means the MLR with HCA model is better than MLR model.

Conclusions

To illustrate the capability of the MLR with HCA model, this model is compared to the MLR model. For modeling study, hydrologic and physiographic data from using 70 catchments in the Peninsular Malaysia were used. The flood quantile associated with 10-, 50-, and 100-year return periods was considered. The overall performance of each model is examined using MSE, RMSE, MAE, and MAPE. The comparison between the two models shows that the MLR with HCA model performance is better.

Instead of these variables for hydrological modeling studies, it is of course extremely probable that the predictions would present more accuracy provided that more available other variables such as physiography, soil and land use properties, and climate were included in the modeling setup. The further studies for the same region are recommended including more available independent variables in the modeling setup.

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Chapter 62
TL-Moments: Application to the Generalized Logistic Distribution

Nur Amalina Mat Jan, Ani Shabri, and Sukma Dewi Azuardi

Introduction

Flooding is an overflow or inundation that comes from a river or other body of water and causes severe damage, loss of properties, and occasionally loss of human lives. Precaution steps are very important to reduce damage of properties and prevent loss of human life. This case can be handled by using flood frequency analysis (FFA) [1].

The frequency analysis is the estimation of how often a specified event will occur [2]. In FFA studies, the probability distribution function and parameter estimation method are the most important factors in producing the best estimation results.

Elamir and Seheult [3] introduced an extension of LMOM called trimmed L-moments (TLMOM) where they trim one smallest and largest value from the conceptual sample. They denote this as $\lambda_r^{(t_1,t_2)}$:

$$\lambda_r^{(t_1,t_2)} = \frac{1}{r} \sum_{k=0}^{r=1} (-1)^k \binom{r-1}{k} E\left(X_{r+t_1-k:r+t_1+t_2}\right). \tag{62.1}$$

The TLMOM method is more related to the choice of amount of trimming. Ahmad et al. [4] stated the purpose of analyzing annual maximum series of floods usually is to predict the magnitude of flood of relatively large return period events. In their paper, they studied that the trimmed L-moments with one smallest value were trimmed, TL-moment (1,0) compared with TL-moment (1,1) and L-moment. The result showed that TL-moment (1,0) gives more accurate estimation in estimating high flow quantile compared to two other methods. In this paper, we continued the

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trimmed L-moments with TL-moments (2,0), (3,0), and (4,0) from the conceptual sample. Estimation of the GLO distribution by using TL-moments (2,0), (3,0), and (4,0) is formulated. Since the TL-moment (1,0) gave the accurate estimation of high flow quantile, the performance of TL-moments (2,0), (3,0), and (4,0) were compared with TL-moment (1,0) through Monte Carlo simulation and the streamflow data.

The Generalized Logistic Distribution

The generalized logistic (GLO) distribution has been used widely in extreme value event evaluation and also popular in hydrological risk analysis. The cumulative distribution function of GLO is

$$F\left(x\right) = \left[1 + \left\{ 1 - k\left(\frac{x - \xi}{\alpha} \right) \right\}^{\frac{1}{k}} \right]^{-1} \tag{62.2}$$

TL-Moment Method

The concepts of TL-moments are almost the same as the L-moments. From Eq. (62.1), the generalization of the first four rth TL-mom for every level of TL-mom is shown in Eqs. (62.3), (62.4), (62.5), and (62.6)

$$\lambda_1^{(\eta,0)} = E\left[X_{(\eta+1):(\eta+1)} \right] \tag{62.3}$$

$$\lambda_2^{(\eta,0)} = \frac{1}{2} E\left[X_{(\eta+2):(\eta+2)} - X_{(\eta+1):(\eta+2)} \right] \tag{62.4}$$

$$\lambda_3^{(\eta,0)} = \frac{1}{3} E\left[X_{(\eta+3):(\eta+3)} - 2X_{(\eta+2):(\eta+3)} + X_{(\eta+1):(\eta+3)} \right] \tag{62.5}$$

$$\lambda_4^{(\eta,0)} = \frac{1}{4} E\left[X_{(\eta+4):(\eta+4)} - 3X_{(\eta+3):(\eta+4)} + 3X_{(\eta+2):(\eta+4)} - X_{(\eta+1):(\eta+4)} \right] \tag{62.6}$$

where $\eta = 1, 2, 3$, and 4. The expected value of order statistics defined by Elamir and Seheult [3] is

$$E\left(X_{n:r} \right) = \frac{r!}{(i-1)!(r-i)!} \int_0^1 x(F) F^{n-1} (1-F)^{r-1} \, dF, \quad r \le n \tag{62.7}$$

The sample TL-moment was presented by Elamir and Seheult [3] as

$$l_r^{(t_1,t_2)} = \frac{1}{r\binom{n}{r+t_1+t_2}} \sum_{i=t_1+1}^{n-t_2} \sum_{k=0}^{r-1} (-1)^k \binom{r-1}{k} \binom{i-1}{r-t_1-k-1} \binom{n-i}{k+t_2} x_{i:n} \quad (62.8)$$

where $t_1 = 1, 2, 3$, and 4, while $t_2 = 0$ or $\eta = 1, 2, 3$, and 4, r represents the order of the L-moment, n represents the sample size, and $x_{i:n}$ is the ith sample order statistic. The TL-moments ratios are skewness and kurtosis. They can be defined as Eq. (62.9):

$$\tau_r^{(\eta,0)} = \frac{\lambda_r^{(\eta,0)}}{\lambda_2^{(\eta,0)}}, \quad r = 3 \text{ and } 4. \quad (62.9)$$

Parameter Estimation for the GLO Distribution

The parameters for each level of TL-moments need to be estimated first before the analysis can be done. The three parameters α, ξ, and k in the GLO distribution can be estimated by matching the first four TL-moments in equations (62.3), (62.4), (62.5), and (62.6) to their sample estimates for a selected η. Table 62.1 shows the parameter estimates for the selected distribution using TL-moments approaches.

Monte Carlo Simulations

Monte Carlo simulation study is conducted to compare the performance of TL-moments (1,0), (2,0), (3,0), and (4,0) for the GLO distribution. The measures of performance that were used are the relative bias (RBIAS) and the relative root mean square error (RRMSE) with different sample size, n, and shape parameter, k. In Monte Carlo simulation, the value of parameter of scalar and location is set as 0 and 1 [5] with shape parameter k in between (-0.4, 0.4) [6]. The RRMSE and RBIAS can be represented as

$$RRMSE = \sqrt{\frac{1}{M} \sum_{m=1}^{M} \left(\frac{\hat{\theta}_i - \theta}{\hat{\theta}_i} \right)^2} \quad (62.10)$$

$$RBIAS = \frac{1}{M} \sum_{m=1}^{M} \left(\frac{\hat{\theta}_i - \theta}{\hat{\theta}_i} \right) \quad (62.11)$$

Table 62.1 TL-moment parameter estimates for each level

Level of TL-moment	Parameter estimates
TL-moment (1,0)	$k = (4 - 27t_3)/20$
	$\alpha = 2l_2/[\Gamma(k)(3\Gamma(2-k) - \Gamma(3-k))]$
	$\xi = l_1 - (\alpha/k) + \alpha\Gamma(k)\Gamma(2-k)$
TL-moment (2,0)	$k = (1/3) - (8/5)t_3$
	$\alpha = 3l_2/[\Gamma(3-k)\Gamma(1+k)]$
	$\xi = l_1 - (\alpha/k)[1 - \Gamma(3-k)$
	$\quad \Gamma(1+k)/2]$
TL-moment (3,0)	$k = (3/7) - (25/14)t_3$
	$\alpha = 48l_2/[5\Gamma(4-k)\Gamma(1+k)]$
	$\xi = l_1 - (\alpha/k)[1 - \Gamma(4-k)$
	$\quad \Gamma(1+k)/6]$
TL-moment (4,0)	$k = (1/2) - (27/14)t_3$
	$\alpha = 40l_2/[5\Gamma(4-k)\Gamma(1+k)]$
	$\xi = l_1 - (\alpha/k) + [\alpha\Gamma(k)\Gamma(5-k)]/24$

where M is the sample size and $\hat{\theta}_i$ and θ are the estimated values and true value of the quantile. In each simulation, 5,000 samples are used for sample sizes 15, 25, and 50. The quantile function $x(F)$ that has been obtained for RRMSE and RBIAS values are $F = 0.9$, $F = 0.95$, $F = 0.98$, $F = 0.99$, and $F = 0.995$, i.e, Q_{10}, Q_{20}, Q_{50}, Q_{100}, and Q_{200}.

Table 62.2 shows the RRMSE of quantiles $x(F)$ for $F = 0.9$, $F = 0.95$, $F = 0.98$, $F = 0.99$, and $F = 0.995$ computed using TL-moments (1,0), (2,0), (3,0), and (4,0) of the GLO distribution for all sample sizes, $n = 15$, 25, and 50, with shape parameter k $(-0.4, 0.4)$. At $k = -0.4$ and $k = 0.4$ for all sample sizes, TL-moments (2,0), (3,0), and (4,0) give smaller RRMSE value for quantiles $x(F)$, $F = 0.90$, $F = 0.98$, and $F = 0.99$. TL-moment (4,0) leads at $k = -0.2$ for all sample sizes and quantiles except at $n = 50$ that shows smaller RRMSE of TL-moment (1,0) for quantile $F = 0.99$ and $F = 0.995$, while, TL-moment (1,0) gives smaller RRMSE value mostly for all sample sizes and quantiles.

The results of RMSE obtained using TL-moment (1,0), (2,0), (3,0), and (4,0) of quantile $x(F)$, $F = 0.9$, $F = 0.95$, $F = 0.98$, $F = 0.99$, and $F = 0.995$ were illustrated in Table 62.3. From the table, the result shows that TL-moment (1,0) produces smaller bias value at $k = -0.4$ for all sample sizes while TL-moment (4,0) produces smaller bias value at $k = 0.4$. At $k = -0.2$, the smaller bias value leaded by TL-moment (1,0) followed by TL-moment (4,0) at $k = 0.2$.

Data Analysis

To show the different result between TL-moments (1,0), (2,0), (3,0), and (4,0) for the GLO distribution, streamflow data is needed. A set of annual maximum flow series for station 3024443 Sg. Serting at Jam. Padang Gudang, Pahang, Malaysia,

Table 62.2 RRMSE of $x(F)$ estimator fitting the GLO distribution to generated GLO samples

k	Level of TL-mom	n=15 F=0.98	F=0.99	F=0.995	n=25 F=0.98	F=0.99	F=0.995	n=50 F=0.98	F=0.99	F=0.995
−0.4	(1,0)	0.581	0.702	0.869	0.476	0.580	0.719	0.365	0.447	0.552
	(2,0)	**0.580**	0.694	0.854	**0.471**	0.569	0.703	0.359	0.441	0.547
	(3,0)	0.586	**0.692**	0.844	0.472	0.564	0.691	**0.358**	0.437	0.542
	(4,0)	0.595	0.694	**0.839**	0.476	**0.562**	**0.683**	0.358	**0.435**	**0.537**
−0.2	(1,0)	0.494	0.608	0.765	0.396	0.483	0.600	0.285	**0.341**	**0.408**
	(2,0)	0.486	0.600	0.764	0.391	0.481	0.605	0.284	0.345	0.423
	(3,0)	0.481	0.591	0.754	0.387	0.476	0.602	0.282	0.346	0.428
	(4,0)	**0.480**	**0.582**	**0.741**	**0.385**	**0.470**	**0.595**	**0.281**	0.344	0.429
0.2	(1,0)	**0.277**	**0.320**	**0.374**	**0.2099**	0.237	0.270	0.144	**0.160**	**0.178**
	(2,0)	0.280	0.332	0.400	0.2103	0.241	0.280	0.143	0.161	0.182
	(3,0)	0.281	0.340	0.423	0.2103	0.244	0.288	0.143	0.162	0.185
	(4,0)	0.281	0.343	0.438	0.2100	0.246	0.296	**0.142**	0.162	0.188
0.4	(1,0)	0.215	0.248	**0.287**	0.158	0.176	0.197	0.107	0.118	0.130
	(2,0)	0.209	**0.245**	0.290	0.151	**0.169**	**0.191**	0.102	0.112	0.124
	(3,0)	0.208	0.250	0.307	0.148	0.167	0.191	0.099	0.109	0.122
	(4,0)	**0.208**	0.254	0.322	**0.147**	0.167	0.194	**0.097**	**0.107**	**0.121**

Table 62.3 RBIAS of $x(F)$ estimator fitting the GLO distribution to generated GLO samples

k	Level of TL-mom	n=15 F=0.98	F=0.99	F=0.995	n=25 F=0.98	F=0.99	F=0.995	n=50 F=0.98	F=0.99	F=0.995
−0.4	(1,0)	**0.095**	**0.082**	**0.052**	**0.070**	**0.060**	**0.037**	**0.041**	**0.035**	**0.022**
	(2,0)	0.117	0.112	0.088	0.084	0.081	0.063	0.050	0.050	0.040
	(3,0)	0.134	0.137	0.119	0.093	0.097	0.085	0.056	0.060	0.055
	(4,0)	0.148	0.159	0.146	0.100	0.110	0.103	0.059	0.069	0.067
−0.2	(1,0)	**0.025**	**−0.003**	−0.044	**0.016**	**−0.003**	−0.031	**0.005**	−0.0039	−0.017
	(2,0)	0.046	0.021	−0.023	0.028	0.011	−0.018	0.012	**0.0038**	−0.010
	(3,0)	0.065	0.043	**0.000**	0.038	0.024	**−0.004**	0.018	0.011	**−0.003**
	(4,0)	0.081	0.065	0.023	0.047	0.036	0.010	0.022	0.017	0.005
0.2	(1,0)	−0.015	−0.034	−0.0571	−0.007	−0.018	−0.030	−0.006	−0.011	−0.016
	(2,0)	−0.007	−0.029	**−0.0565**	−0.003	−0.015	−0.029	−0.004	−0.008	−0.014
	(3,0)	**0.001**	−0.024	−0.059	**0.001**	−0.012	−0.028	−0.002	−0.007	−0.013
	(4,0)	0.011	**−0.017**	−0.057	0.004	**−0.009**	−0.028	**0.000**	**−0.005**	**−0.012**
0.4	(1,0)	−0.023	−0.040	−0.058	−0.012	−0.020	−0.030	−0.008	−0.012	−0.017
	(2,0)	−0.014	−0.032	**−0.052**	−0.005	−0.013	−0.022	−0.005	−0.008	−0.013
	(3,0)	−0.008	−0.029	−0.054	−0.002	−0.011	−0.020	−0.003	−0.007	−0.011
	(4,0)	**−0.002**	**−0.025**	−0.056	**0.000**	**−0.009**	**−0.020**	**−0.002**	**−0.006**	**−0.010**

are used for this purpose. The data consists of 21 annual maximum streamflow data. The data used in this study was provided by the Department of Irrigation and Drainage, Ministry of Natural Resources and Environment, Malaysia.

The result was compared between the method of TL-moments (1,0), (2,0), (3,0), and (4,0) to see the effectiveness of these methods in real life. Figure 62.1 shows
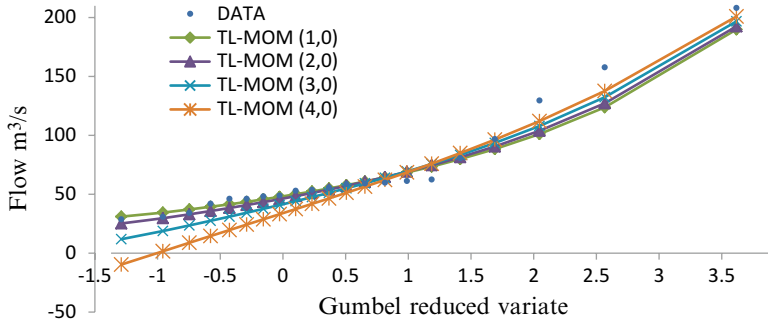
Fig. 62.1 Fitting the GLO distribution to annual maximum flows at Sg. Serting, Jam. Padang Gudang, Pahang, Malaysia

that TL-moment (4,0) gives more accurate estimation for the high quantile estimation followed by TL-moments (3,0), (2,0), and (1,0). However, on the estimation of low flow quantile, TL-moment (1,0) method gives more accurate estimation.

Conclusions

Elamir and Seheult [3] introduced an extension of LMOM called trimmed L-moments (TLMOM) where they trim one smallest and largest value from the conceptual sample. The TL-moments (1,0), (2,0), (3,0) and (4,0) are used to estimate the parameters of the GLO distribution. The Monte Carlo simulations were carried out to see the performance of TL-moments (1,0), (2,0), (3,0), and (4,0) involving various sample sizes n and different values of shape parameter k for different quantile estimators, $x(F)$.

From the result, TL-moments (2,0), (3,0), and (4,0) give better result for the certain k value while TL-moment (1,0) gives better result for other k values. To produce a better estimation, it is important to choose the right k values. These methods were applied in annual streamflow series of Sg. Serting at Jam. Padang Gudang, Pahang, Malaysia. The result shows that TL-moments (2,0), (3,0), and (4,0) give more accurate estimation in estimating the high flow quantile using this data. So, this study demonstrated that the high level of trimmed L-moment also can be another option in estimating the quantile of GLO distribution.

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Chapter 63
On the Performance of Several Approaches to Obtain Standardized Logistic Regression Coefficients

Anwar Fitrianto and Imam Hanafi

Introduction

Logistic regression model is very common to model relationship between independent and dependent variable when the dependent (outcome) variable is categorical. In this kind of situation where we have categorical outcome variable, linear regression model is not suitable since the linear regression models require the outcome variable to be measured on a ratio scale. Moreover, a linear regression model assumes the error terms come from a normal distribution. Logistic regression can deal with binary, nominal, and ordinal outcome variables along with one or more independent variables. Binary outcome variable commonly refers to terms such as success or failure, life or death, presence or absence, win or lose, admission or rejection, are used for these two outcomes. But, sometimes we have outcome variable which has two categories and we name is as polychotomous. The polychotomy can be viewed as a generalization of binary variable.

Logistic regression commonly uses the maximum likelihood estimation (MLE) method to estimate the model coefficients (parameters). A logistics model with k-independent variables specified in the model will have $k+1$ values of betas (logistic regression coefficients) which maximize the probability of obtaining the observed set of data.

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The coefficients of the logistic regression model will be interpreted as the change in the dependent variable which is logit(Y), associated with a one-unit change in the predictor variable [1]. Conversely, different to linear regression, in logistic regression model, $P(Y=1)$ is not a linear function of the independent variables which means the slope of the curve varies depending on the value of the independent variables. It means that when predictor variables are measured at dissimilar scales or in different units, the beta coefficients, β's, need to be standardized to compare the strength of the relationship between the dependent variable and independent variables. By standardizing the coefficients, the independent variables can be compared directly to determine which has the largest magnitude on the dependent variable.

Reviews of Standardized Logistic Regression Coefficients

According to Menard [2], there are several motives of employing standardized coefficients for logistic regression models. Firstly, as it was mentioned in the previous section, standardized logistic regression coefficients have more informative meaning compared to the unstandardized ones especially for variables which do not have natural metric. It is commonly understood that the unstandardized coefficient is interpreted as the impact of a one-unit change in the independent variable on the response variable. Unfortunately, without having the unit itself meaningful, a one-unit change has little or no meaning. Therefore, when the predictor has no natural metric, using a standardized logistic regression coefficient will ensure that the amount of change in the predictor should be adequate to produce substantial change in the outcome variable, if both the variables are related. Having measured the dependent variable in a natural metric justifies no more than standardizing the predictors [3]. Due to that fact, it will be meaningful to standardize both dependent and predictor variables when the first is not measured in a natural metric [4]. The second reason is that standardized regression coefficients are worthwhile to compare relative strength of different predictors or independent variables within a multiple regression or logistic regression model [5]. This is applicable when the variables are measured in different units of measurement. Thirdly, if our interest is whether the predictor with the strongest (or weakest) relationship to the dependent variable is the same in two or more samples, then we can do comparisons across samples. In this case, the unstandardized coefficient does not tell us whether the belief that it is wrong to violate the law is the strongest predictor in one sample; much less can the unstandardized coefficient tell us whether it is the strongest predictor in more than one sample [4].

Approaches to Obtain Standardized Logistic Regression Coefficients

Relationship between $\pi(x)$ and x is typically nonlinear instead of linear. The mathematical expression of $\pi(x)$ is written as

$$\pi\left(x\right) = \frac{\exp\left(\beta_0 + \beta' x\right)}{1 + \exp\left(\beta_0 + \beta' x\right)} = \frac{e^{\left(\beta_0 + \beta' x\right)}}{1 + e^{\left(\beta_0 + \beta' x\right)}}. \tag{63.1}$$

Logistic regression models use the dependent variable as the logarithm of the odds of the proportion. This is well known as the logit of $\pi(x)$. It is modeled as a linear combination of the independent variables, and the error structure is assumed binomial as in the following expression:

$$\log\left(\frac{\pi\left(x\right)}{1 - \pi\left(x\right)}\right) = \beta_0 + \beta' x + \varepsilon. \tag{63.2}$$

We need to obtain an estimate of the vector of unstandardized estimates of Eq. (63.2). Common method to obtain best unstandardized parameter estimates is MLE.

For comparisons and better interpretation in logistic regression, we can also calculate standardized logistic regression coefficients. Currently, several approaches to obtain standardized logistic or logit regression coefficients have been suggested in the literature [4]. The first approach to a standardized coefficient in logit analysis was proposed by Goodman [6]. He divided each unstandardized coefficient by its estimated standard deviation as the following equation:

$$\hat{\beta}_G^* = \frac{\hat{\beta}}{s_{\hat{\beta}}}. \tag{63.3}$$

By dividing each estimated β parameter by its estimated standard deviation, $s_{\hat{\beta}}$, the corresponding "standardized value" of the estimate can be obtained. Each standardized value can be used to test whether the corresponding β parameter is zero.

The second approach to calculate standardized logistic regression coefficients was suggested by [5]. The approach is done by standardizing only the predictors and resulting in the second standardized coefficient. According to [5], the model is fitted to standardize predictor variables. It means that a one-unit change in the standardized predictor is actually a standard deviation change in the original predictor. Then, each regression coefficient represents the effect of a standard deviation change in a predictor, controlling for the other variables. The standardized estimate for predictor x is the unstandardized estimate $\hat{\beta}$ multiplied by s_x, or

$$\hat{\beta}_A^* = \hat{\beta} s_x, \tag{63.4}$$

where s_x is the sample standard deviation of the predictor x.

The third procedure to estimate standardized logistic regression coefficients which was put into practice in SAS [7] is to standardize both predictors and the dependent variable using $\dfrac{\pi}{\sqrt{3}} = 1.814$. It means the standard deviation of the

standard logistic distribution as an estimate for the standard deviation of the dependent variable, Y. By using this approach, we can obtain the following equation:

$$\hat{\beta}_M^* = \frac{\hat{\beta} s_x}{\left(\pi / \sqrt{3} \right)}. \tag{63.5}$$

According to [4], this approach is the same as to standardize the predictors variable and leave the dependent variable in its original metric in OLS.

Meanwhile, the fourth approach of standardized coefficient was suggested by [8]. This approach is calculated based on the standard deviation of both the standard logistic distribution plus the standard deviation of the standard normal distribution (the latter equal to one by definition). It will result in the fourth standardized logistic regression coefficient as follows:

$$\hat{\beta}_L^* = \frac{\hat{\beta} s_x}{\left[\left(\pi / \sqrt{3} \right) + 1 \right]}.$$

Data and Methodology

To demonstrate several approaches to obtain the standardized logistic regression coefficients, we present a numerical example mentioned in [5] of horseshoe crab data. The data comes from a study of nesting horseshoe crabs [8]. In the study, each female horseshoe crab had a male crab attached to her in her nest. The study investigated several factors that affect whether the female crab had any other males, called satellites, residing nearby her. The response variable for each female crab is her number of satellites. Two explanatory variables thought possibly to affect this are shell color score, x_1, and the female crab's shell width, x_2. Both variables describe her color and size. In the sample, the shell color score has standard deviation of 0.8019, and width has a standard deviation of 2.1091 cm. Let Y indicate whether a female crab has any satellites (other males who could mate with her). That is, $Y = 1$ if a female crab has at least one satellite and $Y = 0$ if she has no satellite.

For comparison purposes of calculating the standardized logistic regression coefficients, the horseshoe crab data will be analyzed using in SAS release 9.1. Techniques for implementing logistic regression are found in PROC LOGISTIC in the STAT module of SAS System software, although there are other procedures within SAS that also do logistic regression (PROC CATMOD and PROC PROBIT).

Results and Discussion

Table 63.1 presents the results for the logistic regression analysis of the horseshoe crab data with two predictors, color and width. In order to calculate the standardized logistic regression coefficients, standard deviation of each predictor is used. Based on the results of the analysis, after referring to the Wald statistic, both predictors are statistically contributing to the outcome variable. The logistic prediction equation is

$$\text{logit}\left[P\left(Y = 1\right)\right] = -10.07 - 0.51x_1 + 0.46x_2$$

Crabs's shell color score and the crab's shell width have different influence on the presence of satellites; the color has negative influence but the width has positive one. Negative influence of the color means that probability of a female crab to have satellites decreases when the crab's shell score increases. In the meantime, probability of having the satellites increases for a female crab has wider shell.

Table 63.2 displays the standardized coefficients of the logistic regression which are obtained based on four approaches for the model in which the presence of satellites on a female crab is predicted using crab's shell color score and the female crab's shell width. Calculation of $\hat{\beta}_G^*$ is performed by dividing each unstandardized logistic regression coefficient in Table 63.1 by its standard error: $\hat{\beta}_{Gx_1}^* = -0.51/0.22 = -2.276$ for color and $\hat{\beta}_{Gx_1}^* = 0.46/0.10 = 4.60$ for the width. The remaining standardized logistic regression coefficients which are calculated using the other approaches are displayed in the table. Based on all four approaches, crab's shell width evidenced the larger influence on the presence of satellites. It means that the different approaches to calculate standardized coefficients produce the same order of magnitude for the effects of both predictors. But the magnitude of different approaches has different order. In this example, Menard and Long's approaches seem to have closer magnitudes to each other, and these two approaches tend to have smaller magnitude compared to the other approaches.

Table 63.1 Summary statistics for logistic regression model of the horseshoe crab data

Terms	Est.	SE	Wald	p
Intercept	−10.07	2.81	12.87	0.0003
Color	−0.51	0.22	5.18	0.0229
Width	0.46	0.10	19.41	<.0001

Table 63.2 Comparisons of four approaches of obtaining standardized logistic regression coefficients of the horseshoe crab data

Var	Approaches			
	Goodman [6]	Agresti [7]	Menard [9]	Long [8]
Color	−2.28	−0.41	−0.23	−0.15
Width	4.41	0.97	0.53	0.34

Conclusion

In our numerical example, standardized logistic regression coefficients help us to explore in the differential effects of predictors on the criterion. Through our numerical examples, we have shown that different approaches to calculate standardized coefficients produce the same order of magnitude for the effects of both predictors. But the magnitude of different approaches has different order. In this example, Menard and Long's approaches seem to have closer magnitudes to each other, and these two approaches tend to have smaller magnitude compared to the other approaches.

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Chapter 64
Comparison of Anthropometric Characteristics, Body Composition, Speed and Agility Performance of Universiti Teknologi MARA (UiTM) Football Players

Sufyan Zaki, Adam Linoby, Khairi Zawi, and Annisaa Basar

Introduction

Football is a complicated sport, combining other successful factors in terms of tactical, technical and physical characteristics of the players. To be specific, they are expected to sustain high aerobic fitness and aerobic power, combined with good agility [1], which allows them to maintain fast movement for the entire match duration [2]. Somehow, the players who are involved more in attack movement increase their meaningful pass to teammates and also frequently receive the ball during match play.

In order to have a good speed and agility, anthropometric characteristics and body composition should be considered as an important indicator to the whole players. In detail, differences existed in all anthropometric and performance characteristics between positions [3]. The differences in anthropometrics refers to body mass, weight, height and body mass index (BMI) obviously reported in professional football players [4]. Four specific positions in the football team, namely, the goalkeeper, defender, midfielder and striker, are directly exposed to the increasing tempo and pace in modern football which requires high-intensity, intermittent, noncontinuous exercise and different sprint durations in the match [5, 6].

Speed and agility are obviously differentiating the quality of the team acquired from the opponent's perspective. Traditionally, agility has been known as the ability to change direction quickly. In team sports, agility tends to be used as a strategy in attacking that is combined with sprint ability [7]. It reflects the counter-attacking strategy and also in controlling ball possession during the match.

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The improvement in terms of tactical skills, repeated sprint ability (RSA) refers as players speed could be the key factor that contributes in football triumph [8–10].

The training design for improving RSA is significantly practised by coaches and trainers in developing young players. Thus, training strategies for emerging with the greatest sprint ability, metabolic function, and/or both concurrently may affect the development of RSA [11, 12]. A recent study has examined the repetitive sprint capacity and acceleration and maximum running speed in highly trained male junior football players [13]. In this study, we measured the maximum running speed and agility and its relationship with the body composition of players.

The aim of the present study was to determine the variances in anthropometrics and body composition based on player positions. The fitness variables (i.e. speed and agility) that may correlate with body composition were measured. This study was conducted among the university football players who participated in competitive football tournament during the Malaysian University League 2012.

Methods

Subjects

There were 70 university football players (mean age was 20.3 (±1.32) years). The mean body weight and height (±SD) were 64.9 (±7.91) kg and 171.0 (±5.80) cm, respectively. The measurements were taken during the competitive season in the regular training session time two days after the match ended. Players from all the four positions participated as subjects. Any of the players could withdraw if they are unable to give full effort in the tests. A consent form was signed after the players and the team management have understood all the testing procedures and safety precaution.

Experimental Design and Procedures

All subjects were familiarized with the tests during the early demonstration. Anthropometrics of the four playing positions were measured before the speed and agility test sessions. All tests did not use any instruments which were sensitive to calibration processes. A standard warm-up and stretching session was also done in order to avoid any sports injury especially involving the hamstring during explosive movement. The frequent hamstring injury was due to the determination of repeated sprints exerted for a long period of football match [14]. Thus, all tests were conducted based on standard procedures.

After the anthropometric measurement was recorded (the height, weight and body fat percentage of the subjects), the following speed (30 m sprint) and agility (*T*-test) test was conducted. The agility (*T*-test) test was the first to be done by the subjects. The best time in two successful trials will be counted as the real test score.

Next, after an ample time of resting interval that allowed the players to reduce their training heart rate, the speed test took place which required 30 m of field sprint. The best time from three successful trials was recorded as the player's score. All tests were finished approximately in the same day as it was planned. The obvious testing effect was fatigue due to adherence to the testing procedures. Such effects were minimized by the counterbalancing procedure.

Statistical Analysis

In systematic analysis, all scores for mean and standard deviations were described in the descriptive figures. For all comparisons, a one-way analysis of variance (ANOVA) was applied to determine the mean differences among the forwards, midfielders, defenders and goalkeepers in terms of the two selected fitness parameters. For all comparison purposes, the significance level was predetermined at 95 % level. A Geisser-Greenhouse correction was applied to ensure the significance level remained consistent across all levels of comparisons. Any possible correlation between the speed, agility and the study data on body fat were determined by the Spearman rho calculation.

Results

Performance

The mean body fat percentage is 14.49 (6.42), and this did not demonstrate a significant difference between the playing positions [df (3, 66) = 1.03, $p = 0.38$)]. The mean body fat percentage and performance of speed and agility were illustrated in Figs. 64.1, 64.2 and 64.3 below. The mean (±SD) speed for the defender is 4.12 (.40) followed by the mean of the midfielder 4.24 (.51) and then 4.34 (.76) for the striker and 4.54 (.35) for the goalkeeper. Meanwhile, the mean (±SD) agility for the defender is 10.07 (.73) followed by the mean of the midfielder 10.07 (.69) and then 10.53 (1.17) for the striker and lastly 10.24 (.80) for the goalkeeper. A one-way ANOVA was conducted for comparing the speed and agility test mean from the three positions of play. There was no significant difference between positions in speed performance [df (3, 66) = 1.57, $p = 0.206$)] and players' agility performance [df (3, 66) = 1.09, $p = 0.261$)].

In an attempt to establish whether a correlation might exist between the speed and agility of participants in this study (representing university-level competitive football) and body fat percentage of players (according to specific position of play) in the same level of football match, the analysis yielded a correlation as shown in Table 64.1 which indicated a high significance. However, body fat percentage did not demonstrate a significant influence in the speed and agility performance with an index of 1.19.
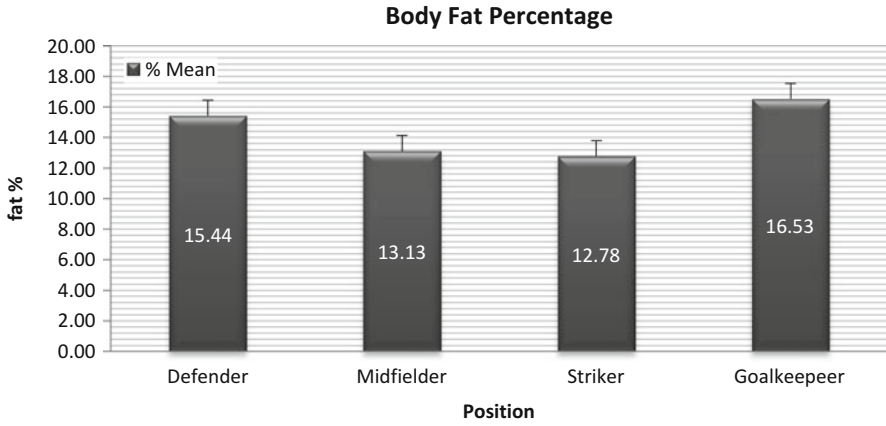
Body Fat Percentage

Fig. 64.1 Distribution of fat percentage between positions
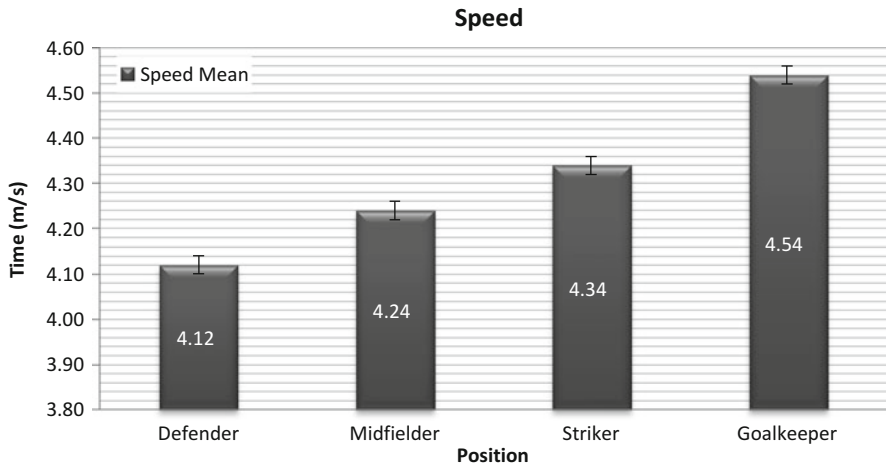
Speed

Fig. 64.2 Speed performance between positions

In summary, except for the speed correlation, all other selected fitness parameters in this study did not suggest any meaningful differences among the midfielder, striker, defender and goalkeeper of male junior university-level football players.

Discussion

This research endeavoured to explore the possibility of differences in selected fitness parameters for university football players according to the three positions in the team. The general findings revealed that strikers have lower body fat percentage,
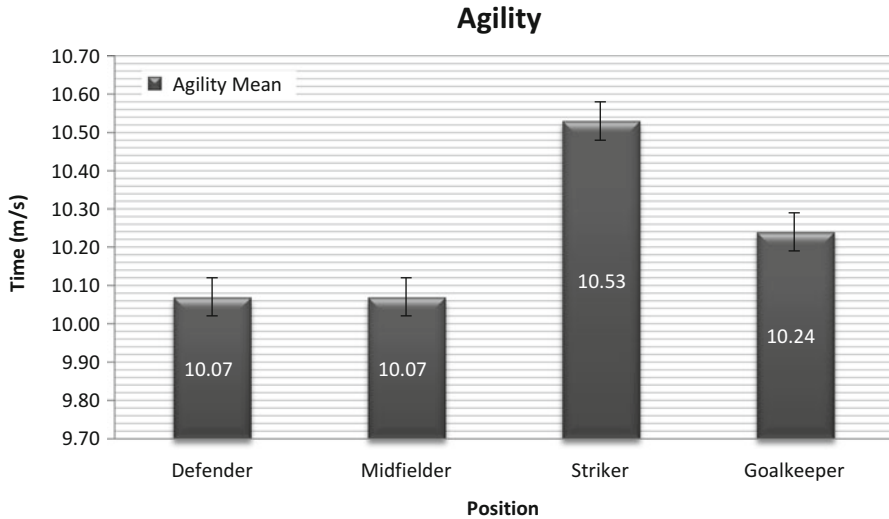
Fig. 64.3 Agility performance between positions

Table 64.1 Speed and agility

	Pearson correlation	Sig. (2-tailed)	N
Agility	.589**	.000	70
Speed	1		70

** $p < 0.05$

but this difference did not achieve statistical significance. In other words, the mean body fat percentage for the four positions ranges from 12.78 to 16.53. The previous research data indicated that anthropometric characteristics of football players were varied when the midfielder was the leanest and shortest, while the goalkeeper and the defender were the tallest and heaviest and have the highest skinfolds [4]. Le Gall et al. [16] recently noted that, players attained the highest level of play in defensive roles were varied in terms of height and/or body mass.

The physical characteristics are an impartial criteria to determine the position role in the team, in which the height was particularly important in that process [15]. The results of the research revealed no significant differences between the positions for all mean variables: anthropometrics, body composition, speed and agility. These findings contradict with a previous study that revealed significant differences in anthropometric and fitness measures between both standards of play and across playing positions [16]. However, a correlation between the speed and agility with body composition indicated a high significant difference, while the standard training schedule in football does not affect the height and body composition of players. The speed ability revealed no significant difference between playing positions, in which the defenders and midfielders were the fastest and comparable with Carlos et al. [4].

Strikers should be the fastest in speed based on the positional needs in the match. Insufficient of players in this position was the possible factor that contributed to the results. Despite the fact that strikers were not the fastest position in this study, they should be discriminated based on the anthropometry or skill performance (sprint) because there are more complex factors to determine the player's career in the future [15]. In players' agility performance, this study disclosed no significant difference in agility, speed and body fat observed, which is comparable with a previous study by Dupler et al. [3].

The comparison made for the players in terms of physical performance in this study represents the similarity in age, training and competitive level of play. A future study could apply the SAQ training method to increase the player's power that is suitable with modern football requirements. Players must have a great endurance level together with power performance for the entire match [17]. Therefore, other football-specific skills should be considered without absolute dependence on anthropometric advantages in order to develop skillful university football players in the future.

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Chapter 65
Fuzzy Multi-criteria Decision Making for Evaluation of IT Supplier

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Introduction

One of the responsibilities of an Information Technology (IT) department is asset purchasing which involves selecting suitable suppliers. In practice, supplier selection task involves group decision making under multiple criteria. Evaluation of supplier relies heavily on previous experiences and human judgments which are vague and uncertain. It is relatively difficult for decision makers to provide exact numerical values for the criteria. Thus, fuzzy set theory was introduced to express the linguistic terms of decision making processes.

In recent years, fuzzy set theory has been applied extensively in solving supplier selection problems. Researches by [1–3] have integrated fuzzy concept into multi-criteria decision making (MCDM) models. In 2008, [4] had presented an evaluation model based on fuzzy numbers and fuzzy ranking approach for solving MCDM problems. However, the model evaluated the performance of alternatives and weight of criteria as crisp numbers with the total related crisp numbers needing to be equal to 100 % which is cumbersome to decision makers. Hence, this paper proposes a new fuzzy evaluation technique that incorporates fuzzy linguistic terms throughout the procedure.

Furthermore, many of the previous literature have only incorporated fixed triangular fuzzy numbers that do not necessarily reflect actual respondents' opinion. Therefore, in this paper, triangular fuzzy numbers were developed based on respondents' opinions.

This paper is organized as follows. The basic definitions and operations on fuzzy numbers are explained in brief in the next section. The procedure of the proposed

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method is presented in section "Proposed Method". In section "Fuzzy Evaluation of IT Supplier", the applicability of the method is demonstrated in solving supplier selection problem in an IT department. Results and discussions are shown in section "Results and Discussions". Finally, conclusion is given in section "Conclusion".

Preliminaries

The basic definitions of a fuzzy number, including the definition in its parametric form, are given in [5, 6] as follows.

Fuzzy Number

A fuzzy number is a fuzzy subset in the universe discourse that is both convex and normal. The membership function of a fuzzy number u can be defined as

$$f_u(x) = \begin{cases} f_u^L(x), & a \leq x \leq b \\ 1, & b \leq x \leq c \\ f_u^R(x), & c \leq x \leq d \\ 0, & \text{otherwise} \end{cases} \tag{65.1}$$

where $f_u^L : [a, b] \rightarrow [0, 1], f_u^R : [c, d] \rightarrow [0, 1], f_u^L$, and f_u^R are left and right membership functions of the fuzzy number u, respectively. Trapezoidal fuzzy numbers are denoted as (a, b, c, d), and triangular fuzzy numbers which are special cases of trapezoidal fuzzy numbers with $b = c$ are denoted as (a, b, d).

Fuzzy Number in Parametric Form

A fuzzy number u in parametric form is a pair $(\underline{u}, \overline{u})$ of functions $\underline{u}(r)$, $\overline{u}(r)$, $0 \leq r \leq 1$, which satisfy the following requirements:

1. $\underline{u}(r)$ is a bounded monotonic increasing left continuous function.
2. $\overline{u}(r)$ is a bounded monotonic decreasing left continuous function.
3. $\underline{u}(r) \leq \overline{u}(r)$

The trapezoidal fuzzy number $u = (x_0, y_0, \sigma, \beta)$ with two defuzzifiers x_0 and y_0 and left fuzziness $\sigma > 0$ and right fuzziness $\beta > 0$ is a fuzzy set where the membership function is defined as follows:

$$f_u(x) = \begin{cases} \dfrac{1}{\sigma}(x - x_0 + \sigma), & x_0 - \sigma \leq x \leq x_0 \\[2mm] 1, & x \in [x_0, y_0] \\[2mm] \dfrac{1}{\beta}(y_0 - x + \beta), & y_0 \leq x \leq y_0 + \beta \\[2mm] 0, & \text{otherwise} \end{cases} \tag{65.2}$$

and its parametric form is

$$\underline{u}(r) = x_0 - \sigma + \sigma r, \tag{65.3}$$

$$\bar{u}(r) = y_0 + \beta - \beta r \tag{65.4}$$

with $u = (x_0, \sigma, \beta)$ where $x_0 = y_0$ denoted the triangular fuzzy number in its parametric form.

Proposed Method

The procedure of fuzzy evaluation can be expressed in a series of steps. Procedure for Step 1 is based on [7] where the corresponding fuzzy numbers for the linguistic terms of importance and performance levels are developed based on respondents' opinions. The procedure in Steps 2 to 6 used fuzzy linguistic terms throughout the process which has an improved [4] method. The procedure is presented as follows:

Step 1: The linguistic terms for importance and performance levels are determined. For k respondents, the lower limit, modal, and upper limit of the respective linguistic terms denoted as a, b, and d, respectively, are given as

$$a = \min(L_1, L_2, L_3, \ldots L_k), \tag{65.5}$$

$$d = \max(U_1, U_2, U_3, \ldots U_k), \tag{65.6}$$

$$b = \frac{\sum_{i=1}^{k} M_i}{k}, \tag{65.7}$$

where

L_i is the lower limit of the range of the respective linguistic term for the i-th respondent,

U_i is the upper limit of the range of the respective linguistic term for the i-th respondent, and

$M_i = \dfrac{1}{2}(L_i + U_i)$ is the modal of the respective linguistic term for i-th respondent, $i = 1, 2, \ldots, k$.

Step 2: For K decision makers, the fuzzy weight $\tilde{w}_j$ of each criterion is calculated using aggregated fuzzy assessment which is defined as

$$\tilde{w}_j = \frac{\sum_{k=1}^{K} \tilde{w}_j^k}{K},$$ (65.8)

where $\tilde{w}_j^k$ is the importance weight of the k-th decision maker. The fuzzy weighted vector criteria can be represented as $\tilde{W} = \begin{bmatrix} \tilde{w}_1 & \tilde{w}_2 & \tilde{w}_3 \end{bmatrix}^T$.

Step 3: The fuzzy grade $\tilde{g}_{ij}$ of each sub-criterion of each alternative is calculated using aggregated fuzzy assessment, which is defined as

$$\tilde{g}_{ij} = \frac{\sum_{k=1}^{K} \tilde{x}_i^k j}{K},$$ (65.9)

where $\tilde{x}_i^k j$ are the ratings of the k-th decision maker.

Step 4: The fuzzy grade matrix $\tilde{G}$ is build and defined as

$$\tilde{G} = \begin{pmatrix} \tilde{g}_{11} & \tilde{g}_{12} & \cdots & \tilde{g}_{1k} \\ \tilde{g}_{21} & \tilde{g}_{22} & \cdots & \tilde{g}_{2k} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{g}_{n1} & \tilde{g}_{n2} & \cdots & \tilde{g}_{nk} \end{pmatrix},$$ (65.10)

where $\tilde{g}_{ij}$ denotes the fuzzy grade of the i-th supplier S_i with respect to the j-th criterion X_j, n denotes the numbers of alternatives, and k denotes the number of criteria.

Step 5: The total fuzzy grade vector $\tilde{R}$ is calculated as

$$\tilde{R} = \tilde{G} \otimes \tilde{W} = \begin{pmatrix} \tilde{g}_{11} & \tilde{g}_{12} & \cdots & \tilde{g}_{1k} \\ \tilde{g}_{21} & \tilde{g}_{22} & \cdots & \tilde{g}_{2k} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{g}_{n1} & \tilde{g}_{n2} & \cdots & \tilde{g}_{nk} \end{pmatrix} \otimes \begin{pmatrix} \tilde{w}_1 \\ \tilde{w}_2 \\ \vdots \\ \tilde{w}_k \end{pmatrix} = \begin{pmatrix} \tilde{R}_1 \\ \tilde{R}_2 \\ \vdots \\ \tilde{R}_k \end{pmatrix},$$ (65.11)

where $\tilde{R}_i$ denotes the total fuzzy grade of the i-th supplier S_i and $1 \leq i \leq n$.

Step 6: The ranking order of $\tilde{R}_i$ is calculated based on the [8] distance minimization method with $\tilde{R} = (x_0, \sigma, \beta)$ as a triangular fuzzy number in parametric form of $R = (a, b, c)$, and the nearest point to $\tilde{R}$ is defined as

$$M\left(\tilde{R}\right) = x_0 + \frac{\beta - \sigma}{4} \qquad (65.12)$$

where $x_0 = b$, $\sigma = b - a$, and $\beta = c - b$.

Fuzzy Evaluation of IT Supplier

The study was done by evaluating the performance of four suppliers of computer assets, which were shortlisted by the Information Technology (IT) Unit of a public university in Malaysia. The decision makers (DMs) consisting of four top senior officers from the IT Unit were involved in this study. Nine items of their existing evaluation form are categorized into three main criteria which are the background of supplier (X_1), product performance (X_2), and service performance (X_3). The hierarchical structure of the supplier selection problem is shown in Fig. 65.1.

A total of 20 respondents consisting of individuals working with the IT Unit were involved in determining the appropriate scale of 0–100 for seven-scale linguistic terms. Triangular fuzzy numbers were developed based on this information using Eqs. (65.1), (65.2), and (65.3) in Step 1. Hence, two sets of fuzzy linguistic questionnaires comprising of the importance levels of each criterion and the satisfaction levels of each sub-criterion, as in Tables 65.1 and 65.2, are used in the evaluation process and are distributed to the DMs.
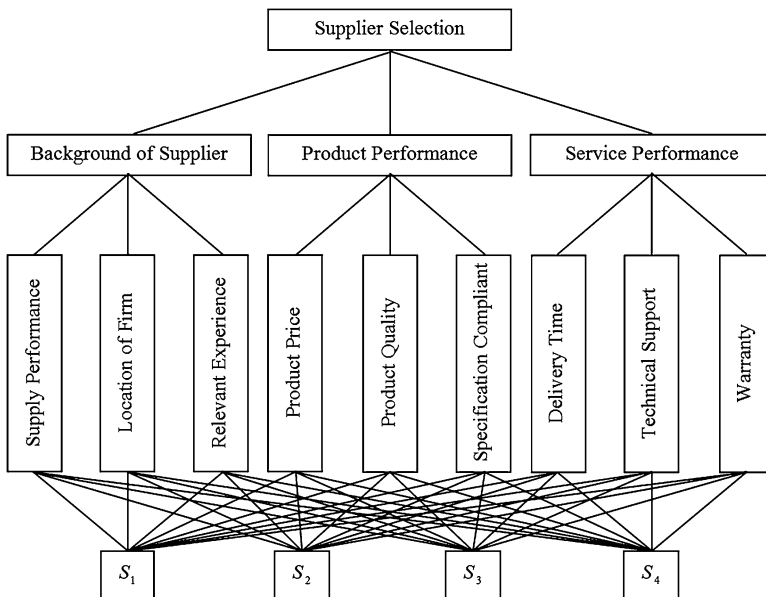
Fig. 65.1 The hierarchical structure of the supplier selection problem

Table 65.1 Linguistic term for importance levels

Linguistic terms	Fuzzy numbers
Very low	(0, 9.43, 40)
Low	(5, 26.53, 50)
Medium low	(10, 40.55, 60)
Medium	(20, 54.5, 80)
Medium high	(40, 68.9, 90)
High	(60, 81.85, 95)
Very high	(80, 94, 100)

Table 65.2 Linguistic term for satisfaction levels

Linguistic terms	Fuzzy numbers
Very poor	(0, 9.68, 40)
Poor	(5, 26.3, 50)
Medium poor	(10, 39.4, 60)
Fair	(20, 53.13, 80)
Medium good	(40, 67.15, 90)
Good	(60, 79.85, 95)
Very good	(70, 93, 100)

Table 65.3 Importance level of criteria by each DM

| Criteria | Decision maker | | | |
	D_1	D_2	D_3	D_4
X_1	H	H	VH	MH
X_2	H	VH	VH	MH
X_3	H	VH	VH	MH

The data were analyzed using the proposed method. Tables 65.3 and 65.4 show the linguistic values given by the DMs for each supplier firm.

Results and Discussions

Based on the fuzzy evaluation method, we obtained the fuzzy weight $\tilde{w}_j$, fuzzy grade matrix $\tilde{G}$, and total fuzzy grade vector $\tilde{R}$ as follows:

$$\tilde{W} = \begin{bmatrix} \tilde{w}_1 \\ \tilde{w}_2 \\ \tilde{w}_3 \end{bmatrix} = \begin{bmatrix} (60, & 81.65, & 95) \\ (65, & 84.69, & 96.25) \\ (65, & 84.69, & 96.25) \end{bmatrix}, \tag{65.13}$$

Table 65.4 Satisfaction level of suppliers by each DM

Criteria	Sub-criteria	D_1				D_2				D_3				D_4			
		S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4
X_1	X_{11}	G	G	G	G	VG	G	MG	MG	G	MG	MG	G	G	MG	MG	G
	X_{12}	G	G	G	G	M	MG	MG	F	VG	VG	G	G	G	MG	MG	MG
	X_{13}	G	G	G	G	G	MG	MG	F	VG	G	G	G	MG	MG	MG	G
X_2	X_{21}	F	F	F	F	F	F	F	MG	G	MG	MG	G	G	MG	MG	MG
	X_{22}	G	G	G	G	G	MG	MG	MG	G	G	G	VG	G	MG	MG	MG
	X_{23}	G	G	G	G	G	G	MG	MG	G	G	G	G	G	MG	MG	G
X_3	X_{31}	G	G	G	G	VG	MG	MG	MG	G	F	G	G	G	MG	MG	MG
	X_{32}	G	G	G	G	G	F	MG	MG	G	MG	G	VG	G	MG	MG	G
	X_{33}	G	G	G	G	G	MG	MG	G	VG	G	G	VG	G	MG	MG	G

$$
\tilde{G} = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \end{array} \begin{bmatrix} X_1 & X_2 & X_3 \\ (59.17,\ 81.02,\ 95.42) & (53.33,\ 75.40,\ 92.50) & (61.67,\ 82.04,\ 95.83) \\ (50.83,\ 74.60,\ 92.92) & (45.00,\ 70.11,\ 90.42) & (43.33,\ 69.05,\ 90.00) \\ (48.33,\ 72.44,\ 92.08) & (43.33,\ 69.05,\ 90.00) & (49.17,\ 73.43,\ 92.08) \\ (61.67,\ 82.04,\ 95.83) & (49.17,\ 73.43,\ 92.08) & (56.67,\ 78.87,\ 94.58) \end{bmatrix},
$$

$$(65.14)$$

and

$$
\tilde{R} = \begin{bmatrix} R_1 \\ R_2 \\ R_3 \\ R_4 \end{bmatrix} = \begin{bmatrix} (124.792,\ 194.703,\ 260.083) \\ (99.625,\ 174.477,\ 250.51) \\ (100.896,\ 175.495,\ 251.302) \\ (119.896,\ 191.276,\ 258.917) \end{bmatrix},
$$

$$(65.15)$$

or, in its parametric form,

$$
\tilde{R} = \begin{bmatrix} R_1 \\ R_2 \\ R_3 \\ R_4 \end{bmatrix} = \begin{bmatrix} (194.703,\ 69.911,\ 65.38) \\ (174.477,\ 74.852,\ 76.033) \\ (175.495,\ 74.599,\ 75.807) \\ (191.276,\ 71.38,\ 67.641) \end{bmatrix}.
$$

$$(65.16)$$

The fuzzy weight $\tilde{w}_j$ indicates that criteria X_2 (product performance) and X_3 (service performance) are of equal importance compared to criterion X_1 (background of supplier). The fuzzy grade $\tilde{G}$ shows that for criterion X_1, the DMs grade S_4 is the best, followed by S_1, S_2, and S_3. For criterion X_2, S_1 is the best, followed by S_4, S_2, and S_3. While for criterion X_3, the DMs also rate S_1 as the best, followed by S_4, S_3, and S_2.

By using the ranking method in [8], we obtained the distance minimization $M\left(\tilde{R}\right)$ as follows:

$$
M\left(\tilde{R}\right) = \begin{array}{c} S_1 \\ S_2 \\ S_3 \\ S_4 \end{array} \begin{bmatrix} 193.57 \\ 174.772 \\ 175.797 \\ 190.341 \end{bmatrix}.
$$

$$(65.17)$$

Thus, this produces the ranking result as $S_1 > S_4 > S_3 > S_2$.

Conclusion

This study has demonstrated the applicability of the proposed evaluation method using fuzzy linguistic terms where the corresponding fuzzy numbers were built based on respondents' opinions. The developed fuzzy numbers were incorporated in the evaluation procedure, and the final ranking was calculated based on distance minimization method. It is hoped that the evaluation results via these fuzzy numbers gave a significant meaning towards future decision making.

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Chapter 66
Factors Affecting Early Adaptation of Primary Intracerebral Hemorrhage Patients with Stroke-Related Disability During Acute Inpatient Recovery Phase

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Introduction

Nontraumatic or primary intracerebral hemorrhage (PICH) is an important public health problem leading to high rates of death and disability in adults with an annual incidence of 10–30 per 100 000 population, accounting for 2 million (10–15 %) of about 15 million strokes worldwide each year [1]. Intracerebral hemorrhage is classified as either primary or secondary. Severity of neurological deficit of ICH depends on the location of the brain lesion [1, 2]. For example, patients with a supratentorial intracerebral hemorrhage involving the putamen, caudate, and thalamus have contralateral sensorimotor deficits of varying severity. The abnormalities include aphasia, neglect, gaze deviation, and hemianopia that result from the disruption of connecting fibers in the subcortical white matter and functional suppression of overlying cortex [2]. Otherwise, a patient with cerebellar or infratentorial ICH may experience phenomena of ataxia, cranial nerve dysfunction including abnormalities of gaze, cranial nerve abnormalities, and contralateral motor deficits, nystagmus, and coma. If the cerebellum is involved, the patient is at high risk of herniation and brainstem compression [1].

PICH stroke patients may be left with significant disabilities which affect their whole well-being. The nature of disability impact from PICH includes physical and

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emotional dysfunctions and impairments of memory, attention, communication, and problem-solving ability [3, 4]. Numerous studies were reported; usually patients with PICH experienced stroke-related disabilities and decreased ability to perform functional activities. The disability should be increased at discharge from hospital setting and between 2 and 3 months during rehabilitation phase at home [3–5]. However, the patients with stroke due to intracerebral are at risk of medical complications during inpatient rehabilitation stay such as developing urinary tract infection, respiratory infection, limb pain, contractures, and depression [6].

Early adaptation to stroke-related disability after experiencing primary intracerebral hemorrhage (PICH) is perceived as a patient's *adapt* to the physiological, functional, psychological, and social changes. Positive adaptation during acute inpatient recovery phase refers to patients' ability to adapt with stroke-related disability and demonstrate potential to recover from the illness and disability. *Critical factors predicted as factors* inhibit early adaptation include patients background such as age, *gender, social economic status* [7], the severity of neurological deficit [9, 10], less functional ability [8, 9], lower stroke knowledge among patients and family caregivers [11], and evidence of post stroke complications [6].

Hence, the objective of this study was to identify the factors affecting *early adaptation to the sudden stroke-related disability* in the early phase after PICH among local population in East Coast Malaysia. So, understanding what are the factors affecting early adaptation to stroke disability as the important aspects of management of the patients with PICH. It is important in *early* prevention of poststroke complications such as respiratory infection, pressure ulcers, pain, and deep vein thrombosis and depression, encouragement adaptation to stroke disabilities and enhance participation in rehabilitation program [3–6].

Methodology

This *cross-sectional study* involved PICH patients admitted in Hospital Universiti Sains Malaysia (HUSM), Kelantan, and Hospital Sultanah Nur Zahirah (HSNZ), Terengganu, Malaysia, from June 2009 to May 2011. Early adaptation to stroke disability was assessed by measuring the level of independence to participate in activities at acute inpatient recovery phase post PICH. The instrument used to assess adaptation response outcome was Functional Independence Measure (FIM). Other independent variables collected include patients' sociodemographic factors, clinical factors, neurological deficit (National Institutes of Health Stroke Scale – NIHSS), complication status (Complication Inventory Checklist – CIC), depression status (Patient Health Questionnaire 9 – item Depression Scale (PHQ 9-DS), and Stroke Knowledge Checklist (SKC). All the tools were interviewed and assessed by a researcher. General linear regression analysis was applied to test the association between the independent variables and early adaptation.

Result and Discussion

The subject consisted of 66 (58 %) men and 47 (41.6 %) women. Their mean (SD) age was 55.0 (SD 11.8) years, ranging from the age of 30 to 89 years. Almost half (51.3 %) of the subjects received education until primary school and/or no formal education. Occupational status varied among the subjects. Similarly, more than half (64.6 %) of the subjects did not have specific jobs and were classified under low social economic status or poor. Majority of the patients have support from their spouses (65.5 %) or by their children. Sixty-six percent of subjects were smokers (66.4 %) and majority of them were hypertension (95.6 %). In relation to the location of brain lesion, findings of this study show basal ganglia were the most common area (49.5 %) of bleeding followed by bleeding in thalamic (14.1 %) and lobar area (20.3 %) in the brain.

In early phase post PICH, the total mean score of early adaptation was 48.1(SD=30.1), which indicated lower early adaptation score. There were significant correlations between neurological deficit [NIHSS] ($r=-.568$), Glasgow Coma Scale ($r=-.371$) and stroke knowledge ($r=.293$), length of stay ($r=.239$) and ICH treatment ($r=.207$) with early adaptation score. Multiple regression analysis showed that there were five associated variables which include females, bleeding intracerebral in non-lobar area, higher neurological deficit score, respiratory infection, and lower stroke knowledge score contributed significantly 52.0 % (Adjusted $R^2=0.52$) the variance of the early adaptation score ($F=22.7$, $p<0.05$) that were associated to lower the score of early adaptation (Table 66.1).

The recent finding confirms that the neurological deficit and location of brain lesion contribute as factors that affect patients' ability to adapt to the functional disability were associated with lower score of early adaptation [10]. This study is consistent with previous study that stated poor physical health status after stroke was independently associated with being as female compared as male at discharge [7]. Previous studies also found a strong association between the occurrence of pneumonia and poor stroke function

Table 66.1 Factors associated with early adaptation in response stroke related disability during recovery phase among post PICH ($n=113$)

Variable	Adjusted (β)[a]	t stat	p value	(95 % CI)
Sex[c]	9.58	2.30	0.023	(1.32, 17.84)
Location of Brail Lestion[d]	−16.70	−3.31	0.001	(−26.70, −6.70)
Neurological deficit (score)	−1.91	−5.22	0.001	(−2.64, −1.19)
Respiratory Infection[e]	−16.71	−3.49	0.001	(−26.21, −7.23)
Stroke Knowledge (score)	2.89	2.65	0.009	(.72, 5.04)

[a]Adjusted regression coefficient
[b]Multiple liner regression ($R^2=0.52$, $F=22.7$). The model reasonably fits well. Model assumption are met: There are no interaction between independence variables and no multicollinearity problem Reference categories:
[c]Female
[d]Lobar
[e]No respiratory infection

outcome [6]. Lower score of stroke knowledge among PICH patients and their caregivers contributes to the decrease in the adaptation response with stroke-related disability. Study reported that patients with acute stroke have a significant lack of knowledge on the causes, warning signs, and risk factors of stroke [11].

Conclusion

Female patients with higher score of neurological deficit, intracerebral bleeding at non-lobar area in the brain, lower stroke knowledge, and respiratory complication at acute phase were found to be associated with lower functional abilities in acute phase post PICH. A better understanding of the factors that affect the process of acute adaptation is essential to develop an adequate stroke education program and specific rehabilitation interventions for patients with stroke related to intracerebral bleeding before discharge.

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Chapter 67
Extended Non-controllable Variable Input-Output Oriented Model in DEA Analysis

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Introduction

DEA measures the relative performance of a group DMUs which consume multiple inputs and produce a number of outputs [1]. The existing discretionary models of DEA assume that all inputs and output can be varied at the discretion of management or other users. In any realistic situation, however, there may exist exogenously fixed or non-discretionary factors that are beyond the control of a DMUs management, which also need to be considered [2–4]. In order to show the sustainability input-output pairs, Khezrimotlagh et al. [5], examine the effects of uncontrollable data to find the efficient DMUs among the technical efficient and also arrange both inefficient and technical efficient DMUs at the same time using Arash method. Banker and Morey [6, 7] state that there are at least two main approaches to incorporating uncontrollable inputs in DEA which are uncontrollable input becomes a constraint in linear programming. Second, a common practice is to run DEA where all the inputs are treated as controllable and then, regress the emerging efficiency scores on non-discretionary inputs. However, the single-stage approach to account for environmental factors runs into difficulty where we have no pre-test understanding of the direction of their influence on efficiency. For this reason, an extended study on non-controllable variable input-output oriented is proposed for this problem. Objective of this research is to improve the error related to the uncontrollable input and the controllable input using the NCNI-O model.

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Mathematical Formulation

Non-controllable Variable Model (NCN)

Two factors influence the efficiency of DMUs for a study which is how to maintain the input and increase the output or maintain the output and reduce the input. In some cases, these DEA procedures are sufficient for making relevant conclusions because some of the variables such as population, competition, length of service, quality and others have an influence on achievement. This environmental factor is called the non-controllable factors.

A variety of DEA models have been presented. Wei et al. [8], has proposed a mathematical method to derive the input target strategy in situations with weight restrictions. Yang and Pollitt [9] mentioned two problems on evaluation of DMUs which are how to treat undesirable outputs with desirable outputs and also how to treat the uncontrollable variables. An efficiency assessed from the pessimistic point of view identifies the problematic DMUs by measuring how much they are efficient in being a poor-performer. Paradi et al. [10] which aim at identification of DEA inefficient firms, can be used for classification of poor performing units, which is especially useful for risk evaluation. The idea of using worst-practice DEA specifically for identification of units with the worst performance is evidently helpful for credit evaluation, but it has more general applications too.

However, in this study, some considerations may be useful in choosing an appropriate DEA model. In applications that involve inflexible inputs (not fully under control), output based formulation would be more appropriate. In order to consider those data, Cooper et al. [11] introduced the following radial model for uncontrollable data based on the Banker and Morey [6] model and called it NCN. Moreover, Charnes et al. [12] extended the additive model as the sets C and NC refer to the indexes of controllable and non-controllable data, respectively.

Non Linear NCNI-O Model

NCN model is divided into two types, namely NCNI model (inputs cannot be controlled) and NCNO model (output cannot be controlled). In this study, researchers focused only on the NCNI output oriented which are pioneered by Banker and Morey [6].

$$\min \ e'_o = \frac{\sum_{i=1}^{r} v_i x_{io}}{\sum_{j=1}^{s} w_j y_{jo} - \sum_{k=1}^{t} u_k z_{ko}} \tag{67.1}$$

subject to:

$$\frac{\sum_{i=1}^{r} v_i\, x_{im}}{\sum_{j=1}^{s} w_j\, y_{jm} - \sum_{k=1}^{t} u_k\, z_{km}} \geq 1; \quad m = 1,\dots,n \tag{67.2}$$

$$w_j \geq 0; \quad j = 1,\dots,s \tag{67.3}$$

$$v_i \geq 0; \quad i = 1,\dots,r \tag{67.4}$$

$$u_k \geq 0; \quad k = 1,\dots,t \tag{67.5}$$

with

$y_{jo} = j$th output of the *o*th DMU
$y_{jm} = j$th output of the *m*th DMU
$x_{io} = i$th input of the *o*th DMU
$x_{im} = i$th input of the *m*th DMU
$z_{ko} = k$th uncontrollable input of the *o*th DMU
$z_{km} = k$th uncontrollable input of the *m*th DMU
$w_j =$ weight of the non-negative *j*th output
$v_i =$ weight of the non-negative *i*th input
$u_k =$ weight of the non-negative *k*th uncontrollable input
$n =$ number of DMUs
$s =$ number of outputs
$r =$ number of inputs
$t =$ number of noncontrollable inputs
$e'_o =$ the efficiency score of the DMU*o*

Using the linear transformation of Norman and Stoker [13], namely $\sum_{j=1}^{s} w_j\, y_{jo} - \sum_{k=1}^{t} u_k\, z_{ko} = 1$ where the objective function substitute with 1, Eqs. (67.1) and (67.2) change to primer linear programming model as below:

$$\min\ e'_o = \sum_{i=1}^{r} v_i\, x_{io} \tag{67.6}$$

subject to:

$$\sum_{i=1}^{r} v_i\, x_{im} + \sum_{k=1}^{t} u_k\, z_{km} - \sum_{j=1}^{s} w_j\, y_{jm} \geq 0; \quad m = 1,\dots,n \tag{67.7}$$

$$\sum_{j=1}^{s} w_j y_{jo} - \sum_{k=1}^{t} u_k z_{ko} = 1 \tag{67.8}$$

$$w_j \geq 0; \quad j = 1,\ldots,s \tag{67.9}$$

$$v_i \geq 0; \quad i = 1,\ldots,r \tag{67.10}$$

$$u_k \geq 0; \quad k = 1,\ldots,t \tag{67.11}$$

Duality Formulation and Vector Average Input and Output

The results of duality output of LINGO can determine the unefficiency of DMUs [14]. In linear programming, DMUs with the duality not zero can be used as a reference set of unefficient DMUs. Thereby, using the method proposed from Winston [11], the Vector Average Input and Output, the input and output target of unefficiency will be obtained. For example, if DMUs A and DMUs B is found efficient while DMUs C is an efficient, so only DMUs A and DMUs B only a reference set of DMUs C, then the target level DMUs C can be found by calculating:

(a) *Vector Average Input*

$$\begin{pmatrix} \text{Duality of} \\ \text{DMU A} \end{pmatrix} \begin{pmatrix} \text{Input} \\ \text{DMU A} \end{pmatrix} + \begin{pmatrix} \text{Duality of} \\ \text{DMU B} \end{pmatrix} \begin{pmatrix} \text{Input} \\ \text{DMU B} \end{pmatrix} = \begin{pmatrix} \text{Input Target} \\ \text{DMU C} \end{pmatrix} \tag{67.12}$$

(b) *Vector Average Output*

$$\begin{pmatrix} \text{Duality of} \\ \text{DMU A} \end{pmatrix} \begin{pmatrix} \text{Output} \\ \text{DMU A} \end{pmatrix} + \begin{pmatrix} \text{Duality of} \\ \text{DMU B} \end{pmatrix} \begin{pmatrix} \text{Output} \\ \text{DMU B} \end{pmatrix} = \begin{pmatrix} \text{Output Target} \\ \text{DMU C} \end{pmatrix} \tag{67.13}$$

DMUs target input/output C, is an improvement to the original input DMUs C so that it is become more efficient.

Categorical Inputs and Outputs

A main difficulty in any application of DEA is in the selection of inputs and outputs. The criteria of selection of these inputs and outputs are quite subjective. All the inputs and outputs that have a bearing on performance of the DMUs to be analyzed should be listed. In this study, the data from six selected Public Higher Education Institutions in Malaysia is used to illustrate the proposed NCNI-O model and to

compare between input and output target with original inputs and output of universities. Based previous literature, the following model structure was used:

Input:	
(a) Academician (Input 1)	Coelli [15]
(b) Teaching and learning sources (Input 2) = Uncontrollable input	Johnes and Johnes [16]
Output:	
(a) Total product revenue = Output 1 (O1)	Steven [17]
(b) Number of papers published in journals = Output 2 (O2)	Groot et al. [18]
(c) Number of awards or recognition research = Output 3 (O3)	Ying Chu and Sung Ko Li [19]

DEA Evaluation Method

Tables 67.1 and 67.2, show the duality score of inefficient universities with their reference set. There are two universities which are efficient, University 6 and University 2 and these two universities will be the reference set to the inefficient universities. By the way, the other four universities can be categorized as inefficient.

Based on Tables 67.1 and 67.2, the vector average input and output of inefficient universities which are University 1, University 3, University 4 and University 5 are calculated and the result of input target obtained. Comparison between input/output targets with original input/output is done. The results are shown in Tables 67.3 and 67.4.

From the comparison above, the value of uncontrollable input, I2 are same with the original value I2. This is proves that the objective of uncontrollable input value should be fixed. At the same time, the value of controllable input, I1 are reducing

Table 67.1 Efficiency score of universities obtained from NCNI-O model

Rank	DMU	Score	Efficiency
1.	University 6	1	Efficient
2.	University 2	1	Efficient
3.	University 1	0.795471	Not efficient
4.	University 4	0.575968	Not efficient
5.	University 5	0.491768	Not efficient
6.	University 3	0.385248	Not efficient

Table 67.2 Reference set and the duality formulation of the universities

University	Reference set	Duality
University 1	University 2	0.736714271
University 3	University 2	0.296378475
University 4	University 2	0.432630778
University 5	University 2	0.137192071

Table 67.3 Comparison between input target and original inputs of universities

University	Input	Input target	Original input	Result
University 1	I1	1296.617	1630	Input I1 reduce
	I2	1367962	1367962	Input I2 fixed
University 3	I1	521.6261	1354	Input I1 reduce
	I2	550324	550324	Input I2 fixed
University 4	I1	761.4302	1322	Input I1 reduce
	I2	803327	803327	Input I2 fixed
University 5	I1	241.458	491	Input I1 reduce
	I2	254744	254744	Input I2 fixed

Table 67.4 Comparison between output target and original outputs of universities

University	Output	Output target	Original output	Result
University 1	O1	11055.87	1296	Output increase
	O2	6572.965	1128	
	O3	630.6274	50	
University 3	O1	4447.752	944	Output increase
	O2	2644.289	498	
	O3	253.7	111	
University 4	O1	6492.49	911	Output increase
	O2	3859.932	866	
	O3	370.3319	105	
University 5	O1	2058.841	86	Output increase
	O2	1224.028	121	
	O3	117.4364	6	

from the original value of I1. The objective to maintain the input and increase the output or maintain the output and reduce the input has been achieved.

Conclusions

In this research, NCNI output oriented (NCNI-O) model is proposed to show the sensitivity of the efficiency score involving changes in uncontrollable inputs of DMUs. The uncontrollable input is the input cannot be reduced by DMUs. From the calculation based on inefficient universities using duality formulation, reference set and vector average input and output, the input and output target improvement are obtained. Comparisons are done between the new value and the old value and it is shown that the uncontrollable input is the same and did not change. From this result, the concepts to maintain the input and increase the output or maintain the output and reduce the input are proven.

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Chapter 68
The Existence of Golden Section in the Traditional Malay Architecture

Marina Mohamed, Nor Fadhilah Dzulkifli, and Nazirah Ramli

Introduction

Since the earliest times, architects have relied on mathematical principles. Some mathematical concepts such as symmetry, proportion, geometry, Fibonacci numbers, and golden section are found in architecture. According to Obara [1] and Fletcher [2], there are many relationships between architecture and mathematics based on geometry shape and existence of golden section in the architecture. The interrelationship of mathematical structure and architecture is found in the precedent architecture such as the pyramid in Egypt and Parthenon in Greece [3]. Boussora et al. [4] also suggested the presence of golden section in the Great Mosque of Kairouan. Furthermore, according to Padovan [5], golden section is one of the most widely used principles in architecture.

Golden section, known as Phi (Phi $= \lim_{n\to\infty} \dfrac{F_n}{F_{n-1}} = 1.618$ with F_n the nth Fibonacci sequence), is one of the mathematical structures that have beauty in them, and it exists everywhere in nature such as in human body, plants, animals, paintings, and even in the solar system. It can create balance and symmetry, and Yahya [6] stated that golden section will cause something to look beautiful, steady, strong, and balanced. Aside from interesting mathematical properties, geometric shapes derived from the golden ratio were believed to be aesthetically pleasing. For instance, many works of ancient art exhibited and incorporated the golden ratio in their design of monuments including the Great Pyramid and the Parthenon.

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In Malaysia, the traditional Malay house is part of the traditional Malay architecture. The design of the house was influenced by the Malay daily needs, beliefs, religion, culture, and their way of life, while its construction was affected by nature and environment [7]. Besides, each functional space within a Malay house also has various functions in order to fulfill their way of life, needs, desires, and requirements [8]. According to Kosman et al. [9], the design of the traditional Malay house is also influenced by the function of the parts and the house itself such as *rumah ibu* function, *serambi*, *rumah dapur*, wide window, stilts, and slope of the roof.

Though a lot of studies have been conducted on the traditional Malay house, the studies only focus on the philosophy, measurements, and spaces of the building. No study has been carried out that relate between traditional Malay architecture and mathematical structures. Therefore, this preliminary study is conducted to investigate the existence of mathematical structure in particular golden section in the traditional Malay house.

Materials and Methods

Materials

This preliminary study was conducted on a traditional Malay house known as *Rumah Negeri Sembilan* which is located at Muzium Negeri Sembilan in Seremban. Figures 68.1 and 68.2 show the aforementioned house and its floor plan, respectively.

Fig. 68.1 *Rumah Negeri Sembilan*

Symbol	Part of the house
A	*serambi*
B	*Rumah ibu*
C	*Kelek anak*
D	store
E	*peran*
F	roof (*serambi*)
G	roof (*Peran*)
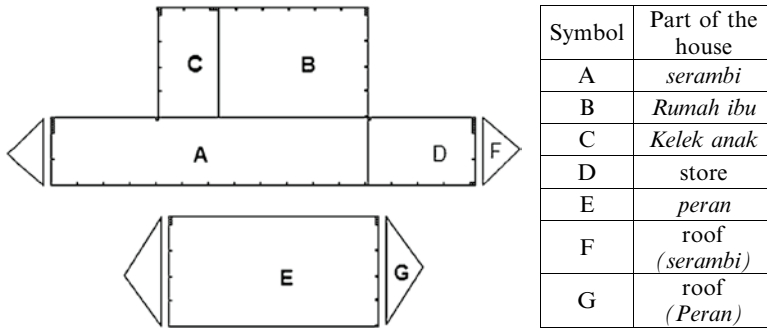
Fig. 68.2 Floor plan of *Rumah Negeri Sembilan*

Table 68.1 Measurement of some parts of the house

Part of the house	Length (a)	Width (b)	Height (c)	a/b	a/c	b/c	Existence of golden section
Serambi	1,200	236	260	5.0847	4.6154	0.9077	X
Rumah ibu	570	430	260	1.3256	2.1923	1.6538[a]	√
Peran	820	430	260	1.9070	3.1538	1.6538[a]	√
Store	420	236	223	1.7797	1.8834	1.0583	X
Kelek anak	230	430	260	0.5349	0.8846	1.6538[a]	√

[a]Falls in interval [1.6, 1.667]

√: The golden section exists in part of the house

X: The golden section does not exist in part of the house

Methods

The investigation focuses on the whole part of the house including *serambi*, *rumah ibu*, *kelek anak*, store, *peran*, and roof. Geometrical analysis was used in obtaining the measurement of length, width, height, and angle in some parts of the house.

Results and Discussion

The measurement of length, width, and height obtained in some parts of the house is shown in Table 68.1. In this study, we consider the ratio between length, width, and height approaches the value of golden section if it falls in the interval [1.6, 1.667]. This interval is chosen since $\dfrac{F_n}{F_{n-1}} \in [1.6, 1.667]$ for $n \geq 5$ with F_n the nth Fibonacci sequence and $\lim\limits_{n \to \infty} \dfrac{F_n}{F_{n-1}} = 1.618$.

Based on Table 68.1, the golden section is found in some parts of the house such as in *rumah ibu*, *peran*, and *kelek anak*. Table 68.1 also shows that only the ratio between width and height approaches the value of golden section.

Table 68.2 Measurement of some elements of the house

Element	Width (a)	Length (b)	b/a	Existence of golden section
Front window	58.08	93.9	1.6167[a]	√
Window (*rumah ibu*)	50	80	1.6000[a]	√
Window (*peran*)	51.5	72	1.3981	X
Window (*kelek anak*)	50	75	1.5000	X
Front door	79	126	1.6000[a]	√
Door – exit (*rumah ibu*)	80	110	1.3750	X
Door – entrance (*rumah ibu*)	90	203	2.2556	X
Door (*peran*)	64	112	1.7500	X
Door (*kelek anak*)	64	160	2.5000	X

[a]Falls in interval [1.6, 1.667]
√: The golden section exists in the element
X: The golden section does not exist in the element

Table 68.3 Measurement of sides and angle of a right triangle of the roof and ladder

Roof/ladder	a	b	c	A	B	cos A	cos B	Satisfy golden triangle
Roof (*kelek anak*)	120	155	170	65.75	24.25	0.411	0.912	X
Ladder (*peran*)	275	110	290	70	20	0.342	0.939	X
Front ladder	165	119.88	203.95	36	54	0.809	0.588	X
Back ladder	165	138.45	215.39	40	50	0.766	0.643	X

X: The roof or ladder does not satisfy golden triangle

Fig. 68.3 Right triangle
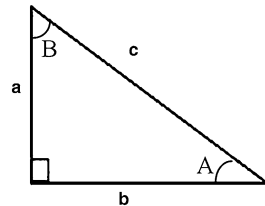
The measurement of length and width of some elements of the house is shown in Table 68.2. Based on Table 68.2, the golden section exists in both front window and door, and window of *rumah ibu*. This shows that both front window and door, and window of *rumah ibu* can be considered as having characteristic pleasing to the eye [10].

The measurement of sides and angle of a right triangle of the roof and ladder is presented in Table 68.3 with the right triangle shown in Fig. 68.3.

Since the interval of golden section or Phi is [1.6, 1667], thus the interval of the reciprocal of golden section (known as Phi) is [0.6, 0.625]. None of the angle of the roof or ladder has the cosine value in [0.6, 0.625]. This shows that the right triangle of the roof and ladder does not satisfy golden triangle property as the golden triangle has the cosine value as Phi [11].

Conclusion

In this preliminary study, we investigate the existence of golden section in a Malay traditional house known as *Rumah Negeri Sembilan* which is located at Muzium Negeri Sembilan in Seremban. The findings show that Phi or golden section exists in some parts of the house such as in *rumah ibu*, *peran*, and *kelek anak*. The presence of Phi can also be found in some elements of the house such as both front window and door, and window of *rumah ibu*. This shows that the three elements can be considered as having characteristics pleasing to the eye [10]. However, none of the part of roof and ladder which has right triangle shape satisfies the golden triangle property.

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Chapter 69
Cartesian Representation for Location Determination in Parts of Islamic Architecture

Nazihah Ismail, Nazirah Ramli, Amirah Hana Mohamed Nor, Nor Fadhilah Dzulkifli, Marina Mohamed, and Ahmad Rasidi Osman

Introduction

Architecture is the procedure of space arrangements that include designing and building science to meet and satisfy human needs [1]. There are several dimensions of architecture that can be categorized in general. Apparently, there are two major types of architecture, western and Islamic architecture. The difference between western and Islamic architecture can be seen from the existence of divine aspect during the development of the building. According to Yaa'cob (1983) cited in Nur Haziqah [2], Islamic architecture is the development of a building that considers the laws of Islam in creating a building that is harmonious, pleasant, and balanced and also can bring human closer to Allah.

Mosque is one of the most significant buildings in Islamic architecture. Mosque apparently meets human needs in terms of being a comfortable place and also meets the rules to face the Qibla. Mosque is one of the buildings that symbolized the majesty and beauty of Islamic architecture. In general, mosque has special features which differentiated them with other buildings. According to [3], the main features found in the mosque are the presence of a dome supported by huge pillars, praying space, and minarets. As stated by Hamdan [4], most of the domes are semispherical

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shaped and some of them are onion shaped which are halved horizontal. Every mosque has a minaret which functions as a high point to make the call to prayer known as Adhan. Basically, the form of the mosque is in rectangular shape in order to accommodate the many pilgrims and erected with large pillars.

In Mathematics, coordinate system is the foundation of analytic geometry, and it has been extensively used in many disciplines such as physics, engineering, astronomy, and many more. For any buildings, they can be represented as three-dimensional spaces with three main axes which are x-, y-, and z-axes. Similarly, the mosque also can be represented in three-dimensional spaces. However, there are lacks of studies that relate coordinate system with Islamic architecture. Therefore, in this preliminary work, we try to relate the construction of an Islamic architecture with the mathematical concept, in particular the Cartesian coordinate.

Materials and Methods

Materials

This preliminary study was conducted at Masjid Tengku Abdullah in Jerantut, Pahang. This mosque is located at the cross out from Temerloh to Jerantut and opposite side of the Jerantut industrial area. Figures 69.1 and 69.2 show the aforementioned mosque.

Methods

The investigation focuses on the whole part of the prayer hall and some parts of the dome. Geometrical analysis was used in obtaining the measurement of length, width, and height of the prayer hall. Tape and theodolite are used for this measurement. Figure 69.3 shows the floor plan of the prayer hall.

In general, the procedure in obtaining the location of columns in Cartesian coordinates is given as follows:

Step 1: Determine the shape of the prayer hall.
Step 2: Determine the center of the prayer hall and assume the center as coordinate (0,0,0).
Step 3: Determine the location of points in the prayer hall relative to center (0,0,0).

Results

Based on the measurement, we found out that the prayer hall is in the square shape and there are 12 columns found in the hall. By assumption, we consider the floor of the prayer hall as the xy-plane and coordinate (0,0,0) is the center of the prayer hall.

Fig. 69.1 Anterior of Masjid Tengku Abdullah

Fig. 69.2 Posterior of Masjid Tengku Abdullah
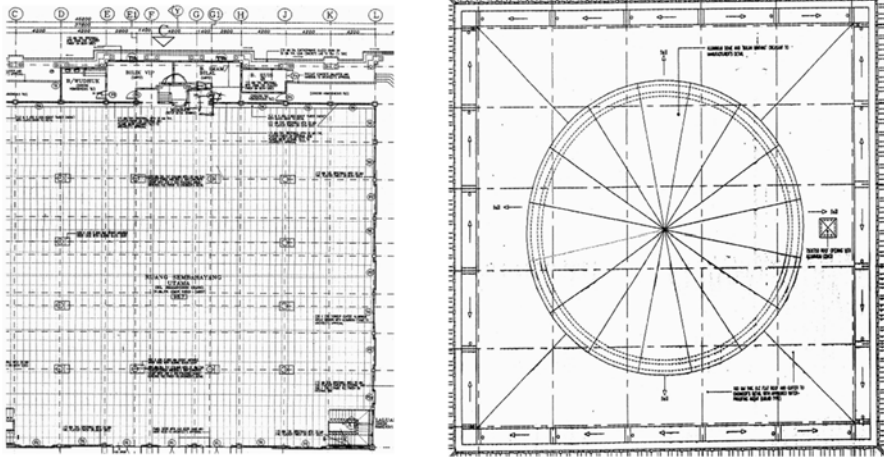
Fig. 69.3 Floor plan of the prayer hall (Source: Jabatan Kerja Raya Kuantan, Pahang)

Table 69.1 Location of columns in Cartesian coordinates

Point	Cartesian coordinate (x, y, z)	Point	Cartesian coordinate (x, y, z)
A	(10.5, 2.9, 0)	G	(−10.5, −4.1, 0)
B	(10.5, 9.9, 0)	H	(−10.5, −11.1, 0)
C	(3.5, 9.9, 0)	I	(−3.5, −11.1, 0)
D	(−3.5, 9.9, 0)	J	(3.5, −11.1, 0)
E	(−10.5, 9.9, 0)	K	(10.5, −11.1, 0)
F	(−10.5, 2.9, 0)	L	(10.5, −4.1, 0)

Based on the floor plan of the prayer hall (Fig. 69.3), the columns are represented by points A to L (further shown in Fig. 69.4). Table 69.1 shows the location of the points in Cartesian coordinates.

If we focus on the xy-plane, the location of some pairs of columns is symmetrical to y-axis as shown in Table 69.2 and Fig. 69.4. The location of columns satisfies four equations which are $f_1(x)=f_1(-x)=9.9$ for $x \in \{-10.5, -3.5, 3.5, 10.5\}$, $f_2(x)=f_2(-x)=-11.1$ for $x \in \{-10.5, -3.5, 3.5, 10.5\}$, $f_3(x)=f_3(-x)=2.9$ and $f_4(x)=f_4(-x)=-4.1$ for $x \in \{-10.5, 10.5\}$.

None of the location of pairs of columns is symmetrical to x-axis, but it is symmetrical to line $y=-0.6$. Table 69.3 and Fig. 69.5 show the location of pairs of columns that is symmetrical to line $y=-0.6$.

This mosque has a dome in the style of Dome of the Rock which is circular as shown in Fig. 69.6.

Table 69.2 Location of pairs of columns that is symmetrical to *y*-axis

Point	Cartesian coordinate (x, y)
A & F	(10.5, 2.9) & (−10.5, 2.9)
B & E	(10.5, 9.9) & (−10.5, 9.9)
C & D	(3.5, 9.9) & (−3.5, 9.9)
L & G	(10.5, −4.1) & (−10.5, −4.1)
K & H	(10.5, −11.1) & (−10.5, −11.1)
J & I	(3.5, −11.1) & (−3.5, −11.1)

Fig. 69.4 Location of pairs of columns that is symmetrical to *y*-axis
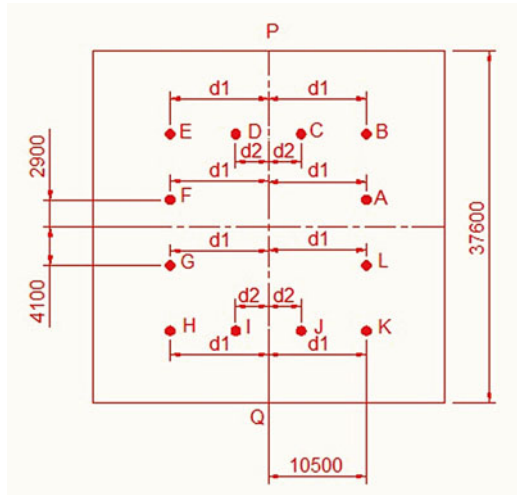
Table 69.3 Location of pairs of columns that is symmetrical to line $y = -0.6$

Point	Cartesian coordinate (x, y)
E & H	(−10.5, 9.9) & (−10.5, −11.1)
F & G	(−10.5, 2.9) & (−10.5, −4.1)
D & I	(−3.5, 9.9) & (−3.5, −11.1)
C & J	(3.5, 9.9) & (3.5, −11.1)
B & K	(10.5, 9.9) & (10.5, −11.1)
A & L	(10.5, 2.9) & (10.5, −11.1)

The vertex of the dome is located at $(0, 0, z_0)$. The surface of the dome is close to the elliptic paraboloid, with the paraboloid opening down and having the equation of $\dfrac{z}{c} = \dfrac{x^2}{a^2} + \dfrac{y^2}{b^2}$, $c < 0$. The traces parallel to *xy*-plane are circles, while the traces parallel to *yz*- and *xz*-planes are parabolas.

Fig. 69.5 Location of
pairs of columns that is
symmetrical to line $y = -0.6$
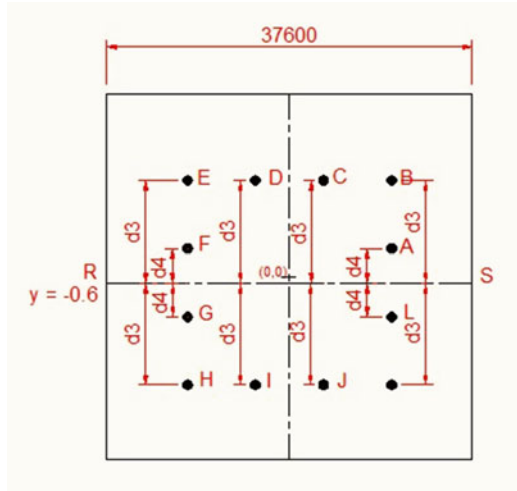
Fig. 69.6 Dome of Masjid Tengku Abdullah, Jerantut

Conclusion

In this preliminary study, we try to relate the construction of an Islamic architecture with the mathematical concept. Here, we investigate the location of some parts of structure at Masjid Tengku Abdullah, Jerantut, and represent them in Cartesian coordinates. The findings show that the prayer hall which is in the square shape (has ratio 1:1 between width and length) is suitable with the function of the hall as suggested by Renaissance Theory [5]. The location of pairs of columns is symmetrical to y-axis and line $y = -0.6$. This shows that the construction of the columns (in the prayer hall) does not only consider the stability of the prayer hall but also consider the extension part such as the space path. Indirectly, this study shows that the mathematical concept of such shapes, Cartesian coordinates, and symmetry is employed in designing a balance construction of the mosque.

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Chapter 70
The Potential of *Pseudomonas* sp. in Ammonia Removal of Landfill Leachate

Siti Suhaila Binti Harith

Introduction

Landfill generates two pollutants, namely, leachate and gas. Organic and inorganic contaminants of landfill leachate are released from the waste due to successive biological, chemical, and physical processes. This process created leachate with different characteristic overtime [1]. With the growing phenomenon of nitrogen pollution in water, removal of nitrogen pollution in wastewater treatment has become an issue. Biotreatment is a cost-effective method for wastewater before being discharged into the streams and rivers. Microbial applications for the removal of environmental pollutants such as ammonia from leachate can provide an attractive alternative to treat older leachate that generally has high concentration of nitrogen compound. There are not many alternative ways to remove organic and nitrogen compound pollutants at one stage except biological methods [2]. The aim of this study was to isolate potential microbes that can be applied to remove ammonia and COD from leachate generated in old landfills.

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Materials and Methods

Sample Collection

(a) Isolation of the bacteria

Samples of leachate, soil, and sediment were taken from the surrounding area of landfill at Batu 55, Maran, and Jengka 10, Maran. Diluted sample was spread on nutrient agar (NA), tryptic soy agar (TSA), Pseudomonas agar, and modified medium used known as leachate agar, incubated at 30 °C for 3 days. Leachate agar was prepared using bacteriological agar added with filter-sterilized leachate (1 % v/v, leachate). The microbial colonies appeared on plate were isolated and purified. A total of 28 bacteria were selected for the screening test on their potential to remove ammonia.

(b) Leachate characterization

Only leachate samples from Batu 55, Maran, landfill were characterized and used as medium. Leachate samples from the landfill were collected in polyethylene bottles from leachate pipe, which carries leachate to a leachate small collection pond. Samples for laboratory analyses of chemical parameters were collected in clean 500 ml plastic bottles. Clean sterilized glass bottles (250 ml) were used to collect bacteriological samples. Analyses were done within 2 h of sampling. Both chemical and physical analyses were carried out and these include BOD, COD, pH, and TSS.

Analytical Methods [3]

Leachate was characterized with the following parameters: ammonia nitrogen (NH_4^+-N), nitrate (NO_3^-) and nitrite (NO_2^-), color (Pt/Co), total suspended solids (TSS), COD, sulfate (SO_4^{2-}), and phosphate (PO_4^{2-}), measured using Spectrophotometer HACH (Model DR 5000). Biological oxygen demand (BOD_5) was determined using BOD bottles incubated for 5 days at 20 °C. Oxygen meter (Dissolved Oxygen Meter, YSI Model 58) was used to measure dissolved oxygen (DO) before and after incubation. The analysis for pH was conducted directly using pH probe (Orion, USA).

Preparation of Inoculums

Nutrient broth (HiMedia, India) was prepared, and selected bacterial isolates were inoculated separately and incubated for 24 h at 30 °C. The cells were recovered by centrifugation (5,000 rpm for 15 min) and were transferred to sterile saline. The cell concentration of each strain was adjusted to an optical density at 600 nm of 0.5 OD and used as inoculums.

Experimental Study

(a)   Batch study

Batch study was conducted in an Erlenmeyer flasks containing leachate with the concentration of COD/N, ratio between 7.0 and 10.0. Shake flask batch culture experiments were performed in triplicates. Leachate was used as a medium with 10 % of inoculums (0.5 OD) from the selected isolates and inoculated in the individual flasks. They were incubated at 30 °C in a shaker maintained at 150 rpm for a period of 3 days. Samples were collected at 0, 24, 48, and 72 h and analyzed for growth of bacteria and change in COD, BOD, nitrate, and ammonia of the medium. All experiments were repeated for three times. Negative control run was leachate without any inoculums added.

Growth of Bacteria and pH Change

The increase in growth of bacteria for every 48 h was monitored by viable count using leachate agar. The pH change in the culture medium was measured using a pH meter. Leachate used as medium was sterilized using filter paper of 0.45 μm (Whatman).

Identification of the Bacteria

The isolate was streaked on nutrient agar and incubated at 30 °C for 24–48 h. For each of the grown colony, the Gram staining was performed and the cells were observed under light microscope. Physiological characteristic of the isolate was determined based on standard procedures as described by Mac Faddin [4] such as oxidase, catalase, triple sugar iron (TSI), IMViC (Indole, Methyl Red/MR, Voges-Proskauer/VP, and Simmons citrate), motility, and oxidative-fermentative test growth on MacConkey agar. For the Gram-negative bacteria, commercial kit such as API 20NE test (bioMerieux S.A.) was used.

Results and Discussions

Leachate Characteristic

BOD_5/COD ratio describes the biodegradability level of materials by which organic matter containing leachate is readily broken down in the environment. It is known that BOD_5/COD ratio of leachate decreases with time in landfill, resulting in the stability of leachate [5]. Table 70.1 shows that values of BOD_5/COD and COD/NH_3-N range between 0.034–0.007 and 6.80–9.92, respectively. This indicates leachate used in this study is from "old" municipal solid waste landfills [6].

Table 70.1 Leachate
characteristic from Batu 55,
Maran, landfill

Parameter (unit)	Value
pH	7.44–8.22
Color (Pt/Co)	2,100–2,300
Total suspended solid (mg·l^{-1})	255–456
Chemical oxygen demand [COD (mg·l^{-1})]	4,403–62,000
Biological oxygen demand [BOD (mg·l^{-1})]	150–450
N-ammonia [NH$_3$-N (mg·l^{-1})]	650–6,250
N-nitrate [NO$_3$-N (mg·l^{-1})]	230–635
N-nitrite [NO$_2$-N (mg·l^{-1})]	0.6–23.4
Phosphate [PO$_4$$^{3-}$ (mg·l^{-1})]	15–592.5
Sulfate (mg·l^{-1})	325–1,875

The Removal of COD, BOD, Ammonia, and Nitrate by Isolates

All the 28 isolates were screened on their ability to reduce ammonia and COD. Out of 28, only 3 isolates showed their potential in ammonia and COD removal. All the three isolates showed the percentage removal of COD, BOD, ammonia, and nitrate with values ranging between 55–60 %, 60 %, 35–49 %, and 25–30 %, respectively. Incubation for more than 3 days did not remove the parameters measured further (data are not shown). This suggested that the remaining organic compound in terms of BOD$_5$ and COD and nitrogenous compounds (NH$_3$-N) was recalcitrant. Initial COD value was between 4,403 and 62,000 mg·l^{-1}, while final COD value ranged from 1,761 to 24,800 mg·l^{-1}, indicating that a nonbiodegradable fraction of 0.4 existed at the end of the experiment. Nonbiodegradable fraction was calculated as ratio between final COD and initial COD. Figure 70.1 showed that isolate 5 can remove up to 60 % and 35 % of COD and ammonia, respectively. Isolate 10 can remove up to 55 % of COD and 40 % of ammonia (Fig. 70.2). Isolate 11 showed the percentage removal of COD and ammonia up to 60 % and 40 % respectively (Fig. 70.3). Viable count of all the experiment varies from 1.5×10^5 to 1.6×10^6 CFU/ml. Isolates 5, 10, and 11 were further investigated for the purpose of identification.

Morphological and Biochemical Characterization

Microscope examination of cells showed that all the three isolates were motile, Gram-negative rod occurring singly when grown in nutrient agar (NA). Cell size varies from 0.5 to 0.8 μm with 1.5–3 μm in width and length. Colonies of all isolates on NA plates were circular, entire, and undulate, averaging at 1 to 2 mm in diameter after 48 h at 37 °C, with smooth surface colonies. Green pigmentation was observed on nutrient broth. Isolates showed insoluble yellow pigments on triple sugar iron agar slants in 48–72 h. All isolates were lactose negative on MacConkey's agar.

Fig. 70.1 The percentage of COD, BOD, and ammonia and nitrate removal by isolate 5
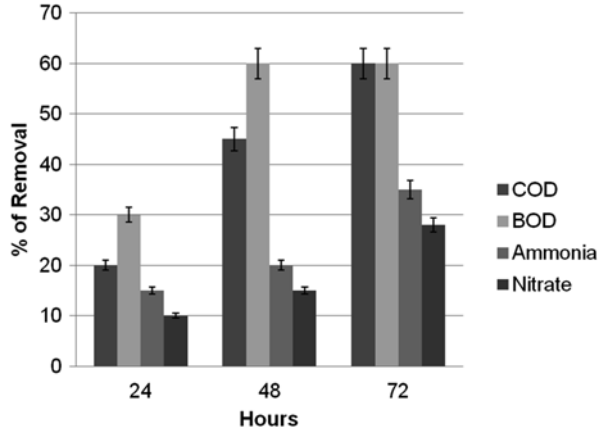
Fig. 70.2 The percentage of COD, BOD, and ammonia and nitrate removal by isolate 10
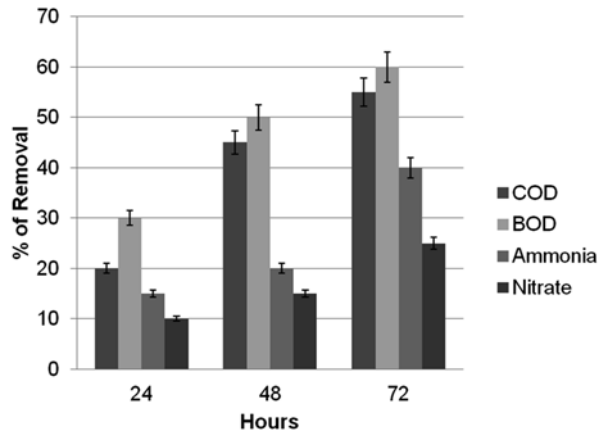
Fig. 70.3 The percentage of COD, BOD, and ammonia and nitrate removal by isolate 11
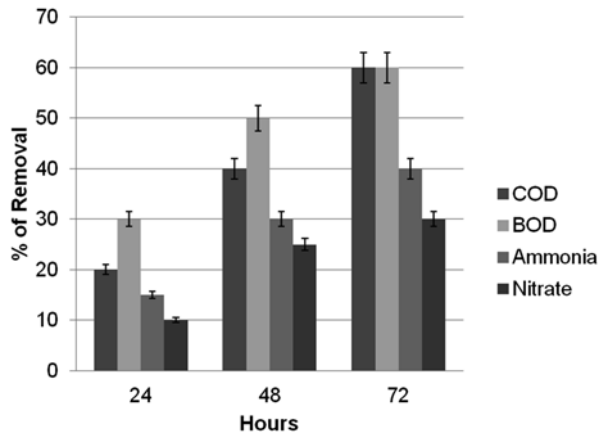
Table 70.2 Biochemical tests and characterization of isolated bacteria

Characteristic		Isolates designation		
		5	10	11
Colony morphology	Form	Circular	Circular	Circular
	Elevation	Umbonate	Umbonate	Umbonate
	Surface	Smooth	Smooth	Smooth
	Edge	Entire	Entire	Entire
Cellular morphology	Shape and size (μm)	Rod	Rod	Rod
		0.5–0.8; 1.5–3	0.5–0.7; 1.5–2.8	0.5–0.8; 1.5–3
Growth	Temperature	30–60 °C	30–60 °C	30–60 °C
	MacConkey	–	–	–
Catalase		+	+	+
Glucose O/F medium		O	O	O
VP		–	–	–
Use of citrate		+	+	+
TSI		–	–	–
Nitrate		+	+	+
Indole test		–	–	–
Methyl Red		–	–	–

Isolates were positive for catalase, citrate, and oxidative metabolism of glucose. All isolates showed negative results for indole, TSI, MR, and VP tests. Isolates were positive for nitrate reduction which indicates their ability to reduce nitrate to nitrite or nitrogenous gases. Based on macroscopic examination and biochemical characteristic, the three isolates were predicted to be in the same group or bacteria (Table 70.2). Commercial kit such as API 20NE test (bioMerieux S.A.) was used for identification purpose, and all the three isolates revealed as *Pseudomonas* sp. (Table 70.3). The identification of the isolate was identified using Bergey's Manual of Systematic Bacteriology [7]. The genus *Pseudomonas* is the most heterogeneous and ecologically significant group of known bacteria and includes Gram-negative motile aerobic rods that are widespread throughout nature and characterized by elevated metabolic versatility, with the presence of a complex enzymatic system [8].

Conclusion

Pseudomonas sp. from local isolate shows the capability in removing organic matters measured in terms of COD and BOD_5 values up to 60 % and ammonia up to 40 %. It has the potential to be utilized in ammonia and COD reduction processes to treat aged leachate.

Table 70.3 Identifications and characteristics of isolates using API 20NE

	Isolates designation		
Characteristic	5	10	11
Indole production on tryptophan	−	−	−
Glucose acidification	−	−	−
Arginine dihydrolase	+	−	+
Urease	+	+	+
Esculin hydrolysis	−	−	−
Gelatin hydrolysis	+	+	+
β–galactosidase	−	−	−
D-glucose	+	+	+
L-arabinose	−	−	−
D-mannose	−	−	−
D-mannitol	+	+	+
N-acetyl-d-glucosamine	+	+	+
Maltose	−	−	−
Gluconate	+	+	+
Caprate	+	+	+
Adipate	+	+	+
L-malate	+	+	+
Citrate	+	+	+
Phenylacetate	−	−	−

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Chapter 71
Phytochemical Investigation of the Leaves of *Tetracera scandens* Linn. and In Vitro Antidiabetic Activity of Hypoletin

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Introduction

Diabetes mellitus is a metabolic disease which is characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action or both. The vast majority of cases of diabetes fall into two broad etiopathogenetic categories. In one category, type 1 diabetes, the cause is an absolute deficiency of insulin secretion, while the other is a much more prevalent category, type 2 diabetes, whereby the cause is a combination of resistance to insulin action as well as inadequate compensatory insulin-secretory response [29]. There are a growing number of people diagnosed with diabetes, and Malaysia is not spared of this phenomenon, as the prevalence stands at 14.9 % of the adult population. Adequate blood glucose control is vital in diabetes management to prevent complications; rapid changes, with the prospect of a changing health scenario, have led Malaysians to be affected by Western health problems [22]. A 2001 study noted that 10 % of the Malaysian population was diagnosed with diabetes [20]. The number of diabetic adults above the age of 30 in Malaysia has increased by almost 80 % in the last 10 years (1996–2006) to 1.4 million. Ninety-five percent of diabetic patients suffer from type 2 diabetes, of which 50 %

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will develop cardiovascular disease within 10 years (http://thestar.com.my/news/story.asp?file=/2010/1/11/nation/20100111140301andsec=nation).

In the measurement of diabetes mellitus, several approaches are often employed which include dietary intervention, use of different classes of oral but safe hypoglycaemic agents, insulin injection, aerobic exercise and food supplements [8]. However, in developing countries and in some other developed countries, these therapeutic options are expensive, and not readily accessible, especially to the poor. Besides these, the therapeutic regimen are considered rigid, multi-pharmaceutical and often associated with intolerable side effects. These factors militate against the effective management/treatment of the patients. In view of these shortcomings, herbal pharmacotherapy is often explored by these patients. Plants are frequently considered to be less toxic and free from side effects than synthetic ones [23]. Recently, the search for appropriate antidiabetic agents has been focused on plants used in traditional medicine partly because of leads provided by traditional medicine to natural products that may be better treatments than currently used drugs responsible for producing serious side effects among diabetics [39].

Tetracera scandens Linn. of Dilleniaceae family known locally as Mempelas Kasar is a climbing vine growing from 3 to 5 m or more in length and grows widely in India, southern China, Indonesia, Myanmar, the Philippines, Thailand, Vietnam and Malaysia. Leaves, stems and roots of *T. scandens* are traditionally used in the form of folk remedies by various indigenous peoples in different countries for the management of hepatitis, internal pains, rheumatism, inflammatory diseases, urinary disorders, dysentery, sore throat, gout and diabetes; for lowering blood pressure; and for child birth [46]. Traditionally, in different regions of Malaysia, the leaves of *T. scandens* are applied to boils to ripen them; the juice is generally taken to treat internal pains; a decoction of the plant is administered after childbirth; the roots are used as an astringent in diarrhoea and a traditional ingredient in a mixture for burns; droplets of water/sap from freshly cut stems are used for eye irritation; the juice gathered by smashing the stem is taken to reduce body heat; and roots are ground and its juice is applied to mouth ulcers. In Indonesia, the finely crushed young shoots are made into a poultice and put on bites of poisonous snakes. The sap of the stem is drunk to relieve cough. In the Philippines, an infusion of the stem is drunk for haemoptysis in tuberculosis [48]. It is also used as a gargle against thrush. Externally, the infusion is applied to a sore throat, the action being due to the large amount of tannins it contains [43]. In Cambodia, the stem is used as a diuretic and in combination with other plants in oedemas of hepatic and renal origin. In Vietnam, the root and the stem are used in hepatitis, gout and inflammation [36]. In India, the juice of the aerial portion is given orally once a day for burning sensation during urination [34].

The polar extracts of the leaves of *T. scandens* have been reported to exhibit potential therapeutic xanthine oxidase (XO) inhibitory activity in a concentration-dependent manner in vitro [36] and antidiabetic activity in vivo [46]. However, no scientific report of this plant on phytochemical investigations or antidiabetic efficacy of its components in vitro has ever been recorded in literature with respect to its utility in traditional medicine by the local herbalists in Malaysia. Hence, we were prompted to do phytochemical investigation as well as to check the in vitro antidiabetic potential of its phytoconstituents.

Materials and Methods

Collection and Identification of Plant Material

Fresh leaves (10 kg) of *T. scandens* were collected from Taman Pertanian, Kuantan, Indera Mahkota, 25200 Kuantan and Pahang Darul Makmur, Malaysia, in October 2008. The plant was identified by Dr. Richard Chung (taxonomist), Forest Research Institute of Malaysia (FRIM), Kuala Lumpur, Malaysia. The voucher specimen (NMPC-Q24) has been deposited in the Herbarium, Kulliyyah of Pharmacy, IIUM, Kuantan, Pahang DM, Malaysia, for future reference.

Preparation of Plant Material

The authenticated fresh leaves (10 kg) were dried in a laboratory dryer at a temperature range of 30–40 °C and were pulverized to a coarse powdered (2.2 kg) form using Universal Cutting Mill (Schemersal, Germany), and the ground material was used in the extraction processes.

Preparation of Nonpolar and Polar Extracts of T. scandens Leaves

Ground material (1.2 kg) was used for the extraction processes. This powdered material was initially treated with DCM to obtain the DCM-soluble compounds (40 g). The insoluble portion was further treated with MeOH to obtain MeOH-soluble compounds (110 g) which was further treated with EtOAc to obtain EtOAc extract (60 g), and the EtOAc-insoluble portion was finally treated with BuOH in order to get BuOH extract (30 g). These extracts were discretely subjected to silica gel and Sephadex LH-20 column chromatography in order to get pure compounds.

Determination of Different Classes of Phytoconstituents Present in T. scandens Leaves

Thin-layer chromatography (TLC) evaluation of nonpolar and polar extracts of the leaves of *T. scandens* was carried out on precoated silica gel 60 F_{254}, 0.2 mm thick aluminium plates in different binary as well as ternary solvent systems, namely, toluene–acetone (TA) (5:1, 2:1, 1:1, 1:2), toluene–ethyl formate–formic acid (T:E:F) (5:4:1), benzene–pyridine–formic acid (B:P:F) (39:6:5), chloroform–MeOH–formic acid (C:M:F) (90:05:0.6) and benzene–acetone–formic acid (B:A:F) (3:1:0.1), respectively, to confirm the presence of different classes of phytochemicals by using different classes of selected reagents [15].

Instruments

Melting points of all compounds were determined using Stuart Scientific SMP 10 instrument. UV spectra were determined using SECOMAM UV–Vis spectrophotometer (Analytik Jena, Germany). ^{1}H and ^{13}C-NMR spectra were recorded on a BRUKER instrument at 600 MHz. TMS was used as internal standard. EI-MS spectra were taken on BRUCKER micrOTOF-Q. All solvents from the extracts were evaporated to dryness using a BUCHI rotary evaporator R-200, water bath and freeze dryer (ALPHA 1-4 LD-2).

In Vitro Antidiabetic Activity of Hypoletin from MeOH Extract of T. scandens Leaves

Cell Culture

3T3-L1 preadipocyte cells obtained from the American Type Culture Collection were cultured in Dulbecco's modified Eagle's medium (DMEM) containing 10 % foetal bovine serum (FBS). Cells were subcultured every 3–4 days at approximately 80 % confluence. Cells were then seeded onto 12-well plates at a density of 2×10^4 cells/well. Two days post-confluence (defined as day 0), cells were stimulated to differentiate with differentiation medium containing DMEM with 10 % FBS, MDI [0.5 mM 3-isobutyl-1-methylxanthine (IBMX), 0.25 μM dexamethasone, 1 μg/mL insulin], for 2 days. In the course of screening adipocyte differentiation-inhibitory activity, 3T3-L1 preadipocytes were treated with differentiation medium in the presence of various concentrations of test compound at day 0. On day 2, differentiating media were replaced with 10 % FBS/DMEM medium containing 1 μg/mL insulin and incubated for another two days (day 4). Thereafter, the cells were maintained in 10 % FBS/DMEM medium for an additional four days (day 8) with medium changes every 2 days. All media contained 1 % penicillin–streptomycin (10,000 U/mL). Cells were maintained at 37 °C in an incubator in a humidified atmosphere of 5 % CO_2 [38].

Cell Viability

Cell viability was assessed by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay. Mature adipocytes were seeded in 96-well plates and grown until confluence. Test compounds were dissolved in dimethyl sulphoxide (DMSO). Cells were then incubated with either 0.01 % DMSO or test compounds (10, 20, 50 and 100 μg/mL). Our preliminary study showed that DMSO at a final concentration of <0.1 % in media did not affect cell viability or differentiation. The experiment was allowed to proceed for 48 h at 37 °C in a humidified 5 % CO_2 atmosphere. Cells were then washed two times with phosphate buffer saline (PBS). After that, 20 μl of

MTT stock solution (5 mg/ml) was added to each well and the plates were further incubated for 4 h at 37 °C. 100 μL of dimethyl sulphoxide (DMSO) was added to each well to solubilize the water-insoluble purple formazan crystals. After 1 h, the absorbency was measured at wavelength of 570 nm and reference wavelength of 630 nm with a microplate reader [31].

Adipocyte Differentiation

Nine days after the differentiation induction, cells were washed three times with PBS and fixed with 10 % formalin for 1 h at room temperature. After fixation, cells were washed once with PBS and stained with freshly diluted Oil Red O solution (3 parts of 0.6 % Oil Red O in isopropanol and 2 parts of water) for 1 h. Cells were then washed twice with distilled water and visualized under a microscope. Images were collected on an Olympus microscope. For quantitative analysis, Oil red O staining was dissolved with isopropanol, and optical density was measured at 520 nm by enzyme-linked immunosorbent assay (ELISA) plate reader [42].

Glucose Uptake Activity Assay

Glucose uptake activity was analysed by measuring the uptake of radiolabeled glucose according to the procedure performed by Bai et al. [4]. Briefly, >90 % fully differentiated adipocytes grown in 12-well plates were washed twice with serum-free DMEM and incubated for 3 h at 37 °C with 1 mL of serum-free DMEM. The cells were then washed three times with Krebs–Ringer–phosphate–HEPES (KRPH) buffer (118 mM NaCl, 5 mM KCl, 1.3 mM $CaCl_2$, 1.2 mM $MgSO_4$, 1.2 mM KH_2PO_4 and 30 mM HEPES, pH 7.4) and incubated with 0.9 mL of KRPH buffer for 30 min at 37 °C. Insulin and test compound including the control were added, and the cells were incubated at 37 °C for a further 60 min. Glucose uptake was initiated by the addition of 0.1 mL of KRPH buffer containing 2-deoxy-D-[^{3}H] glucose (0.037 MBq; PerkinElmer) and glucose (0.001 mM). After 60 min, glucose uptake was terminated by washing the cells three times with ice-cold PBS. The cells were lysed through incubation for 20 min at 37 °C with 0.7 mL of 1 % Triton X-100. Levels of radioactivity in the cell lysates were determined using a Tri-Carb 2700 TR liquid scintillation counter.

Statistical Analysis

Results are presented as mean standard error of three experiments. Data were analysed by ANOVA using SPPS version 19. A *P*-value of less than 0.05 was considered statistically significant.

Results

Phytochemical Investigation of the MeOH Extract of the Leaves of T. scandens

Pulverized dry leaves of *T. scandens* (1.2 kg) were used for the extraction processes to obtain DCM extract (40 g) and MeOH extract (110 g). MeOH extract was further treated with EtOAc to obtain EtOAc extract (60 g), and the EtOAc-insoluble portion was finally treated with BuOH in order to get BuOH extract (30 g). Phytochemical TLC analysis of polar (MeOH, BuOH), semipolar (EtOAc) and nonpolar (DCM) extracts of the leaves of *T. scandens* in BA, TEF, BPF, CMF and BAF solvent systems collectively showed the presence of more than ten spots of phenolic compounds and six terpenoidal compounds using 1 % ethanolic solution of aluminium chloride and 0.5 g vanillin in 100 ml sulphuric acid/ethanol (40:10) as spray reagents, respectively.

DCM extract upon repeated column chromatography, TLC evaluation and crystallization with CHCl₃/EtOH afforded three pure terpenoidal compounds, namely, stigmasterol (50 mg) (Fig. 71.1a), betulinic acid (500 mg) (Fig. 71.1b) and isomeric mixture of sitosterol (Δ^5) glycoside and stigmasterol ($\Delta^{5,22}$) glycoside (30 mg). EtOAc and BuOH extracts fractionated from MeOH extract of the leaves of *T. scandens* afforded six flavonoids, namely, kaempferol (Fig. 71.1c), quercetin (Fig. 71.1d), isoscutellarein (Fig. 71.1e), hypoletin (Fig. 71.1f), astragalin (Fig. 71.1g) and kaempferol-3-*O*-(6″-*O*-*p*-trans-coumaroyl) glucoside (Fig. 71.1h). These compounds were identified by spectroscopic analysis as well as comparison of their spectral data with previously reported values. Structures of all compounds were elucidated through UV–Vis, mass, IR and NMR spectral analysis. The occurrence of all these compounds is being reported for the first time from this plant.

Stigmasterol

($C_{29}H_{48}O$, MW: 412): colourless crystal (50 mg); m.p.: 140–141 °C (uncorrected) (144–146 °C [24]); solubility: CHCl₃; EI-MS *m/z*: 413 [M+H]⁺; IR (KBr) ν_{max} cm⁻¹: 3,456.07 (OH), 1,639.73 (C=C); ¹H-NMR (CDCl₃,600 MHz, δ (ppm)): δ 3.55 (1H, m, H-3), 5.36 (1H, d, *J*=4.8 Hz, H-6), 5.17 (1H, dd, *J*=15, 9 Hz, H-22), 5.04 (1H, dd, *J*=15, 9 Hz, H-23), 1.0 (3H, s, CH₃-10), 0.90 (3H, d, *J*=6.0 Hz, CH₃-20), 0.85 (3H, d, *J*=2.4, CH₃-27), 0.80 (3H, d, *J*=2.4 Hz, CH₃-26), 0.65 (3H, s, CH₃-13), ¹³C-NMR (CDCl₃, 150 MHz): δ 140.77 (C-5), 129.84 (C-22), 77.24 (C-3), 129.28 (C-6), 77.24 (C-3), 45.95 (C-14), 45.84 (C-17), 45.95 (C-24), 42.23 (C-9), 31.67 (C-25), 40.51 (C-13), 33.72 (C-20), 31.91 (C-12), 42.23 (C-4), 32.43 (C-1), 39.69 (C-10), 26.08 (C-8), 31.54 (C-7), 21.13 (C-16), 35.53 (C-2), 25.42 (C-28), 21.23 (C-15), 19.84 (C-21), 19.41 (C-11), 23.08 (C-27), 21.09 C-26), 18.80 (C-19), 19.05 (C-29), 18.99 (C-18) [21].
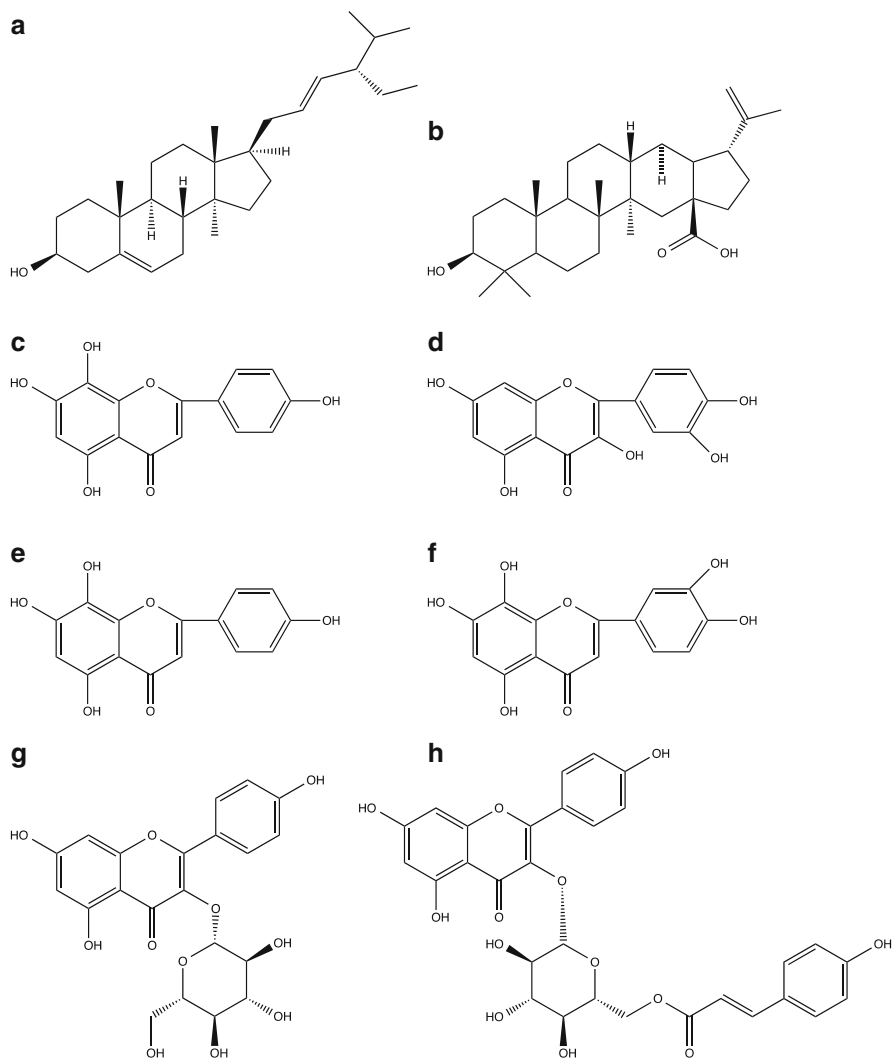
Fig. 71.1 Structure of pure compounds isolated from the nonpolar and polar extracts of the leaves of *T. scandens*. (**a**) Stigmasterol, (**b**) betulinic acid, (**c**) kaempferol, (**d**) quercetin, (**e**) isoscutellarein, (**f**) hypoletin, (**g**) astragalin, (**h**) kaempferol-3-*O*-(6″-*O*-*p*-trans-coumaroyl) glucoside

Betulinic Acid

($C_{30}H_{48}O_3$, MW: 456): colourless crystals (500 mg); m.p.: 296–297 °C (uncorrected) (295–296 °C [10]); solubility: EtOAc; EI-MS *m/z*: 457 [M + H]⁺; IR (KBr) ν_{max} cm⁻¹: 3,450 (OH stretching), 2,943 (aliphatic C–H stretching), 1,686 (C=C absorption peak), 1,458 (CH₂), 1,044 (cycloalkane); ¹H-NMR (CDCl₃, 600 MHz, δ (ppm)): δ 4.74 (1H, br s, Hₐ-29) 4.61 (1H, br s, Hᵦ-29), 3.2 (1H, dd, *J* = 11.4, 4.2 Hz, H-3), 3.02

(1H, m, H-19), 1.77 (3H, s, Me-30), 0.99 (3H, s, Me-26), 0.94 (3H, s, Me-27), 0.83 (3H, s, Me-25), 0.76 (3H, s, Me-24), ^{13}C-NMR (CDCl$_3$, 150 MHz): 39.07 (C-1), 27.59 (C-2), 79.22 (C-3), 38.91 (C-4), 55.54 (C-5), 18.49 (C-6), 34.52 (C-7), 40.89 (C-8), 50.71 (C-9), 37.41 (C-10), 21.05 (C-11), 25.70 (C-12), 38.57 (C-13), 42.64 (C-14), 30.74 (C-15), 32.36 (C-16), 56.46 (C-17), 47.09 (C-18), 49.46 (C-19), 155.6 (C-20), 29.91 (C-21), 37.23 (C-22), 28.19 (C-23), 14.90 (C-24), 16.23 (C-25), 16.34 (C-26), 14.60 (C-27), 179.96 (C-28), 109.91 (C-29), 19.58 (C-30) [10].

Isomeric Mixture of Sitosterol (Δ^5) Glycoside and Stigmasterol ($\Delta^{5,22}$) Glycoside

White amorphous (30 mg); m.p.: 277–279 °C; solubility: EtOH; EI-MS *m/z*: 434, 421, 413, 392; IR (KBr) ν_{max} cm^{-1}: 3,418 (OH), 2,932 (OH), 1,379 (OH def), 1,022, 621 (cycloalkane); ^{13}C-NMR (CDCl$_3$, 150 MHz): 140.63, 121.44, 121.41, 100.89, 76.88, 73.64, 70.28, 61.26, 56.36, 55.59, 50.77, 49.78, 45.30, 42.03, 40.05, 39.09, 38.45, 37.00, 36.40, 31.60, 31.56, 29.42, 28.87, 27.99, 25.57, 24.07, 24.04, 22.78, 20.77, 19.91, 19.29, 19.11, 18.80, 11.97, 11.86, 5.71. Looking at the integration of the above-mentioned signals and overall proton counting in ^{1}H-NMR, the mixture of sitosterol glycoside and stigmasterol glycoside was deduced.

Kaempferol

(4′, 3, 5, 7-Tetrahydroxyflavone (C$_5$H$_{10}$O$_6$), MW: 286): yellow crystals (25 mg); m.p.: 278–279 °C (275–278 °C [33]); solubility: EtOH and slightly soluble in water; EI-MS *m/z*: 287 [M + H]$^+$; IR (KBr) ν_{max} cm^{-1} 3431 (OH), 1,612 (C=C), 1,383 (OH def), 1,255, 1,304, 1,176 and, 723; λ_{max} (MeOH) nm: 215, 265, 371; (MeOH/NaOMe): 218, 265, 370; (MeOH/NaOMe after 10 min) 214, 278, 389; (MeOH/NaOAc): 252, 271, 376; (MeOH/NaOAc/H$_3$BO$_3$) 211, 265, 369; (MeOH/AlCl$_3$) 229, 270, 306; (MeOH/AlCl$_3$/HCl): 270, 325; ^{1}H-NMR (600 MHz, acetone-d$_6$, δ (ppm)): δ 12.17 (1H, s, OH-5), δ 8.16 (2H, dd, *J* = 1.8, 8.4 Hz, H-2′, 6′), 7.02 (2H, dd, *J* = 2.4, 9 Hz, H-3′, 5′), 6.54 (1H, d, *J* = 1.8 Hz, H-8), 6.27 (1H, d, *J* = 1.8 Hz, H6); ^{13}C-NMR (DMSO-d$_6$, 150 MHz): 147.12 (C-2), 136.75 (C-3), 176.71 (C-4), 162.44 (C-5), 99.26 (C-6), 165.05 (C-7), 94.61 (C-8), 157.89 (C-9), 104.27 (C-10), 123.44 (C-1′), 130.58 (C-2′, C-6′), 116.46 (C-3′, C-5′), 160.26 (C-4′) [33].

Quercetin

(3, 3′, 4′, 5, 7-Pentahydroxyflavone (C$_5$H$_{10}$O$_7$), MW: 302): yellow crystals (20 mg); m.p.: 296–297 °C (uncorrected) (308–310 °C [45]); solubility: EtOH, slightly soluble in water; EI-MS *m/z*:: 303 [M + H]$^+$; IR (KBr) ν_{max} cm^{-1}: 3,413 (OH), 1,611 (C=C), 1,264, 1,264, 1,169; λ_{max} (MeOH) nm: 213, 255, 366; (MeOH/NaOMe): 215, 242, 330; (MeOH/NaOMe after 10 min) 215, 243, 328; (MeOH/NaOAc): 217,

256, 376; (MeOH/NaOAc/H$_3$BO$_3$): 213, 260, 376; (MeOH/NaOAc/H$_3$BO$_3$ after 10 min): 216, 243, 328; (MeOH/AlCl$_3$) 223, 270, 362; (MeOH/AlCl$_3$/HCl): 217, 266, 362; (MeOH/NaOH) 215, 319. ^{1}H-NMR (600 MHz, acetone-d$_6$, δ (ppm)): δ 6.25 (1H, d, J = 2.4 Hz, H-6), 6.51 (1H, d, J = 1.8 Hz, H-8), 6.99 (1H, d, J = 8.4 Hz, H-5′), 7.70 (1H, dd, J = 8.4, 2.4 Hz, H-6′) 7.81 (1H, d, J = 2.4, H-2′), 12.17 (1H, s, OH-5); ^{13}C-NMR (DMSO-d$_6$, 150 MHz): 147.02 (C-2), 136.85 (C-3), 176.65 (C-4), 162.41 (C-5), 99.22 (C-6), 165.06 (C-7), 94.53 (C-8), 157.84 (C-9), 104.22 (C-10), 121.53 (C-1′), 116.29 (C-2′), 145.91 (C-3′), 148.42 (C-4′), 115.84 (C-5′), 123.85 (C-6′) [14, 45]).

Hypoletin

(3′,4′,5,7,8-Pentahydroxyflavone (8-hydroxyluteolin) (C$_5$H$_{10}$O$_7$), MW: 301): yellowish brown crystals (30 mg); m.p.: 296 °C (uncorrected); solubility: acetone and EtOH, slightly soluble in water; EI-MS *m/z*: 301 [M$^+$]$^+$; IR (KBr) ν_{max} cm^{-1}: 3,429 (OH), 1,578 (C=C), 1,375 (OH def), 1,283.41, 1,209, 1,147. λ_{max} (MeOH) nm: 213, 280, 340; (MeOH/NaOMe): 215, 290, 375; (MeOH/NaOMe after 10 min): 218, 296, 375; (MeOH/NaOAc): 212, 285, 329; (MeOH/NaOAc/H$_3$BO$_3$): 215, 316, 362; (MeOH/AlCl$_3$): 212, 288, 394; (MeOH/AlCl$_3$/HCl): 213, 287, 360. ^{1}H-NMR (600 MHz, acetone-d$_6$, δ (ppm)): δ 6.27 (1H, s, H-6), 6.59 (1H, s, H-3), 6.90 (1H, d, J = 2.4 Hz, H-2′), 7.43 (1H, d, J = 2.4 Hz, H-5′), 7.46 (1H, dd, J = 2.4, 2.4 Hz, H-6′), 8.77 (1H, s, OH-4′), 9.52 (1H, s, OH-3′), 10.64 (1H, s, OH-7), 9.98 (1H, s, OH-8), 12.37 (1H, s, OH-5); ^{13}C-NMR (acetone-d$_6$, 150 MHz): 149.85 (C-2), 102.54 (C-3), 182.25 (C-4), 153.50 (C-5), 98.74 (C-6), 163.99 (C-7), 125.29 (C-8), 153.16 (C-9), 103.49 (C-10), 121.69 (C-1′), 116.13 (C-2′), 145.68 (C-3′), 145.85 (C-4′), 113.74 (C-5′), 119.37 (C-6′).

Isoscutellarein

(4′,5,7,8-Tetrahydroxyflavone (8-hydroxy-apigenin) (C$_{15}$H$_{10}$O$_6$), MW: 286): brown crystals (18 mg); m.p.: 292–294 °C (uncorrected) (278–288 °C [5]); solubility: acetone and EtOH; EI-MS *m/z*: 287 [M+H]$^+$; IR (KBr) ν_{max} cm^{-1}: 3,448 (OH), 1,610 (C=C), 1,252, 1,183; λ_{max} (MeOH) nm: 230, 282, 305; (MeOH/NaOMe): 216, 292, 366; (MeOH/NaOMe after 10 min) 210, 236, 376; (MeOH/NaOAc): 216, 292, 365; (MeOH/NaOAc/H$_3$BO$_3$): 216, 292, 365; (MeOH/AlCl$_3$) 231, 291, 327; (MeOH/AlCl$_3$/HCl): 212, 288, 318; (MeOH/NaOH): 210, 299, 329; ^{1}H-NMR (600 MHz, acetone-d$_6$, δ (ppm)): δ 6.26 (1H, s, H-6) 6.72 (1H, s, H-3), 6.93 (2H, d, J = 8.4 Hz, H-3′, H-5′) 8.00 (2H, d, J = 8.4 Hz, H-2′, H-6′), 8.81 (1H, s, OH-4′), 10.44 (1H, s, OH-8), 10.59 (1H, s, OH-7), 12.36 (1H, s, OH-5); ^{13}C-NMR (DMSO-d$_6$, 150 MHz): 145.65 (C-2), 102.51 (C-3), 182.80 (C-4), 161.28 (C-5), 98.80 (C-6), 163.82 (C-7), 125.21 (C-8), 153.57 (C-9), 103.45 (C-10), 121.60 (C-1′), 128.82 (C-2′, C6′), 116.10 (C-3′, C5′) 153.20 (C-4′) [5].

Astragalin

(Kaempferol-3-β-O-glucoside ($C_{21}H_{20}O_{11}$, MW: 448): pale yellow crystals (30 mg); m.p.: 207–209 °C (uncorrected) (207–208 °C [35]); solubility: acetone, EtOH, H_2O; EI-MS m/z: 447 [M-1]$^+$; λ_{max} (MeOH) nm: 207.4, 274.3, 331.1; (MeOH/NaOMe): 206.8, 280.5, 398.0; (MeOH/NaOMe, after 10 min): 206.9, 280.3, 398.7; (MeOH/NaOAc): 250.9, 281.6, 359.7; (MeOH/NaOAc/H_3BO_3): 207.0, 275.9, 303.9; (MeOH/AlCl$_3$): 205.4, 275.9, 345.9; (MeOH/AlCl$_3$/HCl): 220.7, 281.3, 343.0; (MeOH/NaOH): 217.4, 280.4, 398.6. ^{1}H-NMR (600 MHz, acetone-d$_6$, δ (ppm)): δ 3.21 (2H, brd, H-6″), 3.29 (1H, m, H-5″), 3.31 (1H, dd, J = 4.5, 9.3 Hz, H-3″), 3.34 (1H, d, J = 6.6 Hz, H-4″), 3.41 (1H, t, J = 8.4 Hz, H-2″) 4.66 (1H, d, J = 7.8 Hz, H-1″), 6.26 (1H, s, H-8), 6.79 (1H, s, H-6), 6.92 (2H, d, J = 8.4 Hz, H-3′, H-5′), 8.12 (2H, d, J = 8.4 Hz, H-2′, H-6′), 10.45 (1H, s, OH), 12.77 (1H, s, OH); ^{13}C-NMR (D, DMSO-d$_6$, 150 MHz): 60.67 (C-6″), 69.30 (C-4″), 74.23 (C-2″), 76.15 (C-3″), 77.42 (C-5″), 99.21 (C-8), 102.53 (C-6), 103.6 (C-10), 106.47 (C-1″), 116.12 (C-3′, C-5′), 121.30 (C-9), 121.33 (C-1′), 125.44 (C-3), 129.33 (C-2′, C-6′), 157.33 (C-7), 161.41 (C-2), 164.17 (C-5), 164.19 (C-4′), 182.05 (C-4) [1, 28].

Kaempferol-3-O-(6″-O-p-trans-coumaroyl) Glucoside

($C_{30}H_{26}O_{13}$, MW: 594): yellow amorphous powder (10 mg); m.p.: 258–260 °C (uncorrected) (214–216 °C [52]); solubility: MeOH and H_2O; EI-MS m/z: 593 [M-1]$^+$; IR (KBr) ν_{max} cm^{-1}: 3,448.36 (OH), 1,610.31 (C=C), 1,252.03, 1,183; U.V$_{max}$ (MeOH) nm: 209, 267, 316; (MeOH/NaOMe): 209, 275, 368; (MeOH/NaOMe after 10 min) 209, 276, 372; (MeOH/NaOAc): 210, 277, 313; (MeOH/NaOAc/H_3BO_3): 210, 267, 316; (MeOH/AlCl$_3$) 229, 293, 306; (MeOH/AlCl$_3$/HCl): 229, 277, 303; (MeOH/NaOH): 211, 275, 371; ^{1}H-NMR (600 MHz, DMSO-d$_6$, δ (ppm)): δ 3.17 (1H, dt, J = 3.9, 8.7 Hz, H-4″), 3.22 (1H, dt, J = 4.2, 7.8 Hz, H-2″), 3.27 (1H, dt, J = 4.8, 9.0 Hz, H-3″), 3.38 (1H, dt, J = 6.6, 12.0 Hz, H-5″), 4.03 (1H, dd, J = 6.0, 12.0 Hz, H-6″a), 4.26 (1H, dd, J = 1.8, 11.4 Hz, H-6″b), 5.43 (1H, d, J = 7.8 Hz, H-1″), 6.08 (1H, d, J = 15.6 Hz, H-α‴), 6.13 (1H, d, J = 1.8 Hz, H-6), 6.37 (1H, d, J = 1.8 Hz, H-8), 6.78 (2H, dt, J = 2.4, 8.7 Hz, H-3‴, H-5‴), 6.85 (2H, dt, J = 2.4, 8.7 Hz, H-3′, H-5′), 7.32 (1H, d, J = 15.6 Hz, H-β‴), 7.34 (2H, d, J = 8.7 Hz, H-2‴, H-6‴), 7.97 (2H, dt, J = 2.4, 8.7 Hz, H-2′, H-6′), 10.26 (2H, brs, OH-7), 12.55 (1H, s, OH-5); ^{13}C-NMR (d, DMSO-d$_6$, 150 MHz): 177.6 (C4), 166.4 (Cγ‴), 164.4 (C5), 161.3 (C7), 160.1 (C4′), 159.9 (C4‴), 156.7 (C2), 156.5 (C9), 144.8 (Cβ‴), 133.2 (C3), 131.0 (C6′), 130.3 (C2‴, C6‴), 125.1 (C1‴), 120.9 (C1′), 116.0 (C3‴, C5‴), 115.3 (C3′), 113.8 (Cα‴), 104.0 (C10), 101.1 (C1″), 99.0 (C6), 93.9 (C8), 76.4 (C5″), 74.4 (C3″), 74.3 (C2″), 70.1 (C4″), 63.1 (C6″) [41, 11, 26, 52].
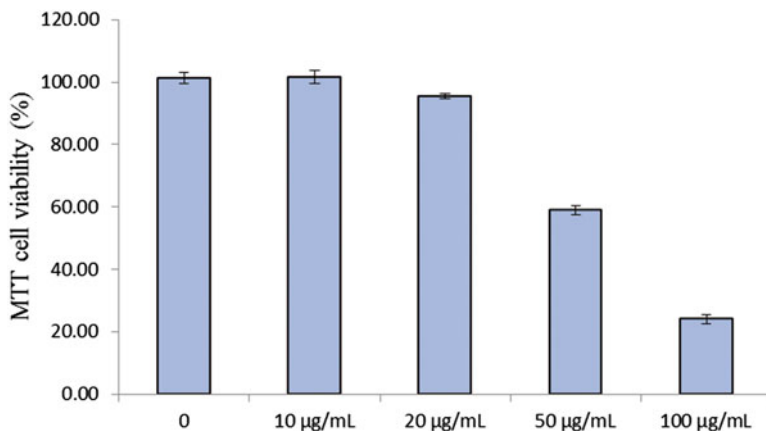
Fig. 71.2 Effect of different concentrations of hypoletin on the proliferation of 3T3-L1adipocytes. Assays were performed at least three times with three replicates for each treatment

Determination of In Vitro Antidiabetic Activity of Hypoletin

Due to the rare occurrence of hypoletin in plants, its in vitro antidiabetic effect was explored. Hence, the treatment of hypoletin in a dose-dependent manner was determined on the induction of lipid accumulation by using Oil Red O staining and glucose regulation in 3T3-L1 adipocytes in vitro with regard to its possible preventive role in the management of diabetes.

Effect of Hypoletin on the Viability of 3T3-L1 Cells

The viability assay was used to determine any possible adverse effects of hypoletin. 3T3-L1 cells were incubated in the presence of the compounds at various doses for 48 h. As shown in Fig. 71.2, the concentrations (0, 10, 20 and 50 µg/mL) had no effect on the cell viability. Based on the MTT assay, the dosage of 100 µg/mL significantly decreased the cell viability; therefore, it was not used as treatment dose in this study.

Effect of Hypoletin on Adipocyte Differentiation in 3T3-L1 Preadipocytes

To evaluate the effect of hypoletin on adipocyte differentiation, 3T3-L1 preadipocytes were treated with different concentrations of the compound for 2 days. Cells treated with MDI were used as positive control and DMSO as negative control.
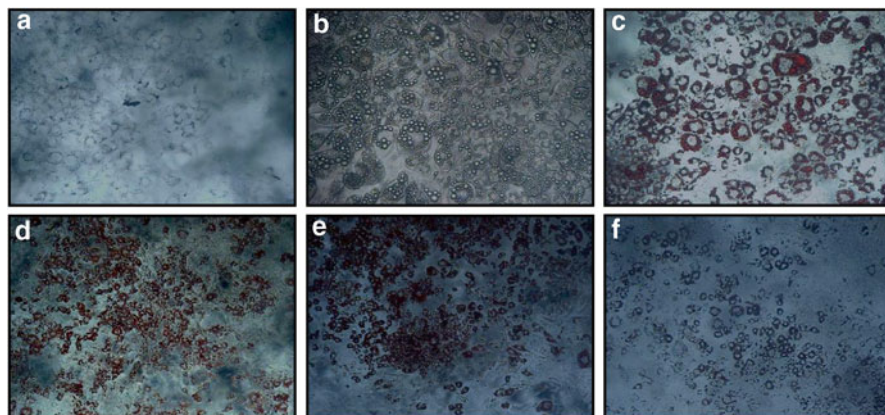
Fig. 71.3 The effect of hypoletin on adipocyte differentiation. In the presence of insulin, dexamethasone (DEX) and 3-isobutyl-1-methylxanthine (IBMX), undifferentiated 3T3-L1 preadipocytes were induced by hypoletin at day 0. Eight days after the induction, the cells were photographed at a magnification of 100×. (**a**) Control (DMSO), (**b**) MDI (before stained with Oil Red O), (**c**) MDI (after stained), (**d**) 10 μg/mL hypoletin, (**e**) 20 μg/mL hypoletin, (**f**) 50 μg/mL hypoletin. *Red* areas in the figures show the formation of lipid droplets

After 8 days, morphological changes and decreased lipid accumulation were observed in these cells (Fig. 71.3). Cells were stained with Oil Red O and the rate of lipid accumulation was quantified [4]. Hypoletin stimulated the adipogenesis process at low concentration and inhibited lipid accumulation in the cytoplasm of treated cells with increased concentration (Fig. 71.4). As shown by the Oil red O staining, hypoletin treatment reduced intracellular fat accumulation by up to 79.7 % relative to MDI-treated control cells at a dose of 50 μg/mL. In addition, lipid accumulation in the cell also reduced from 2.33 and 1.79-fold at concentrations of 10 and 20 μg/mL to 1.52-fold compared to DMSO control.

Effect of Hypoletin on Glucose Uptake in Differentiated 3T3-L1 Adipocytes

To determine 2-DG uptake in 3T3-L1 adipocytes, >90 % of differentiated 3T3-L1 adipocytes were treated with hypoletin at the indicated concentrations for 60 min, and then glucose uptake was assessed. The results indicate that hypoletin stimulated glucose uptake in 3T3-L1adipocytes. In addition, hypoletin effects at a dose of 20 μg/mL were significantly comparable to MDI and metformin action. In parallel, this was an interesting finding since this compound reduced lipid formation with increased concentration but can improve glucose uptake in the adipocytes. Taken together, this shows that hypoletin could possess antidiabetic and anti-obesity effects by enhancing the blood glucose uptake and inhibit the adipogenesis process (Fig. 71.5).
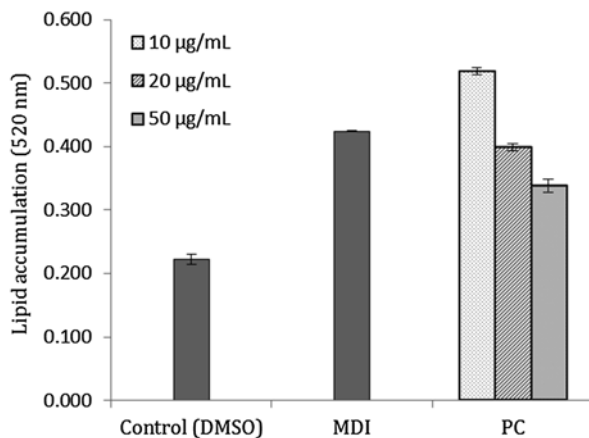
Fig. 71.4 Effects of hypoletin (PC) on adipocyte differentiation of 3T3-L1 preadipocytes. Preadipocytes were induced with insulin in the presence of dexamethasone (DEX) and 3-isobutyl-1-methylxanthine (IBMX) at day 0 with the indicated concentrations of hypoletin. At day 8, the cells were fixed and stained with diluted Oil Red O. The Oil Red O-stained adipocytes were photographed at a magnification of 200×. Next, the Oil Red O was eluted and quantified at 520 nm. All values are presented as means ± SD of three independent experiments
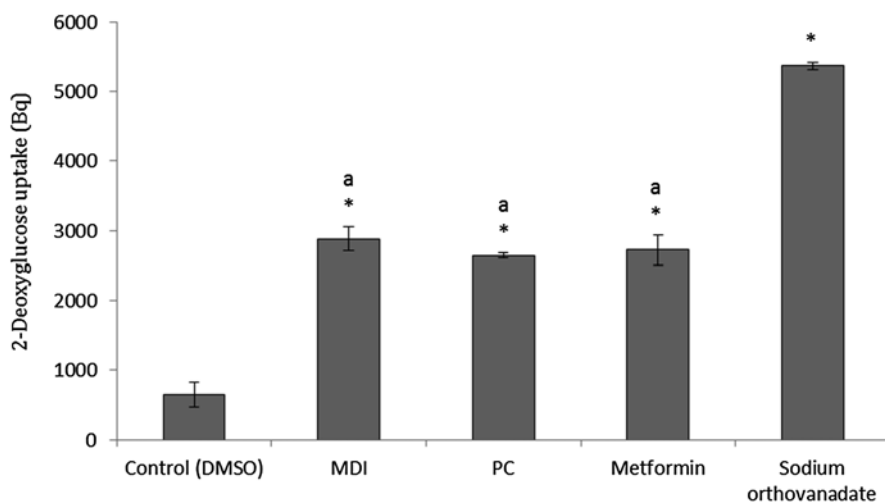
Fig. 71.5 The effect of hypoletin (PC) on glucose uptake in 3T3-L1 adipocytes. Adipocytes in 12-well plates were incubated for 60 min with hypoletin (20 µg/mL) or with MDI, metformin (1 mM) and sodium orthovanadate (5 mM) as a positive control, or with DMSO as a negative control, then assayed for 2-deoxy-D-[^{3}H] glucose uptake. Levels of radioactivity in the cell lysates were determined using a liquid scintillation counter. Data are means ± SD, ($n=3$). *$p<0.05$ vs. untreated group (control), $a=$ significant at the indicated concentration

Discussion

Since ancient times, diabetes has been effectively cured with medicinal plants. A number of experimental and clinical studies have shown the efficacy of various herbs in lowering blood glucose in diabetes. These herbal preparations exhibit their beneficial effects by different mechanisms which may or may not affect insulin release [19]. Currently, different kinds of synthetic drugs, namely, biguanides, diphenylalanine derivatives, glucosidase inhibitors, meglitinides, sulphonylureas and thiazolidinediones in addition to insulin, are extensively used in the management of diabetes all across the world. However, due to various side effects, the efficacies of these drugs are quite controversial, and there is a strong demand for new but safe drugs for the effective treatment of diabetes [44]. Plants have emerged as a rich source of potentially useful antidiabetic drugs. However, only a few have been subjected to detailed scientific exploration due to a lack of mechanism-based available in vitro assays [6, 13, 27].

A number of experiments have shown the beneficial effects of medicinal plants in the management of diabetes mellitus. Many mechanisms of actions have been proposed for these plant extracts. Some reports have linked their effects to the activity of pancreatic cells (synthesis, release, cell regeneration/revitalization) [50] or the increase in the inhibitory effect against insulinase and the increase of the insulin sensitivity or the insulin-like activity of the plant extracts [3, 30]. Others have suggested that the mechanisms may involve improved glucose homeostasis [2], increase of peripheral utilization of glucose, increase of synthesis of hepatic glycogen [51] and/or decrease of glycogenolysis acting on the enzyme [9] inhibition of intestinal glucose absorption [37], reduction of glycemic index of carbohydrates [12] and reduction of the effect of glutathione [40].

Adipocyte differentiation is a crucial process to maintain the normal function of adipocytes [42]. Many lipid droplets were observed in mature 3T3-L1 cells stimulated by the inducers [16]. The formations of lipid droplets serve as the marker for the adipocyte differentiation process. In this study, we found that hypoletin isolated from the leaves of *T. scandens* exhibited dose-dependent adipocyte differentiation in 3T3-L1 cells. In the absence of inducer cocktail (MDI), hypoletin was still able to differentiate adipocyte formation in 3T3-L1. Hence, it is suggested that there is an insulin-mimicking activity of the hypoletin on adipocytes. Accordingly, stimulation of glucose uptake is another insulin-mimicking activity of the extract. In contrast, the hypoletin reduced the adipocyte differentiation process. Since the inhibition of adipocyte differentiation has been suggested as an important approach for the treatment and prevention of obesity [42], we propose that hypoletin can also be used for the management of diabetes-obesity-related diseases. Besides, glucose uptake in insulin-responsive tissues such as the skeletal muscle and adipose tissue is essential for the maintenance of whole-body glucose homeostasis [7]. Enhanced glucose transport and utilization can lower the blood glucose both in animals and humans. Metformin and sodium orthovanadate are two antidiabetic drugs known to increase

cellular glucose utilization, on leptin secretion, glucose uptake, and lactate production in isolated cultured rat adipocytes [32] were used as the positive controls. Our results showed that hypoletin could significantly stimulate glucose uptake ($P < 0.05$) compared to DMSO control cells. Furthermore, the treated adipocytes also showed a significant result with metformin and MDI-treated cells.

The phytochemical screening revealed the presence of flavonoids and sterols which play a major role in controlling free radicals and diabetes [23, 46, 49]. Oxidative stress is one of the pathophysiological mechanisms that develops diabetes and leads to its complications. Chronic excess of glucose causes toxic effects on the structure and impairment of organ function due to free radical generation [25]. Moreover, flavonoids are known to regenerate the damaged β-cells in the alloxan-induced diabetic rats and are considered effective antihyperglycaemic agents [17]. Flavonoids, especially quercetin, have been reported to possess antidiabetic activity. It is reported that quercetin brings about the regeneration of pancreatic islets and probably increases insulin release in streptozotocin-induced diabetic rats [47]. Also in another study, it has been reported that quercetin stimulates insulin release and enhances Ca^{2+} uptake from isolated islet cells which suggest a place for flavonoids in non-insulin-dependent diabetes [18]. Many new bioactive principles isolated from plants having antihyperglycaemic effects have shown antidiabetic activity equal and even more potent than the known oral hypoglycaemic agents such as daonil, tolbutamide and chlorpropamide. However, many other active agents obtained from plants have not been well characterized and documented. More investigations are still sought to evaluate the precise mechanism of action of hypoletin with antidiabetic effect at the molecular level [6].

Conclusion

All six flavonoids along with three terpenoidal compounds isolated from the MEOH extract of leaves of *T. scandens* in this study are reported for the first time from this plant. Kaempferol-3-*O*-(6″-*O*-*p*-trans-coumaroyl) glucoside, a rare compound, has been isolated for the first time from family Dilleniaceae. Hypoletin (3′,4′,5,7,8-pentahydroxyflavone) was checked for its in vitro antidiabetic potential and found to improve glucose uptake in the adipocytes which mimics insulin action. It might possess antidiabetic and anti-obesity effects by enhancing the blood glucose uptake and inhibiting the adipogenesis process and therefore could provide lead for the synthesis of a safe antidiabetic drug. The active compound, hypoletin, from the leaves of *T. scandens* should be explored further for its use in the efficacious management of diabetes.

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Chapter 72
Bioactive Terpenoids from the Stem Bark of *Entada spiralis* Ridl. (Sintok)

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Introduction

The search of new natural therapeutic agents from plant source is now gaining popularity due to the increasing development of the resistant pattern of a microorganism to most currently used antimicrobial drugs [1]. The scientific investigation of the secondary metabolites such as saponin, terpenoids and sterol would be one of the alternatives to tackle the problems.

The antimicrobial active constituents from *E. spiralis* stem bark have not yet been investigated chemically and pharmacologically to date, although they are useful in the traditional practice for treating scalp and bloody defecation and as body soap. Triterpenoid saponins such as oleanolic acid, echinocystic acid, entagenic acid and acacic acid glycosides were previously investigated in other *Entada* species [2–4]. The echinocystic acid and acacic acid that have been isolated from *E. africana* were reported to exhibit moderate to high cytotoxic potency [5]. The phytochemical studies of *E. rheedii* revealed the presence of saponins [3–6], thioamides [7–9] and phenylacetic derivatives [10, 11]. Currently, entagenic acid isolated from the seed kernels of *E. rheedii* exhibited moderate cytotoxic potency and antioxidant properties [12]. In this work, we embarked upon the isolation and structure identification of two antimicrobial bioactive compounds from *E. spiralis* stem bark together with their antimicrobial profile.

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Materials and Methods

General Experimental Procedures

The ^{1}H NMR and ^{13}C NMR spectra were recorded in CDCl$_3$, FT-NMR 600 MHz Cryoprobe, Bruker Avance 111 600 MHz. All chemical shifts (δ) are given in ppm units with reference to tetramethylsilane (TMS) as internal standard and the coupling constant (*J*) are in Hz. APCIMS and ESIMS were recorded on a Bruker micrOTOF-Q 86 mass spectrometer operating in positive mode. Vacuum liquid chromatography (VLC) was performed using silica gel 60 (230–400 mesh, Merck). The isolation process was carried out by circular chromatography. Thin-layer chromatography (TLC) was carried out on Kieselgel 60 F$_{254}$ (Merck) aluminium support plates developed using chloroform-methanol system. TLC plates were visualized using UV$_{366}$ and UV$_{254}$.

Bioautographic Profile of the Antimicrobial Active Compounds

An agar overlay bioautographic assay was set up for the detection of bioactive compounds of *E. spiralis* stem bark. The thin-layer chromatogram (TLC) was overlaid with inoculated agar, which was previously measured and adjusted to final concentration of approximately 1.5×10^6 cell/ml (bacteria) and 0.5–2.5×10^3 cell/ml (fungi). The TLC bioautogram was incubated overnight at 37 °C (for bacteria) and at room temperature for 2–5 days (for fungi). The active compounds appeared as clear zones against a pink background of living microorganisms after spraying with a solution of 0.5 % (V/V) of iodonitrotetrazolium (INT) salt in sterile water or as clear inhibition zone against growing fungi.

Results

The isolation of the antimicrobial bioactive compounds that was conducted by subjecting to circular chromatography and followed by solid-phase extraction (SPE) afforded two terpenoid compounds: ester saponin (**1**) (Fig. 72.1) and terpenoid benzoate (**2**) (Fig. 72.2). Their structures were identified by 1D and 2D NMR data (^{1}H, ^{13}C NMR, DEPT, COSY, HSQC and HMBC) and mass spectra and compared with those reported in the literature [12–17]. The compound (**1**) was identified as 16-*β-D*-arabinofuranosyl-15-*β-D*-xylopyranosyl-5,8,9,10-tetrahydroxyl-17,18,19, 20-tetramethyl diterpene ester and (**2**) as 4-(*β-D*-glucopyranosyl)-1-hydroxybenzene-(20-hydroxyl-18,19-dimethylcyclotetradecanol) benzoate. Tables 72.1 and 72.2 showed part of NMR data of (**1**) and (**2**). The comparison of NMR data of (**1**) and (**2**) with other species of Leguminosae was shown in Table 72.3.

Regarding to the molecular structure and function, it had been reported that the ability of compound to inhibit microbial growth could depend on the hydroxyl

Fig. 72.1 The structure of compound (*1*) of *E. spiralis* stem bark
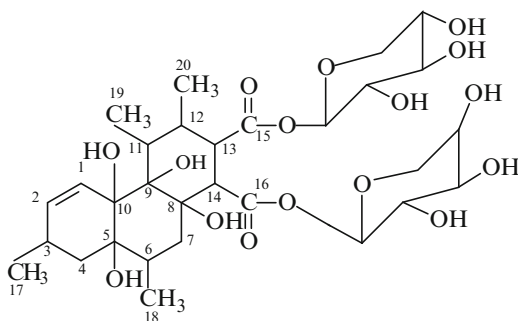
Fig. 72.2 The structure compound (*2*) of *E. spiralis* stem bark
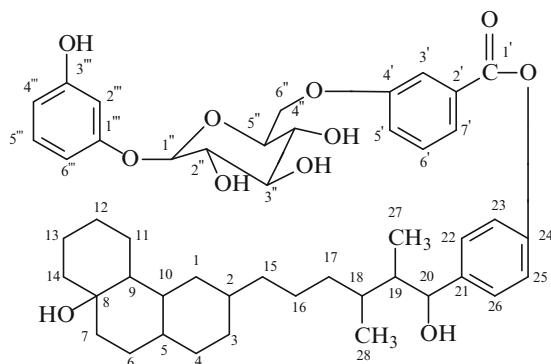
Table 72.1 ^{1}H NMR (600 MHz) and ^{13}C NMR (600 MHz) data of compound (**1**) in CDCl$_3$

Position	DEPT	^{13}C (δ)	^{1}H δ, mult,J (in Hz)
1	CH	124.56	5.97, d
2	CH	143.81	–
3	CH	22.71	1.28, m
4	CH$_2$	28.79	2.2, m
5	C(OH)	83.13	–
6	CH	28.15	1.29, m
7	CH$_2$	31.20	2.95, m
8	C(OH)	96.13	–
9	C(OH)	96.14	–
10	C(OH)	83.48	–
11	CH	27.12	1.28, m
12	CH	29.38	1.28, m
13	CH	31.94	1.29, m
14	CH	29.71	1.28, m
15	C	174.76	–
16	C	175.75	–
17	CH$_3$	14.14	0.82, m
18	CH$_3$	23.06	0.89, m
19	CH$_3$	21.03	0.82, m
20	CH$_3$	17.37	0.88, m

Table 72.2 ^{1}H NMR (600 MHz) and ^{13}C NMR (600 MHz) data of compound (**2**) in acetone

Position	DEPT	^{13}C (δ)	^{1}H δ, mult (Hz)
1	CH$_2$	29.20	1.29, m
2	CH	30.30	1.36, m
3	CH$_2$	28.69	1.61, m
4	CH$_2$	28.65	1.34, m
5	CH	29.16	1.32, m
6	CH$_2$	28.56	1.26, m
7	CH$_2$	29.33	1.33, m
8	C(OH)	78.29	–
9	CH	29.07	1.27, m
10	CH	31.72	1.46, m
11	CH$_2$	28.52	1.26, m
12	CH$_2$	29.29	1.32, m
13	CH$_2$	29.03	1.30, m
14	CH$_2$	28.94	1.31, m
15	CH$_2$	38.80	1.70, m
16	CH$_2$	28.78	1.27, m
17	CH$_2$	28.91	1.31, m
18	CH	28.82	1.59, m
19	CH	29.41	1.33, m
20	CH(OH)	67.46	4.17, d (1.2)
21	C	132.59	–
22,26	CH	131.10	7.61, dd (3.0,3.6)
23,25	CH	128.73	7.72, dd (3.0,3.6)
24	C	131.15	–
27	CH$_3$	23.63	1.35, m
28	CH$_3$	24.77	1.47, m

Table 72.3 Comparison of H-NMR and C-13 NMR data of (**1**) and (**2**) with other species

Other species from Leguminosae			
(**1**)			
δ ^{13}C (ppm)	δ_H (ppm)	δ ^{13}C (ppm), δ_H (ppm)	References
103.67 (Ara)		103.60 (*E. africana*)	[5]
107.85 (Xyl)		107.50 (*E. africana*)	[5]
	5.97	5.65 (*Albizia coriaria*)	[13]
	2.20	2.28 (*E. rheedii*)	[12]
(**2**)			
67.46		67.8 (*Cassia spectabilis*)	[18]
128.78		127.6 (*E. phaseoloides*)	[19]
131.10		132.1 (*E. phaseoloides*)	[19]
	4.40 (Glc)	4.4 (Glc)	[20]

substituents [21]. Therefore, this particular reason may explain the inhibitory effect of (**1**) and (**2**) since both compounds carry hydroxyl groups. To the best of our knowledge, this is first reported on the isolation of new bioactive compounds (**1**) and (**2**) from the *E. spiralis* stem bark.

The mass spectra data (APCI) showed the molecular ion peak signal at *m/z* 663.4494 which corresponds to its molecular weight of $C_{30}H_{46}O_{16}$ [M + H]$^+$. The ion peak at *m/z* 397.3782 [(M + H)−266]$^+$ that was observed after consecutive loss of arabinose and xylose molecules corresponds to the molecular weight of the aglycone. The ion peak at *m/z* 255.2093 refers to the fragmentation process in aglycone.

The positive ion mode ESIMS of this compound showed [M + H]$^+$ ion peak at *m/z* 803.5314 in accordance with the molecular formula of $C_{47}H_{62}O_{11}$. Further fragment ion peaks were observed at *m/z* 691. 4088 [(M + H)−112], 531.3464 [(M + H)−112−160], 481.3456 [(M + H)−112−160−44] and 413.2590 [(M + H)−112−160−44−74] corresponding, respectively, to the successive loss of one hydroxybenzene, one glucose, one carbonyl group and one phenyl group. The fragment ion at *m/z* at 413.2590 corresponds to the molecular ion of the aglycone with a molecular formula $C_{28}H_{44}O_2$. The fragment ion at *m/z* 301.1355, 225.1087 and 139.0708 refers to the fragmentation in the aglycone molecule.

The TLC bioautograms in Fig. 72.3 revealed the antimicrobial active constituents that are responsible in inhibiting the microbial growth.
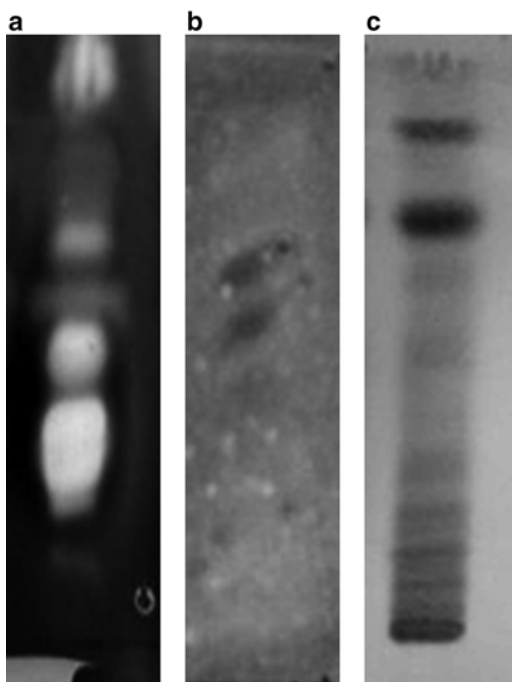
Fig. 72.3 (**a**) TLC bioautogram against *S. epidermidis*; (**b**) TLC bioautogram against *T. mentagrophytes*; (**c**) TLC chromatogram of terpenoid compounds after spraying with vanillin reagent

TLC chromatogram in Fig. 72.3c illustrated the terpenoid compounds of *E. spiralis* stem bark regarding the appearance of purple, grey and pink spots. These compounds are responsible for the inhibitory effect (the clear zone) against *S. epidermis* (TLC A) and *T. Mentagrophytes* in (TLC B) which can cause dermatophytosis such tinea or ringworm.

Up until now, the cases of tinea due to *Trichophyton* sp. have been increased considerably especially in children. The infection can be observed as skin lesion, favus of the scalp, the hairless skin and the nail. The incidence of tinea incognito (TI) appears to have increased over recent years, although no large series of cases has been reported in children, and the most frequently isolated dermatophyte was *Trichophyton mentagrophytes* [22]. Therefore, the finding highlights the importance of *E. spiralis* stem bark as a potent natural drug.

Conclusion

The antimicrobially active terpenoid compounds in the presence of hydroxyl groups of *E. spiralis* stem bark are successfully isolated and identified. The compounds are found to be a promising natural drug for the treatment of skin infections associated with the studied microorganisms.

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Chapter 73
Effect of Hydrogen Peroxide Treatment of Rubber Leaf Powder in Removing Pb(II) Ions

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Introduction

Heavy metal pollution and solid waste disposal are two major problems faced by the environment nowadays. The common industries which contributed to the Pb(II) pollution in wastewater are paint, chemical, batteries, and fertilizer [1, 2]. Pb(II) is harmful to the aquatic organism and human health. Adsorption method by plant leaf adsorbent can be an alternative to conventional methods to overcome the problem such as sludge disposal problem and chemical consumption since the adsorbents reported by researchers have high adsorption capacity and less amount of dosage used and method used are simple [3–5].

The primary alcohol groups on the adsorbent surface can be oxidized to carboxylic acid groups (active groups) for Pb(II) adsorption [3]. The increase in the amount of carboxylic acid groups on the adsorbent surface could increase the amount of metal ions adsorbed on the adsorbent surface. Hydrogen peroxide and potassium permanganate are commonly used as oxidizing agents. According to Nada et al. [6], hydrogen peroxide is used to remove adhering organic matter on the adsorbent and

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reduce the leaching of soluble organic compound from plant wastes. This study investigated the effect of hydrogen peroxide treatment on rubber leaf powder in removing Pb(II) ions. The effects of various physicochemical parameters on adsorption efficiency of Pb(II) particularly pH, dosage, shaking rate, initial Pb(II) concentration, contact time, and temperature were studied. Desorption study was conducted using various concentrations of HCl and EDTA.

Methods

Chemicals and Adsorbent Treatment

Pb(II) solutions at different concentrations were prepared by dilution with deionized water from 1,000 mg/L $Pb(NO_3)_2$ standard solution purchased from Merck, Germany. All other chemicals used in this study were of analytical reagent grade. Untreated rubber leaf (URL) powder was collected from Universiti Teknologi Mara Pahang rubber plantation in Jengka, Malaysia. The rubber leaves were washed with water to remove dirt and particles and then dried in an oven at 105 °C for 24 h. To obtain particle size of <180 μm, dried rubber leaf was ground by using a mechanical grinder. Oxidation of rubber leaf powder was conducted according to our previous paper [7]. Fifteen grams of URL and 500 mL (2 %; w/v) H_2O_2 solution were mixed in a beaker and stirred for 2 h by using magnetic stirrer at room temperature (30±0.5 °C). The treated adsorbent was filtered and washed extensively with deionized water. The adsorbent was dried overnight in an oven at 80 °C. The dried adsorbent was kept in plastic containers and hydrogen peroxide-treated rubber leaf powder was designated as HPRL.

Batch Pb(II) Adsorption Experiment

All batch Pb(II) adsorption experiments were duplicated and the results were taken as average. Pb(II) adsorption was fixed using 50 mL Pb(II) solutions and known weight of HPRL adsorbent. The mixture was shaken at 120 stroke/min using thermostated water bath shaker in a 100 mL conical flask for 90 min at room temperature (30.0±0.5 °C) (unless stated otherwise). The effect of pH was studied in pH range 2–5. The initial pH was adjusted by adding drops of 1.0 M NaOH or HCl solutions. The effect of adsorbent dosage was performed in the range 0.01–0.10 g. The shaking rate was varied from 30 to 150 stroke/min to investigate the effect of shaking rate. The kinetic study was carried out using three different concentrations of Pb(II) solutions (20, 40, and 80 mg/L) at various contact time (0–120 min). The isotherm study was conducted using

a weight of 0.02 g HPRL and mixed with 50 mL of Pb(II) solution at different concentrations (10–200 mg/L) and temperatures (30, 40, and 50 °C). The mixture was shaken for 120 min to ensure the equilibrium time was achieved. Desorption study was carried out using HCl and EDTA as desorbing solutions and deionized water as control. After loading with 50 mL (40 mg/L) of Pb(II) solution, the metal-laden adsorbent was filtered and dried in an oven at 80 ºC for 60 min. Dried metal-laden adsorbent was added into 50 mL of different concentrations of HCl or EDTA (0.001–0.10 M). After adsorption, the mixture was filtered on Whatman filter paper No. 42, and the filtrates containing Pb(II) ion were analyzed using atomic absorption spectrophotometer (AAS) (Perkin Elmer, AAnalyst 800 model, USA). After analysis, the amount of Pb(II) adsorbed, q_e (mg/g), and percentage removal were calculated by using Eqs. 73.1 and 73.2, respectively:

$$q_e = \frac{C_o - C_e}{m} V. \tag{73.1}$$

$$\text{Removal}(\%) = \frac{C_o - C_e}{C_o} \times 100. \tag{73.2}$$

where C_o and C_e are Pb(II) concentrations before and after adsorption (mg/L), respectively, V is the volume of Pb(II) solution (L), and m is the weight of HPRL (g). The desorption percentage (D_p) of Pb(II) concentrations was determined by using Eq. 73.3:

$$D_p = \frac{C_{(des)}}{C_{(ads)}} \times 100. \tag{73.3}$$

where, $C_{(des)}$ (mg/L) and $C_{(ads)}$ (mg/L) are Pb(II) concentration desorbed and adsorbed from HPRL, respectively.

Results and Discussions

Effect of pH

Solution pH can affect the chemical speciation of Pb(II) ions and surface binding sites of the adsorbent. Therefore, the initial pH of metal solution should be optimized to avoid the precipitation of Pb(OH)$_2$. Wang et al. [8] reported that at pH below than 5, lead ions are in the form of free Pb(II). Therefore, the experiments were done at pH range 2–5. In general, the amount of Pb(II) adsorbed increased

with increasing pH values. The lowest amount of Pb(II) ions adsorbed occurred at pH 2 (1.5 mg/g) and the highest at pH 5 (40.2 mg/g). At pH 3–4, the amount of Pb(II) adsorbed increased sharply from 11.6 to 31.5 mg/g, respectively. The difference in the amount of Pb(II) adsorbed at lower and higher pH can be explained by the repulsive forces between Pb^{2+} and H_3O^+ ions. The amount of Pb(II) adsorbed was reduced at lower pH due to the stronger repulsive forces between Pb^{2+} and H_3O^+ ions. Therefore, the amount of Pb(II) was reduced. Beyond pH 4, there was no significant increase in the amount of Pb(II) adsorbed. Based on this finding, pH 4 was considered as the optimum pH for subsequent Pb(II) adsorption experiments.

Effect of Adsorbent Dosage

The effect of adsorbent dosage on Pb(II) adsorption showed that the amount of Pb(II) adsorbed decreased with increasing adsorbent dosage. The amount of Pb(II) adsorbed decreased from 38.2 to 18.9 mg/g by increasing the adsorbent dosage from 0.01 to 0.10 g. However, the percentage removal (%) increased with increasing adsorbent dosage (figure not shown). The lowest percentage of Pb(II) removal (19.1 %) was recorded at 0.01 g, while the highest Pb(II) removal (94.6 %) was recorded at 0.10 g. At a higher dosage, the surface area was increased, which also increased the number of adsorption sites. Therefore, more Pb(II) ions could be adsorbed on the adsorption sites. Conversely, as the dosage increased while the Pb(II) concentration was fixed, the ratio of adsorption sites to the number of Pb(II) also increased (high adsorbent/ adsorbate ratio). This caused the ineffectiveness of the utilization of adsorption sites and hence, reduced the amount of Pb(II) adsorbed at higher dosage [9].

Effect of Shaking Rate

The effect of shaking rate on adsorption study is related to the distribution of the solute in the bulk solution and the formation of the external boundary film [10]. In general, the amount of Pb(II) adsorbed on the adsorbent surface of HPRL increased as the shaking rate increased. The lowest amount of Pb(II) adsorbed occurred at the lowest shaking rate (30 stroke/min) with the value of 9.61 mg/g and the highest amount at the rate of 150 stroke/min (22.87 mg/g). This adsorption characteristic can be explained due to the decrease of mass transfer resistance between the adsorbate and adsorbent surface in terms of external film diffusion [9]. Therefore, it would favor higher adsorption rate and increase the concentrations of Pb(II) ions from the solution to adsorb at the surface of the adsorbents. However, beyond 120 stroke/min, there was no significant difference in the amount of Pb(II) adsorbed for HPRL. Hence, shaking rate of 120 stroke/min was selected for subsequent experiments.

Fig. 73.1 Effect of initial Pb(II) concentration and contact time of Pb(II) adsorption by HPRL (adsorbent weight, 0.02 g; pH, 4; volume, 50 mL; shaking speed, 120 stroke/min)
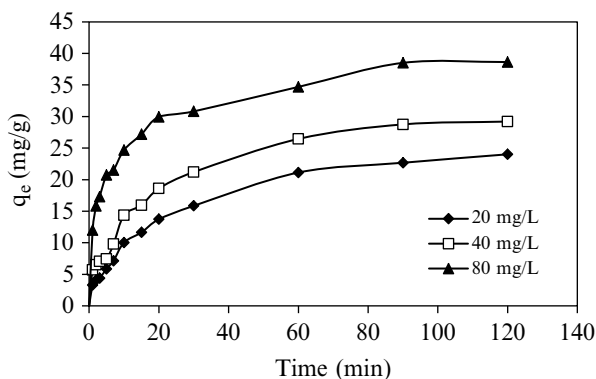
Effect of Initial Pb(II) Concentration and Contact Time

This parameter is important to determine the time required for the transport of the adsorbate to the binding sites at different concentrations. In general, the amount of Pb(II) adsorbed increased with increasing initial Pb(II) concentration and contact time. At low concentration, the time taken to reach equilibrium was fastest than higher concentration of Pb(II) (Fig. 73.1). This was due to less competition among heavy metal ions for binding sites [11]. At higher concentration of Pb(II), the driving forces to transport adsorbate to the adsorbent surface and collision between and adsorbate surface increases thus increased the amount of Pb(II) adsorbed. The amount of Pb(II) adsorbed increased from 24.0 to 38.63 mg/g as the Pb(II) concentration was increased from 20 to 80 mg/L, respectively.

Adsorption Kinetic

Adsorption kinetic was studied using two kinetic models of pseudo-first-order model and pseudo-second-order model. The pseudo-first-order kinetic model can be described as the diffusion control process assuming a non-dissociation molecular adsorption of Pb(II) on XRL surface. Pseudo-second-order kinetic model is based on the assumption that the rate-determining step is due to chemisorptions [12]. The pseudo-first-order kinetic equation is given by

$$\log\left(q_e - q_t\right) = \log q_e - \frac{k_1}{2.303} t \qquad (73.4)$$

where q_t and q_e are the amount of Pb(II) adsorbed (mg/g) at time t (min) and at equilibrium, respectively; k_1 is the rate constant (min^{-1}) of the pseudo-first-order adsorption process. A straight-line plot of log (q_e–q_t) against t (plot not shown) was

Table 73.1 The pseudo-first-order and pseudo-second-order parameters at different concentrations of Pb(II)

[Pb]	$q_{e,\exp}$	Pseudo first order $q_{e,\text{cal}}$	Pseudo second order k_1		h	k_2	$q_{e,\text{cal}}$	
(mg/L)	(mg/g)	(mg/g)	(min^{-1})	R^2	(mg/(g.min))	(mg/(min.g))	(mg/g)	R^2
20	24.03	21.58	3.68×10^{-2}	0.990	1.90	2.75×10^{-3}	26.32	0.979
40	29.20	25.47	4.15×10^{-2}	0.973	2.96	2.84×10^{-3}	32.26	0.985
80	38.63	30.69	3.92×10^{-2}	0.966	8.40	5.25×10^{-3}	40.00	0.995

used to determine the rate constant k_1 and correlation coefficient (R^2). The values of the constants and correlation coefficients are presented in Table 73.1. It can be noticed that even though the correlation coefficients for the pseudo-first-order model are high, the calculated amounts of adsorption ($q_{e,\text{cal}}$) deviate from the experimental values ($q_{e,\exp}$). This would suggest that pseudo-first-order model is not suitable to represent Pb(II) adsorption on HPRL.

The pseudo-second-order kinetic equation is given by

$$\frac{t}{q_t} = \frac{1}{h} + \frac{1}{q_e} t \tag{73.5}$$

where $h = k_2 q_e^2$ can be regarded as the initial adsorption rate as $t \rightarrow 0$ and k_2 is the rate constant of pseudo-second-order adsorption (g/(mg.min)). The plot of t/q_t versus t should give a straight line if pseudo-second-order kinetic model is applicable and q_e, k_2, and h can be determined from the slope and intercept of the slope, respectively (plot not shown). From Table 73.1, a very high correlation coefficient ($R^2 > 0.99$) was obtained for all Pb(II) concentrations. The calculated amounts of adsorption ($q_{e,\text{cal}}$) and the experimental values ($q_{e,\exp}$) were close to each other. This would suggest that the pseudo-second-order model fitted well with the adsorption data, and chemisorption could be the rate-determining step.

Adsorption Isotherm

Three isotherm models applied were Langmuir, Freundlich, and Dubinin-Radushkevich isotherm model. Langmuir model was developed based on the assumptions that monolayer adsorption capacity occurs on the adsorption sites [4]. In contrast, Freundlich model assumes neither homogenous site energies nor limited levels of sorption, characteristic of heterogeneous surfaces [4]. The Dubinin-Radushkevich model is useful to determine whether the Pb(II) adsorption mechanism undergoes physical or chemical adsorption which cannot be determined by Langmuir and Freundlich model. The Langmuir [13] equation can be written as

Fig. 73.2 Adsorption isotherm plot. Inset: linearized Langmuir plot (adsorbent weight, 0.02 g; pH, 4; volume, 50 mL; shaking speed, 120 stroke/min; initial Pb(II) concentration, 10–200 mg/L; temperature, 303 K; equilibrium time, 120 min)
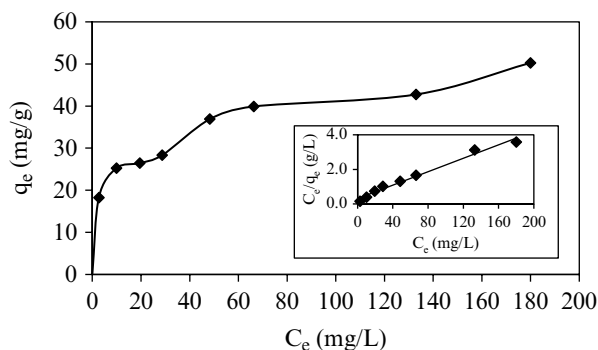
Table 73.2 Langmuir, Freundlich, and Dubinin-Radushkevich isotherm constants and correlation coefficients for HPRL

Temperature (K)	$q_{e,exp}$ (mg/g)	Langmuir			Freundlich			Dubinin-Radushkevich		
		q_{max} (mg/g)	b (L/mg)	R^2	K_F (mg/g)	n	R^2	q_m (mg/g)	E (kJ/mol)	R^2
303	50.3	52.6	0.1	0.983	14.1	4.2	0.967	58.7	22.4	0.967
313	41.0	41.7	0.2	0.999	18.7	6.2	0.970	66.5	22.4	0.992
323	26.8	30.3	0.3	0.973	21.4	9.6	0.585	61.3	22.4	0.955

$$\frac{C_e}{q_e} = \frac{1}{q_{max}b} + \frac{C_e}{q_{max}} \tag{73.6}$$

where q_{max} is the maximum adsorption capacity (mg/g) and b is a constant (L/mg) related to energy of adsorption which quantitatively reflects the affinity between the adsorbent and adsorbate. The Langmuir plot of Pb(II) ions at temperature of 303 K is shown in Fig. 73.2, and the summary of the Langmuir constants (b), maximum adsorption capacity, and correlation coefficients is given in Table 73.2. In general, the isotherm plot showed that the adsorption capacities increased with increasing initial Pb(II) concentrations. The shape of the isotherm plot obtained is "L"-type isotherm according to the Giles classification system [14], an indication of chemical adsorption, which reflected a relatively high affinity or strong interaction between the adsorbate and the adsorbent. The maximum adsorption capacity (q_{max}) of Pb(II) by HPRL was 52.6 mg/g. The Langmuir plots for HPRL have a high correlation coefficient (R^2) value and are very close to unity at all temperatures. Besides that, the experimental adsorption isotherm capacity ($q_{e,exp}$) values are close to the calculated model, suggesting that the adsorption isotherm followed well Langmuir model. The decreases in the maximum adsorption capacity from 52.6 to 30.3 mg/g (Table 73.2) as the temperature was increased from 303 to 323 K suggested exothermic adsorption process by HPRL.

The Freundlich model [15] can be written as

$$\log q_e = \log K_F + \frac{1}{n}\log C_e \tag{73.7}$$

Table 73.3 Desorption of
Pb(II) by HCl and EDTA as
desorbing solutions at various
concentrations

Concentration	Desorption (%)	
(M)	HCl	EDTA
0.001	76.51	37.62
0.010	80.73	53.07
0.050	95.99	65.34
0.100	96.47	85.04

where K_F represents adsorption capacity (mg/g) and n is a constant related to adsorption intensity. If the value of n is greater than unity, it is an indication of a favorable adsorption. The maximum adsorption capacity (K_F), n and correlation coefficient (plot not shown) of Pb(II) are given in Table 73.3. The K_F (mg/g) value is much lower than the experimental adsorption capacity, and low value of R^2 indicated that adsorption of Pb(II) by XRL and HPRL did not fit well with Freundlich model.

The linear form of Dubinin-Radushkevich (D-R) isotherm equation [16] is given by Eq. 73.8:

$$\ln q_e = \ln q_m - K \varepsilon^2 \qquad (73.8)$$

where ε (Polanyi potential) is equal to RT $\ln(1 + 1/C_e)$, R is the gas constant (8.314 J/(mol.K)), T is the temperature (K), q_m is the adsorption capacity based on D-R model (mg/g), and K is related to mean adsorption energy (E) in kJ/mol as given by Eq. 73.9:

$$E = \frac{1}{\sqrt{2K}} \qquad (73.9)$$

According to Erdem et al. [17], the physical adsorption involves if the E value lies between 1 and 8 kJ/mol, while for the chemical adsorption, the E value should be greater than 16 kJ/mol. If the E value is between 8 and 16 kJ/mol, ion exchange will be the most likely adsorption mechanism involved. The D-R constant and correlation coefficient (R^2) values by HPRL are presented in Table 73.2. For HPRL, the E value of 22.4 kJ/mol was recorded at all temperatures. This value indicates that the chemical adsorption might be one of the mechanisms involved in Pb(II) adsorption.

Desorption Study

This study can be used to elucidate Pb(II) adsorption behavior onto HPRL. In general, as the concentration of desorbing solutions (HCl and EDTA) increased, the desorption percentage also increased (Table 73.3). From Table 73.3, the desorption percentage recorded by HCl as desorbing is higher than EDTA solution. According to HSAB classification system [18], Pb(II) was classified as "borderline" metal ion. It can form ionic complexes with hard base groups like -COO⁻, -NH₂, and -C-O⁻.

Proton (H^+) is a hard acid and can displace the Pb(II) ions that are attached to hard base groups. This explains the ability of protons to desorb Pb(II) through acid washing. Washing with deionized water, however, did not exhibit any recovery of Pb(II).

Conclusions

The amount of Pb(II) adsorbed was influenced by pH, dosage, shaking time, initial Pb(II) concentration, contact time, and temperature. Adsorption kinetic followed pseudo-second-order model, suggesting chemical adsorption as the rate-determining step. The isotherm study indicates monolayer adsorption of Pb(II) on HPRL surface. HPRL was desorbed well in HCl solution, suggesting that ion exchange is one of the possible mechanisms involved in adsorption study. Another possible mechanisms involved in the Pb(II) adsorption onto HPRL surface include chemical adsorption as supported by E value calculated from Dubinin-Radushkevich model and isotherm study.

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Chapter 74

DNA Fingerprinting of Parent Stocks and the Progenies Produced Under Different Salinity Acclimation of *Chlorella* sp.

M.Z. Mohd Syahril, O. Roshani, and W.W.A.A. Siti Nur Aminah

Introduction

Microalgae biomass is a valuable source for a wide range of fine chemicals and other biologically active compound and potential health benefits [1]. For culturing purposes, it is important to know the level of genetic biodiversity among the culturing populations as well as the level of heterozygosity of each progeny. The level of genetic diversity of this species is required for purposes of management, quality control, conservation, and mass alga production. *Chlorella* sp. mainly reproduces by autospores [2] at a very fast rate and renew into four new cells every 17–24 h. It is everywhere in nature and has been isolated in diverse aquatic and aerial habitats. Many genera of this type are highly adaptable to grow under minor conditions. According to [3], the identification of *Chlorella* species was difficult because its morphology and physiology characteristic normally changed with environmental conditions. The objective of this study is to determine genetic variation between parent stock and progenies produced by *Chlorella* sp. and also to determine genetic changes under various conditions which are agitated on orbital shaker and aerated through mechanical and under different salinities.

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Materials and Method

Materials

The stock culture of *Chlorella* sp. was obtained from the Marine Biotechnology Laboratory, Faculty of Science and Biotechnology, University of Selangor (UNISEL), Bestari Jaya, Selangor.

Culture Condition

Microalgae were cultivated on seawater medium at different salinities of 0, 10, 20, and 30 ppt in 500 mL conical flask. Cells were grown in liquid medium with shaking speed of 150 rpm and by aeration method at room temperature under continuous illumination of white light fluorescent lamps at an intensity of 40 W. The Chlorella culture was harvested for experiment when they reach the late log growth phase.

Genomic DNA Extraction

Extraction of DNA was carried out using the modified CTAB extraction method as described by Stockinger [3]. The method that yields better (quality and quantity) genomic DNA was employed for subsequent RAPD analysis.

DNA Amplification

A total of 20 oligonucleotide primers (OPA-01–OPA-20) were screened for the RAPD analysis. Primers that produce clear and sharp bands were chosen for the scoring of bands and genetic distance analysis. The amplification reactions consisted of 1X reaction buffer, 3.5 mM $MgCl_2$, 0.6 mM dNTP mixture, 0.1 unit of *Taq* polymerase, 0.8 µM primer, 50 ng DNA template, and distilled water in a final volume of 25 µL in each reaction. The PCR amplification of DNA was performed in two replicates, using a programmable thermocycler (Eppendorf) programmed at 45 cycles of denaturation at 94 °C for 30 s, annealing at 36 °C for 30 s, and extension at 72 °C for 60 s and a final extension at 72 °C for 2 min. The PCR products were then separated by gel electrophoresis (1.2 % agarose gel) and stained with red safe staining. The PCR bands were then scored for analysis.

Data Analysis

The bands of all PCR profiles were scored as either presence (1) or absence (0) for each algae culture population. The data matrices of 1s and 0s from the scorable bands were used to calculate the genetic distance and to construct the Unweighted Pair Group Method with Arithmetic Mean (UPGMA) dendrogram according to Nei and Li's [4] indices using RAPDistance and NTSYS Version 2.0.

Results and Discussion

Observation under inverted microscope showed that *Chlorella* sp. for different salinities has almost identical morphology and size, but *Chlorella* sp. grows well under salinity of 10 ppt (Fig. 74.1). The time taken for *Chlorella* sp. to complete their cycle is about 4–7 days, because when this period exceeds, the *Chlorella* sp. is dead.
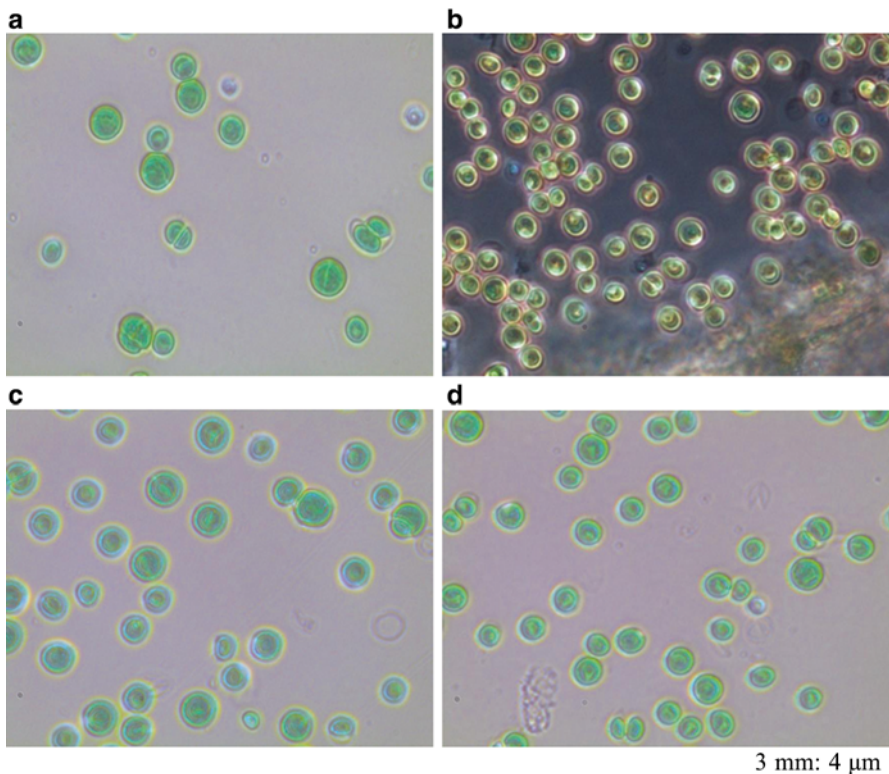
Fig. 74.1 Chlorella cell culture in conical flask under different salinities (100× magnification): (**a**) 0 ppt, (**b**) 10 ppt, (**c**) 20 ppt, and (**d**) 30 ppt
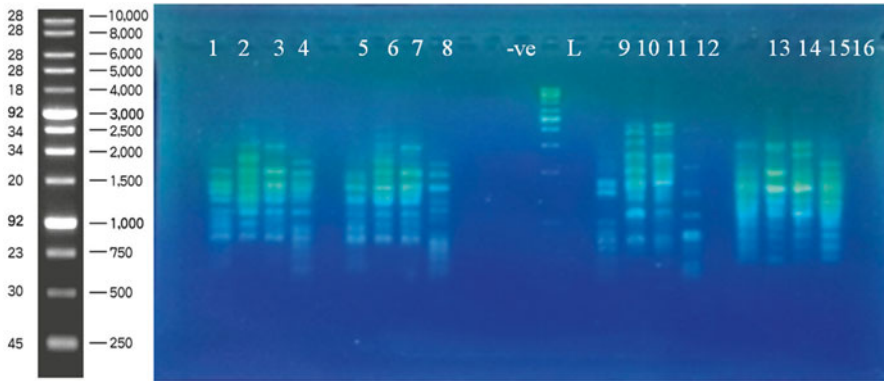
Fig. 74.2 The PCR profile of *Chlorella* sp. progeny by agitation on orbital shaker from different population generated by primers OPA-02, OPA-03, OPA-04, and OPA-013

In this research, genomic DNA of unicellular microalgae was successfully extracted using the modified CTAB extraction method. Gel electrophoresis analysis was performed for further analysis in order to check the quantity of the samples. Among the 20 primers tested, 4 primers (OPA-02, OPA-03, OPA-04, and OPA-13) gave clear and sharp fragment profiles and thus were selected for further analysis. Examples of such profile are shown in Fig. 74.2. This study showed that the good fragments of amplification DNA were obtained from the primers containing 60 % or more of GC bases in their sequence. All of the four selected primers produced different RAPD fragments pattern.

The result obtained indicated that all the species did not have similar genotypes and also have a different size of fragment (Fig. 74.2). These differences proved that *Chlorella* sp. was able to adapt to the new environment [5]. Other than that, [2] stated that *Chlorella* sp. does not need special requirements for the environmental conditions; it multiplies intensively and is widely distributed. From their study, they isolate *Chlorella* sp. from a geothermal well at 42 °C, and the stress caused by temperature, light intensity, and concentration of mineral elements in the nutritive medium was studied. The result showed that *Chlorella* sp. is not sensitive to high light intensity and have a high photosynthetic productivity preserved over a broad temperature range of 26–39 °C. *Chlorella* sp. did not die when cultivated under 44 °C and survived the stress temperature of 51 °C. From their observation, *Chlorella* sp. did not have special requirement concerning the concentration of nutrients and absent of lag phase. According to [6], organisms with high optimal growth temperature tend to yield higher productivity because of their wider possibilities for adaptation.

Figure 74.3 shows the genetic distance for *Chlorella* sp. culture using aeration and orbital shaker method for both parents and progenies under different salinities of 0, 10, 20, and 30 ppt. Two clusters were formed which separated the parts, one for aeration and another for agitation on orbital shaker. The large distance occurred between parents and progenies through aeration are due to the contamination
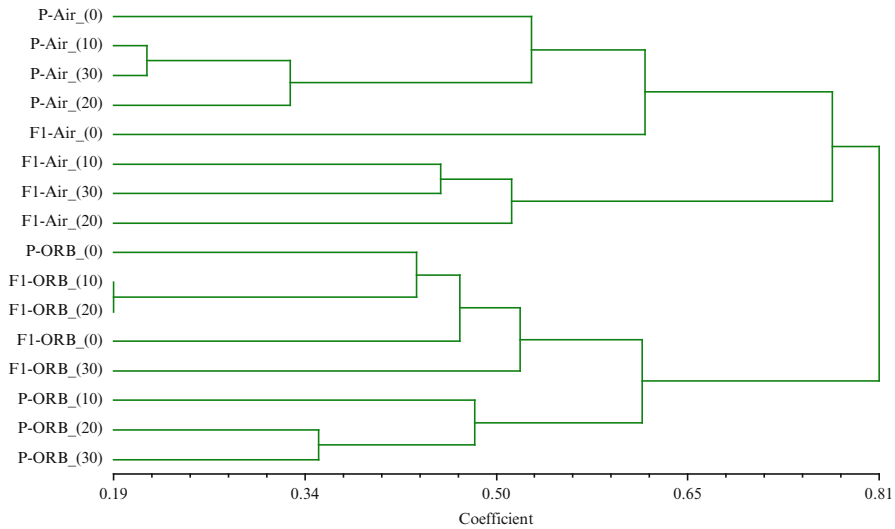
Fig. 74.3 Genetic distance based on different salinities of *Chlorella* sp.

compared to agitation on orbital shaker. Contamination also led to genetic changes or mutation, in which *Chlorella* sp. is able to adapt to the new environment. It is continuously cultured and the *Chlorella* sp. strains were also changed. Reference [7] state that microalgae are adapted to scavenge their environments for resources, to store them, or to increase their efficiency in resource utilization. Microalgae depend on sufficient supply of a carbon source and light to carry out photosynthesis [8]. It can change their internal structure for biochemical and physiological acclimation. This is due to their metabolisms, either autotrophic, heterotrophic, mixotrophic, or photoheterotrophic, and their ability for metabolic shift as a response to changes in the environmental conditions.

According to [9], shaking the suspension culture of mammalian cell helps to increase their growth rate and recombinant protein productivity. Orbital shaker produced gentle motion of the medium and kept the organisms in suspension with small formation of foam [10]. The cultures obtained from agitation on orbital shaker are more pure compared to aeration because antigen was destroyed rapidly during incubation on the orbital shaker.

Reference [11] used agitation on orbital shaker method to overcome the cross contamination and excessive evaporation while using aeration methods. A cover system used during orbital shaking aims to prevent direct well-to-well spilling of cell suspensions by small splashes or aerosol, to prevent airborne contaminants to enter the wells, and finally to prevent excessive evaporation of water from the culture with no more than 5 % volume loss per day. In addition, the cover allowed a sufficient degree of replacement of the headspace air to maintain an oxygen level in the headspace of more than 75 % of air saturation. The agitation of suspension cultures

by orbital shaking can improve gas exchange into and out of the medium [12]. According to [13], they state that shake bioreactor system is flexible, cost-effective, and easy to use and has reliable performance.

Conclusion

Chlorella's maximum growth is at 10 ppt, and it shows that the genetic distance between parents and progenies was 73 and 62 %, respectively, for culture by aeration and agitation on orbital shaker, whereas the genetic distance in population under different salinities ranges from 19 % to 81 %, and the genetic distance between culturing method used was 82 %. Under different salinities, the culture of *Chlorella* in 0 ppt shows a distance relationship from other culture in 10, 20, and 30 ppt, indicating close relationships. Culture by the use of agitation on orbital shaker is more pure compared to aeration which helps to limit or prevent accumulation of other extracellular proteins of biological interest.

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Chapter 75
Genetic Polymorphisms of Unicellular Green Algae Strains Using Random Amplified Polymorphic DNA

O. Roshani, M.Z. Mohd Syahril, and R. Mohd Hafiz

Introduction

Microalgae are microscopic algae, typically found in freshwater and marine waters. They are unicellular species which live individually or in groups. Their sizes can range from a few micrometers (μm) to a few hundreds of micrometers depending on their species. The lack of morphological characteristics makes the delimitation of species difficult for most microalgae. To circumvent this disadvantage, biochemical and physiological characteristics have been used to help unravel microalgae taxonomy. However, the majority of such characteristics are phenotypic, being influenced both by the environmental conditions and the growth stage of the plant. Furthermore, the evaluation procedures involved are time-consuming and relatively expensive.

Molecular markers provided a new type of data that could be used to test hypotheses concerning the classification of microalgae based on morphological, physiological, and biochemical characteristics. This technique is a promising tool for the improvement and enhancement of biomass production, pigment production, and tolerance to stresses in unicellular microalgae. Most of the molecular marker techniques were used to investigate population genetics, genetic diversity, gene mapping, genetic evolution, and application in breeding and conservation [1, 2]. This study will justify the genetic diversity o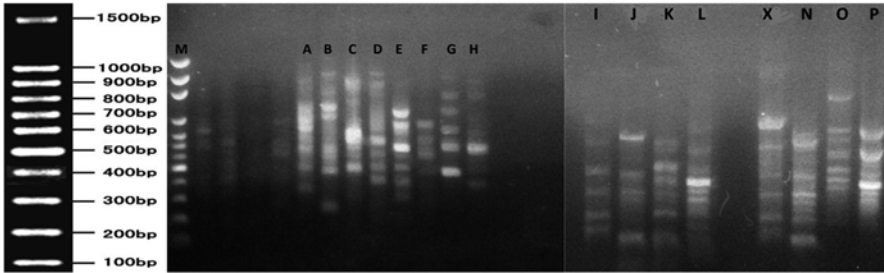f the unicellular microalgae (*Tetraselmis* sp., *Chlorella* sp., and *Nannochloropsis* sp.) from culture collections in the Marine Biotechnology Laboratory, UNISEL, by using RAPD markers.

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Methodology

Materials

The stock culture of *Tetraselmis* sp., *Chlorella* sp., and *Nannochloropsis* sp. was obtained from the Marine Biotechnology Laboratory, Faculty of Science and Biotechnology, University of Selangor (UNISEL), Bestari Jaya, Selangor.

Genomic DNA Extraction

Extraction of DNA was carried out using the modified CTAB extraction method as described by Stockinger [3]. The method that yields better (quality and quantity) genomic DNA was employed for subsequent RAPD analysis.

DNA Amplification

A total of 20 oligonucleotide primers (OPA01-OPA20) were screened for the RAPD analysis. Primers that produce clear and sharp bands were chosen for the scoring of bands and genetic distance analysis. The amplification reactions consisted of 1Xreaction buffer, 3.5 mM $MgCl_2$, 0.6 mM dNTP mixture, 0.1 unit of *Taq* polymerase, 0.8 µM primer, 50 ng DNA template, and distilled water in a final volume of 25 µL in each reaction. The PCR amplification of DNA was performed in two replicates, using a programmable thermocycler (Eppendorf) programmed at 45 cycles of denaturation at 94 °C for 30 s, annealing 36 °C for 30 s, extension 72 °C for 60 s, and 2 min of final extension at 72 °C. The PCR products were then separated by gel electrophoresis (1.2 % agarose gel) and stained with red safe staining. The PCR bands were then scored for analysis.

Data Analysis

The bands of all PCR profiles were scored as either presence (1) or absence (0) for each algae culture population. The data matrix of 1s and 0s from the scorable bands was used to calculate the genetic distance and to construct the unweighted pair-group method with arithmetic mean (UPGMA) dendrogram as according to Nei and Li's (1979) indices using RAPDistance and NTSYS version 2.0.

Fig. 75.1 The PCR profile of unicellular microalgae (*Tetraselmis* sp., *Chlorella* sp., and *Nannochloropsis* sp.) from various culture populations generated by RAPD primer (OPA-02, OPA-03, OPA-07 and OPA-13). Only clear and sharp bands were scored

Result and Discussion

Differences between unicellular green algae strains in their morphological characteristics became an indicator in identifying the type of species. For the strain of *Tetraselmis* sp., the shapes are almost spherical but slightly have small flagella. For the strain of *Chlorella* sp., it is spherical in shape with thin cell membrane and lives in small colonies. Their color is slightly different compared with the two microalgae which are deep emerald green in color. For the *Nannochloropsis* sp., the shapes are spherical and it is smaller in size (approximately 2 μm). The morphological identification of the three different strains can be used to identify the strain; however, the morphological characteristics of the strain will lead to many constraints in performing the classification procedure. For example, for the strain of *Tetraselmis* sp., its rapid movement makes it not easy to be observed, and due to this constraint, this method is less effective than using the molecular approaches.

In this research, the genomic DNA of unicellular microalgae was successfully extracted using the modified CTAB extraction method. The DNAs obtained from the samples were considered free from protein contamination because the absorbance ratio A_{260}/A_{280} was between 1.7 and 2.0. The yield of the DNA samples was between $1,676 \pm 93$ μg.μL^{-1} of cells. Gel electrophoresis analysis was performed for further analysis in order to check the quantity of the samples. Among the 20 primers tested, four primers (OPA-02, OPA-03, OPA-07, and OPA-13) gave clear and sharp fragment profiles and thus were selected for further analysis. Examples of such profile are shown in Fig. 75.1. This study showed that the good fragments of amplification DNA were obtained from the primers containing 60 % or more of GC bases in their sequence. All of the four selected primers produced different RAPD fragment patterns.

The RAPD technique was demonstrated as a useful method in assessing genetic variation among the three culture populations of unicellular microalgae. The UPGMA cluster analysis (Fig. 75.2) shows that the genetic distance among the culture

Dendrogram genetic distance among the different species of unicellular green algae
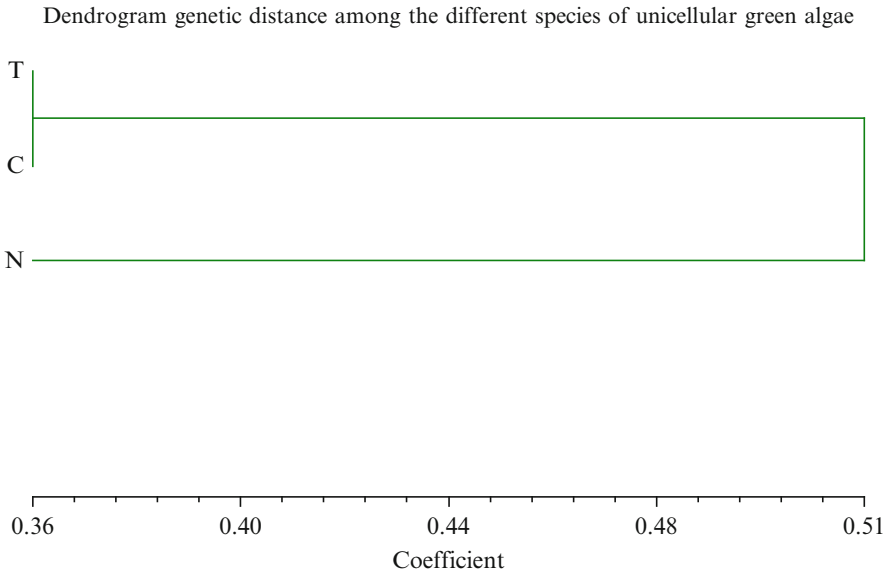
Fig. 75.2 UPGMA cluster analysis of all the culture populations of unicellular microalgae (*Tetraselmis* sp. (*T*), *Chlorella* sp. (*C*), and *Nannochloropsis* sp. (*N*)) based on the genetic distance generated from Nei and Li's indices

population of the unicellular microalgae was low, giving a genetic distance coefficient ranging from 0.36 to 0.69. The UPGMA analysis showed that *Tetraselmis* sp. is closer to *Chlorella* sp. which is 0.36 than to *Nannochloropsis* sp. (0.69). The higher value (0.69) of genetic distance was observed between *Chlorella* sp. and *Nannochloropsis* sp. From the result, the genetic distance between the two species is 0.36 because the *Tetraselmis* sp. and *Chlorella* sp. are from the same division (Chlorophyta) [4], in contrary with the division of *Nannochloropsis* sp. (Heterokonta) [5]. In addition, the genetic distance between the species of *Nannochloropsis* sp. and *Tetraselmis* sp. and *Chlorella* sp. is of higher value (0.69). However, the three species of microalgae have the same ancestor which is Eukaryota; due to the evolution that took place, the genetic material in every individual species is changed according to several factors. The greater genetic distance occurs when the species come to the difference division in their taxonomy.

Genetic distance levels of unicellular microalgae in the same species with different culture populations ranged from 0.26 to 0.41 for the strain of *Chlorella* sp., 0.22 to 0.44 for the strain of *Tetraselmis* sp., and 0.47 to 0.77 for the strain of *Nannochloropsis* sp. The UPGMA cluster analysis (Fig. 75.3) shows the genetic distance among the culture populations of the same species of the unicellular microalgae.

The culture populations of *Chlorella* sp. and *Tetraselmis* sp. show that they are closely related in three populations in the different culture flasks with genetic
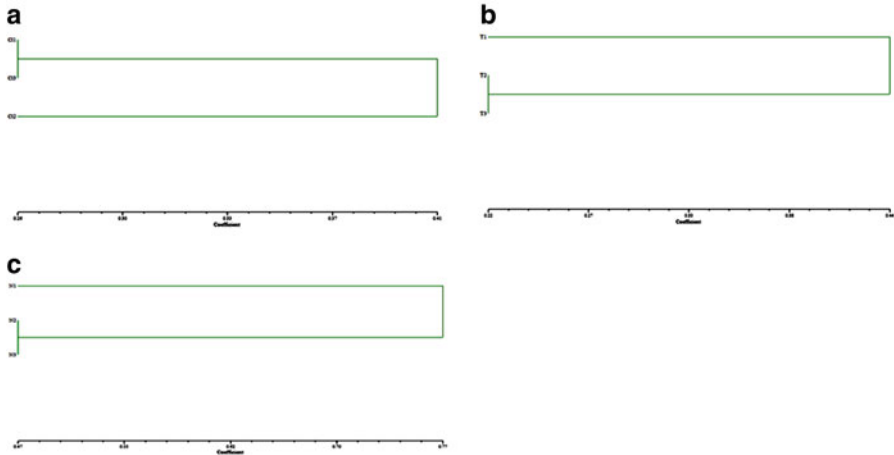
Fig. 75.3 UPGMA cluster analysis based on the genetic distance generated from Nei and Li's indices of genus within the strain of (**a**) *Chlorella* sp., (**b**) *Tetraselmis* sp., and (**c**) *Nannochloropsis* sp. in different cultures

distance levels of 0.26–0.41 and 0.22–0.44, respectively. It is due to the culturing environment that is similar, and with that, there is a close relationship between the same populations of *Chlorella* sp. and *Tetraselmis* sp. and in different culture populations. Meanwhile, the culture populations of *Nannochloropsis* sp. show that the genetic distance between the populations is recorded the highest (0.47–0.77). This is due to the *Nannochloropsis* sp., that is, the marine algae, which consumes salt water for the culturing system. For the marine environment, the pH level and the salinity difference will change the balance of the environment. That will make the genetics of the *Nannochloropsis* sp. in the culture change and lead to the greater genetic distance between the individual species. As reported by [6], environmental conditions or stresses are the basis of much evolutionary change. During periods of severe stress, because of the intense selective pressure, fundamental changes, such as species extinctions and bursts, within species are likely to occur. Overcoming this will depend on the genetic variability present in a given lineage.

Conclusion

As a conclusion, the genetic diversity of the *Chlorella* sp. and *Tetraselmis* sp. in the Marine Biotechnology Laboratory, UNISEL, is low (0.36) because they share the same division (Chlorophyta), use the same media, and have an almost similar culture condition. However, the culture population of the *Nannochloropsis* sp. is higher than the culture populations of *Chlorella* sp. and *Tetraselmis* sp. (0.69) because they do not share the same division (Heterokonta) and they use different

culture media (artificial seawater). Although morphological identification is useful for differentiating species and genetic diversity, it also depends on environmental culture conditions to detect the strains and populations; hence, the use of RAPD markers has proven to differentiate strain culture populations. It is necessary to introduce some strains from other places to increase the gene pool stability and for future culturing purposes.

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Chapter 76
Ionic Polymer Metal Composite (IPMC): Potential Material for Microtechnology Devices

Suhaila M. Yusuf, Abbas A. Dehghani-Sanij, and Robert C. Richardson

Introduction

IPMC is one of the emerging sub-elements of electroactive polymers and smart materials. It is referred to as smart material due to its ability to actuate simply by applying electrical stimuli. Its structure consists of a thin polymer membrane with metal electrodes plated on both faces. The thickness of the polymer membrane is about 200 μm, while the metals are about 5–10 μm each. The perfluorinated polymer membrane contains free cations that are fixed in a network of anions. Fabrication of IPMC is briefly described in [1–3].

IPMC is working based on a simple principle. In initial state, mobile cations, fixed anions, and water molecules are equally distributed. When an electrical field is applied onto the conductive platinum surfaces of IPMC, the mobile cations together with the attached water molecules will move toward the cathode while the anions remain fixed in place. This movement causes the IPMC to bend due to expansion of the material on one side and contraction on the other side. However, this stage is imbalanced because the water molecules will diffuse back and IPMC is in relaxation stage. Figure 76.1 shows the principle of actuation of IPMC.

A number of important characteristics are owned by the IPMC, and these make the IPMC suitable for use as actuators. Those characteristics have been listed in [4, 5] as follows:

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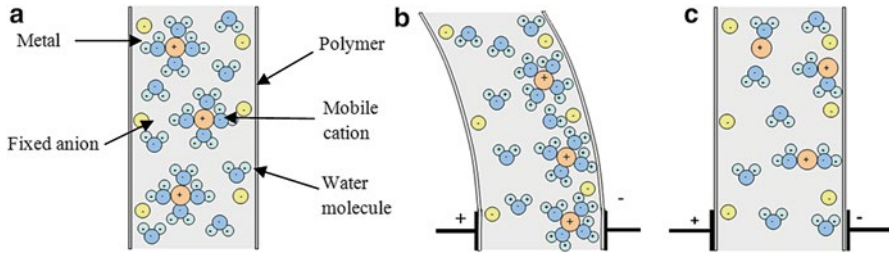
Fig. 76.1 IPMC during (**a**) initial stage, (**b**) actuation stage, and (**c**) relaxation stage

- Actuated by low voltage (1–3 V) and relatively large displacement
- Fast bending response (>100 Hz) – thickness, counterion, etc., contribute for the maximum speed
- Durable and stable chemically – possible to bend over 1×10^6 times
- Flexible and compliant material – Young's modulus ~200 MPa
- Moveable in water/wet environment
- Can be miniaturized without loss in actuation and sensing properties
- Lightweight

IPMC is potentially considered as one of the materials for developing biomedical devices. This is because it actuates using very low voltage (1–3 V) and can perform in wet environments. In this paper, we have used small-scale IPMC to characterize the displacement and force properties. A LabVIEW-based vision system has been developed to measure the IPMC displacement.

Experimental Setup

Vision System for Displacement Measurement

A LabVIEW vision system has been developed for displacement measurement. A USB Veho VMS-001 Microscope with up to 30 fps frame rate and resolution of 320×240 pixels per frame is used to capture the images. These images are then transferred to the system for the next stage which is image processing. This microscope has a base zoom level of 20× and can be further zoomed up to a factor of 200×. This gives an advantage to the microscope to record small deflection of the IPMC. Keyence LKG32 laser sensor is used to validate all the measurements calculated by the vision system. It is positioned horizontally to the IPMC while the microscope is positioned perpendicular to the IPMC. Figure 76.2 shows the experimental setup for measuring the displacement.

The LabVIEW program has three main functions which are (1) image acquisition, (2) edge detection, and (3) displacement measurement. All images are captured continuously and processed in real time. Luminance plane is extracted from the color images due to having a better edge detection rather than using black-white
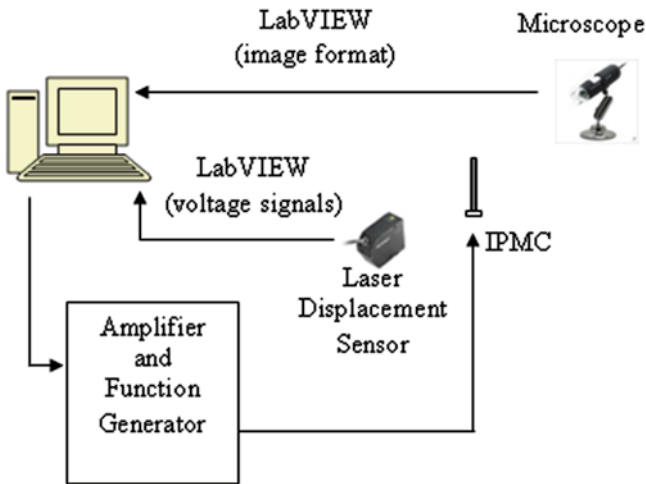
Fig. 76.2 Experimental setup for displacement measurement by vision system

Fig. 76.3 Displacement calculation by vision system
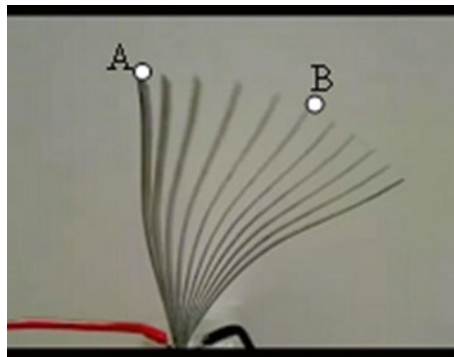
approach. Calculation of displacement is carried out relative to the initial position of the IPMC as shown in Fig. 76.3 using Eq. 76.1:

$$d = \sqrt{\left(x_B - x_A\right)^2 + \left(y_B - y_A\right)^2} \tag{76.1}$$

To validate the measurement of displacement from the vision system, comparison between measurement by vision system and laser displacement sensor must be done. To achieve this, the LabVIEW system should have the ability to track the same position of laser beam at all times during actuation. As the laser beam is pointed in a straight line, the system has to measure the same line, as shown in Fig. 76.4.

Calibration information must be given before each measurement is done. It is important in order to generate an accurate relation between each pixel of the images and the real-world coordinates. It has to be done whenever there is a change in image acquisition condition such as repositioning the microscope or change in zooming factor.

Fig. 76.4 Measurement of displacement in a straight line by laser sensor
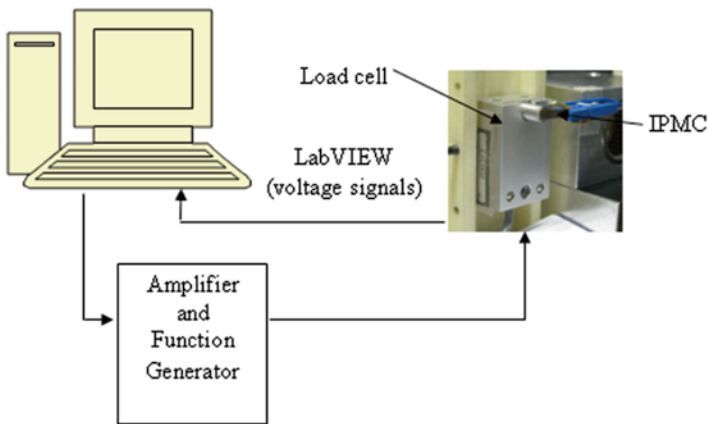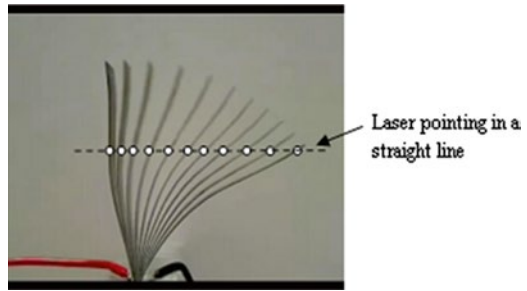
Fig. 76.5 Experimental setup for force measurement

Force Experimental Setup

To measure the force produced by the IPMC, a Transducer Technique GSO-10 sensitive load cell with a maximum capacity of 10 g has been used. Experimental setup for force measurement is shown in Fig. 76.5.

Results and Discussion

In these experiments, we used IPMC manufactured by ERI (Environmental Robots Inc.) and deionized water as the solvent. Three different voltages (1 V, 2 V, and 3 V) are used with fixed 0.5 Hz frequency. Six samples of IPMC with various sizes are used for displacement and force measurement. The sizes of IPMCs are as follows:

- 10 mm length×1 mm width×0.2 mm thickness
- 10 mm length×1 mm width×0.3 mm thickness
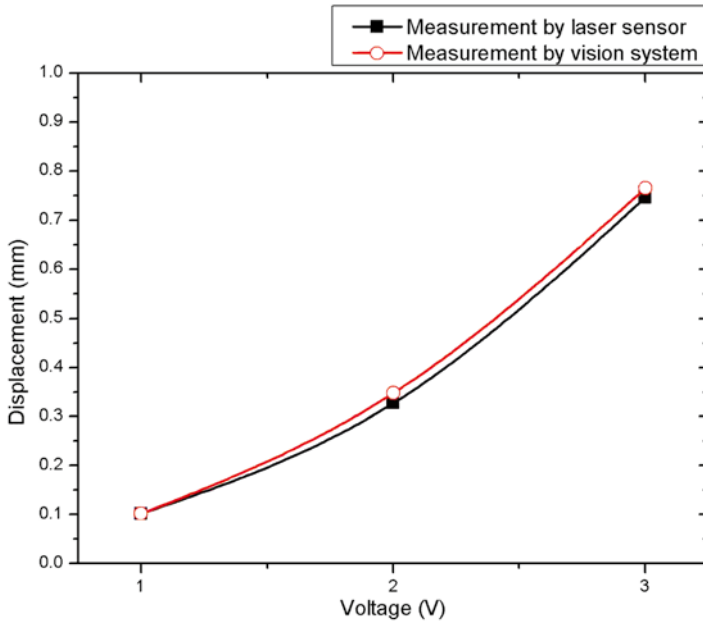
Fig. 76.6 Comparison between measurement of displacement by vision system and laser sensor

- 10 mm length × 2 mm width × 0.2 mm thickness
- 10 mm length × 2 mm width × 0.3 mm thickness
- 10 mm length × 3 mm width × 0.2 mm thickness
- 10 mm length × 3 mm width × 0.3 mm thickness

On account of better accuracy that has been given in terms of calculating the tip displacement [6], experimental works of measuring the displacement using the current vision system have been carried out. However, this measurement has to be validated to prove the reliability of the system. As described previously in Fig. 76.4, the vision system has to record all the laser beam's positions in order to verify its reliability. In comparing both systems, the sum of squared error (SSE) is 7.68E-04, which suggests a good agreement between measurement by the vision system and the laser sensor for IPMC sized 10 mm × 3 mm × 0.3 mm with applied 1–3 V and 0.5 Hz frequency as shown in Fig. 76.6.

The experimental results for various sizes of IPMC displacement and blocked force with applied voltages 1–3 V and fixed frequency 0.5 Hz are shown in Fig. 76.7a, b, respectively. It shows that bigger size of IPMC gives better displacement. The displacement and force depend on the voltage magnitude as well as the size of the IPMC itself. The thickness of the IPMC plays an important role in determining the displacement. As shown in Fig. 76.7a, IPMC with 0.2 μm thickness gives higher displacement than the 0.3 μm thickness. This is possibly from the metal thickness that increases the composite's stiffness. In terms of length and width, bigger size IPMC leads to higher
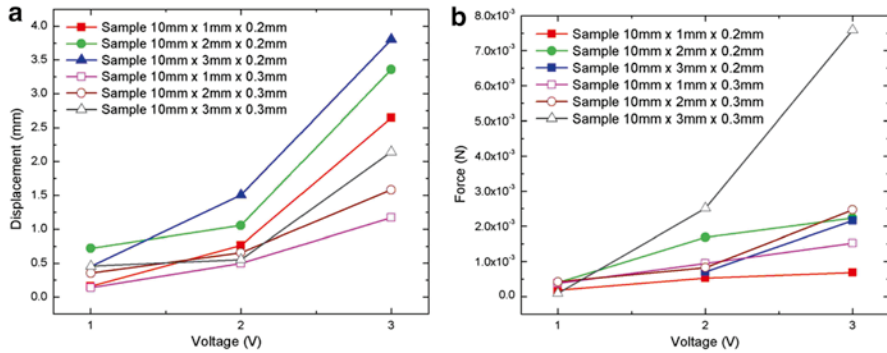
Fig. 76.7 (**a**) Displacement and (**b**) blocked force measurements for various sizes of IPMC

displacement. In Fig. 76.7b, IPMC sample 10 mm×3 mm×0.3 mm produced the highest force. This is again due to the composite's stiffness that increases the blocked force during actuation.

Summary

IPMC is one of the new smart materials that are being extensively investigated. It has the advantage to operate in both wet and dry environments. Furthermore, the results have shown that with only small voltage excitation, the IPMC can develop significant displacement and force. Therefore, it is believed that IPMC can provide enough actuation for certain micro-systems such as microgripper and micro-pump. It was also shown in this paper that a vision system can provide a better result for displacement and in addition it allows direct curvature measurement as well. Further works are to develop a prototype of microgripper that can be used to grasp micro-objects and use the feedback from the vision system developed.

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Chapter 77
Effects of Post-deposition Annealing Time in Nitrogen Ambient on Y_2O_3 Films Deposited on Silicon

Hock Jin Quah and Kuan Yew Cheong

Introduction

The effort to enhance the performance while reducing the dimension of silicon (Si)-based metal-oxide-semiconductor (MOS) devices has resulted in the employment of high-dielectric-constant (k) materials as the gate oxide. The utilization of high-k materials may alleviate the extensive leakage of current through the native oxide of Si (SiO_2) due to direct tunneling [1–3]. Numerous high-k materials, such as HfO_2 [4], Al_2O_3 [5], ZrO_2 [6], CeO_2 [7], and Y_2O_3 [3, 8–12], have been widely investigated in Si-based MOS devices. Of these high-k materials, Y_2O_3 is an attractive material to be exploited as a gate oxide due to its high-k value ($k = 15$–18), large band gap (~5.5 eV), large conduction band offset (~2.3 eV), low lattice mismatch, and good thermal stability with Si [3, 8–12]. Even though Y_2O_3 is a potential candidate, previous studies have revealed that deposition of Y_2O_3 gate on Si substrate and post-deposition annealing (PDA) of the Y_2O_3/Si MOS structure have contributed to the formation of interfacial layer (IL) consisting of either SiO_2 or yttrium silicate [3, 9–12]. To impede the formation of IL, nitridation on the surface of Si prior to the deposition of Y_2O_3 gate [10] and PDA of Y_2O_3/Si MOS structure in nitrogen (N_2) ambient were performed [10, 12]. However, recent study has revealed that Y_2O_3 gate subjected to PDA in N_2 ambient has demonstrated the highest leakage current and the lowest breakdown voltage when compared to Y_2O_3 gate PDA in other ambient, such as oxygen, nitrous oxide, argon, and forming gas (95 % N_2 + 5 % H_2) [12]. In order to improve the electrical characteristics of Y_2O_3 gate subjected to PDA in N_2 ambient, the effects of PDA times (15, 30 [12], and 45 min) in N_2 ambient have been systematically studied in this paper.

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Experimental Procedures

RF magnetron sputtering (Edwards A500) was utilized to deposit approximately 5-nm thick Y_2O_3 films on n-type Si (100) substrate. Si substrate with a resistivity of 0.01–30 Ω and a thickness of 375 ± 25 μm was used in this work. Prior to the deposition process, the Si substrate was subjected to RCA cleaning and the native oxide of SiO_2 was etched using $HF:H_2O$ (1:50) solution. The detail of Y_2O_3 deposition process has been reported previously [11–13]. The sputtered samples were post-deposition annealed at 1,000 °C in nitrogen ambient for 15, 30, and 45 min in a horizontal tube furnace. The heating and cooling rate of 10 °C/min were used. The phases and orientations as well as the surface morphology of the oxide were investigated by X-ray diffraction (XRD, P8 Advan-Bruker) and field-emission scanning electron microscopy (FESEM, ZEISS SUPRA 35VP), respectively. In order to fabricate $Al/Y_2O_3/n$-Si MOS capacitors, a blanket of aluminum (Al) was evaporated on the Y_2O_3 films using thermal evaporator (AUTO 306). Then, an array of Al gate electrodes (area = 0.0025 cm^2) was defined using photolithography process. Finally, a layer of Al was evaporated at the back of the Si substrate. Inductance-capacitance-resistance (LCR) meter (Agilent 4248A) and semiconductor parameter analyzer (Agilent 4156C) were used to measure capacitance-voltage (C-V) and current-voltage (I-V) characteristics of the metal-oxide-semiconductor (MOS) test structure, respectively.

Results and Discussion

Surface morphology of Y_2O_3 films that have been subjected to different post-deposition annealing times in nitrogen ambient was examined using FESEM. It was observed that these films were smooth and uniform without the presence of defects, such as crack or void. A typical FESEM image of Y_2O_3 film annealed at 30 min in N_2 ambient is shown in Fig. 77.1. XRD patterns of the investigated samples are presented in Fig. 77.2. Y_2O_3 phase with five different planes at (222), (400), (440), (541), and (543), which are well matched with ICDD file no. 00-041-1105, was detected. An increment in the intensity of the peaks related to Y_2O_3 phase is observed as PDA time increased. Besides the detection of Y_2O_3 phase, XRD also detected the presence of yttrium silicate ($Y_2Si_2O_7$) phase at (130) plane (ICDD file no. 01-074-2163) for all of the investigated samples. $Y_2Si_2O_7$ was formed maybe due to the reaction between SiO_2 and Y_2O_3 [12, 14]. It is believed that an interfacial layer (IL) consisting of a SiO_2 and $Y_2Si_2O_7$ mixture was formed. When PDA time is increased, the intensity of (130)-oriented $Y_2Si_2O_7$ peak is enhanced. This indicates that a thicker IL consisting of more $Y_2Si_2O_7$ phase may be formed when PDA time is prolonged.

Figure 77.3 shows a typical high-frequency *C-V* characteristic of MOS capacitor with Y_2O_3 gate oxide PDA at different times. From the *C-V* curves, a reduction in
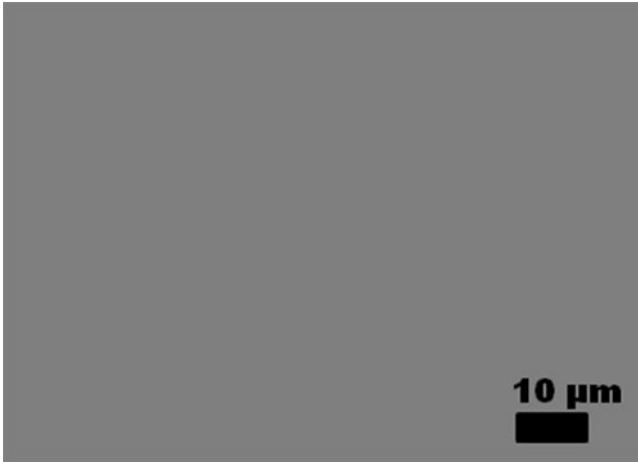
Fig. 77.1 Typical FESEM image of Y_2O_3 film annealed for 45 min
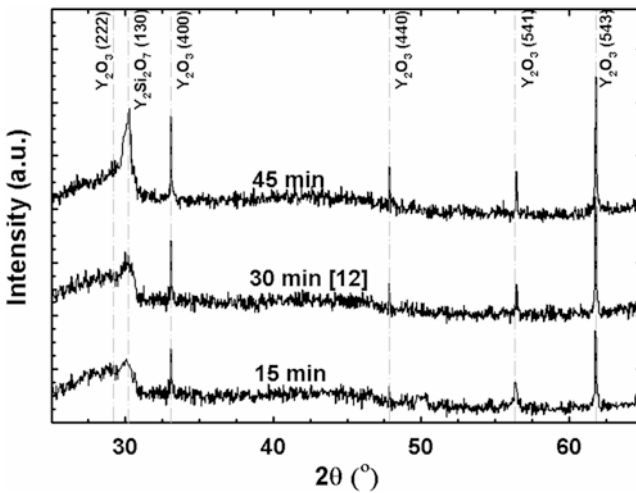

Fig. 77.2 XRD patterns of Y_2O_3 film annealed at different times

maximum accumulation capacitance (C_{ox}) as PDA time increased is a supporting evidence to signify that thicker IL was formed. In addition, flatband voltage shift (ΔV_{FB}) to negative direction as displayed by the *C-V* curves denotes that positive effective oxide charge (Q_{eff}) is present in the investigated samples [7, 13, 15]. This observation could be supported by calculating Q_{eff} in Y_2O_3 gate oxide using the following equation:

$$Q_{eff} = \Delta V_{FB} C_{ox} / q A_G \tag{77.1}$$
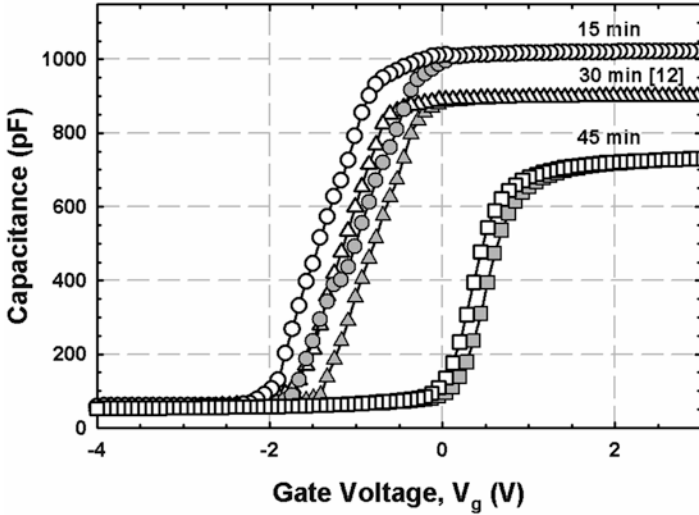
Fig. 77.3 High-frequency capacitance-voltage curves for Y_2O_3 gate oxide annealed at different times in nitrogen ambient
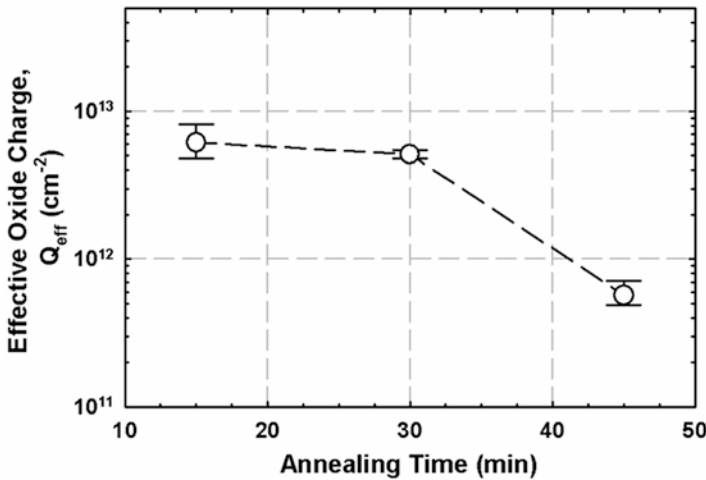
Fig. 77.4 Effective oxide charge of Y_2O_3 gate annealed at different times. The *error bars* indicate maximum, average, and minimum values of the investigated parameters

where q is electronic charge and A_G is area of capacitor [7, 13]. The Q_{eff} calculated from five samples for each of the investigated parameters is shown in error bar as a function of PDA time (Fig. 77.4). A reduction in positive Q_{eff} is attained when PDA time is increased. This indicates that less oxygen (O_2) vacancies are formed in the Y_2O_3 gate PDA at 45 min. The reason that contributes to this observation is related
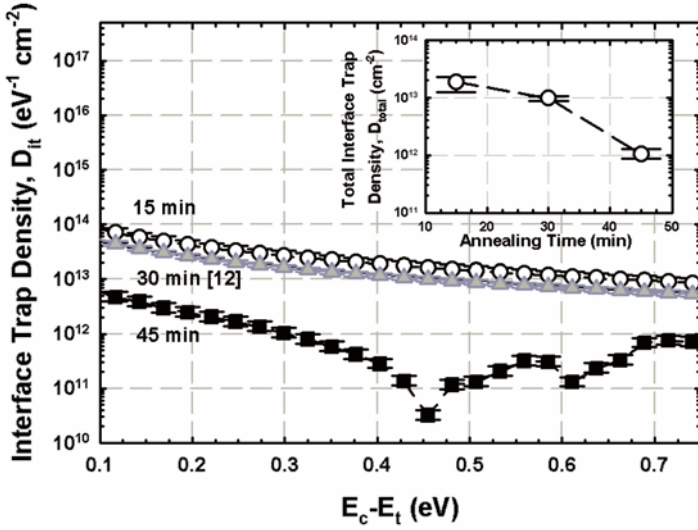
Fig. 77.5 D_{it} and D_{total} of Y_2O_3 gate oxide annealed at different times

to the nitridation process. Since more N_2 is present at the oxide/semiconductor interface at 45 min, the tendency of oxygen dissociated from Y_2O_3 gate to react with Si forming SiO_2 is reduced. Thus, this unreacted oxygen, which diffuses inward to the oxide/semiconductor interface, will diffuse outward to compensate the O_2 vacancies in Y_2O_3 gate.

The oxide/semiconductor interface trap density (D_{it}) was estimated from the *C-V* curves using Terman's method. A comprehensive description on the extraction of D_{it} using Terman's method has been explained in [7, 16]. The D_{it} in the investigated samples was calculated using

$$D_{it} = C_{ox}d\left(\Delta V_g\right)/qAd\left(\Phi_s\right) \qquad (77.2)$$

where $\Delta V_g = V_g - V_g$ (ideal) is the voltage shift of the experimental curve from the ideal curve, V_g is the experimental gate voltage, and Φ_S is the surface potential of Si at a specific gate voltage [7, 13, 16]. Figure 77.5 shows the error bar of D_{it} values of five samples for each of the investigated parameter as a function of energy trap level (E_c-E_t). It is observed that D_{it} reduces as PDA time increases. This is an indication that the oxide/semiconductor interface quality is improved when PDA time is increased. The improvement in the interface quality as PDA time increases is related to the reduction of broken bonds in Y_2O_3 due to the compensation process. In addition, the increment of PDA time allows the formation of IL consisting of more $Y_2Si_2O_7$, which may also assist in improving the interface quality. Inset of Fig. 77.5 presents total interface trap density (D_{total}) in error bar as a function of PDA time. D_{total} was
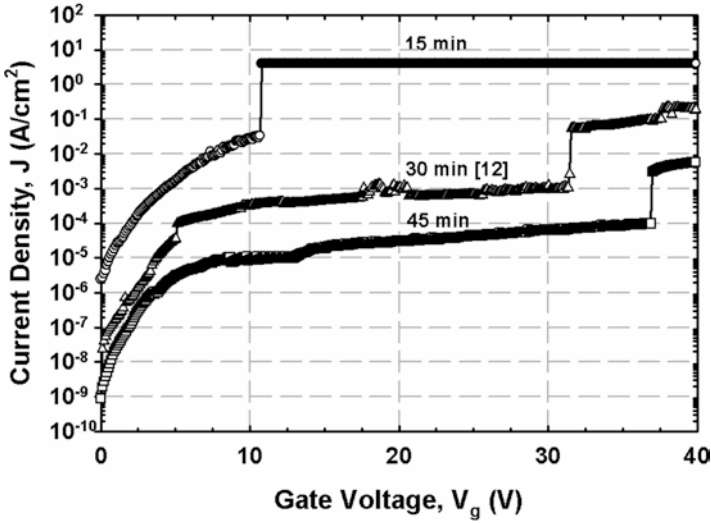
Fig. 77.6 Leakage current density-gate voltage for sample annealed at different times

calculated from the area under $D_{it} - (E_c-E_t)$ plot (Fig. 77.5) [7, 13]. The trend attained from D_{total} was similar to D_{it}.

Typical leakage current density-gate voltage (J-V_g) characteristics of Y_2O_3 gate oxide PDA at different times are shown in Fig. 77.6. In general, an improvement in breakdown voltage (V_B) and a reduction in leakage current density were perceived when PDA time increases. This is due to the attainment of the lower Q_{eff}, D_{it}, and D_{total} for sample annealed at longer duration. In addition, the formation of thicker IL consisting of more $Y_2Si_2O_7$ as PDA time is prolonged may also assist in improving the J-V_g characteristics.

Conclusion

As a conclusion, the effects of post-deposition annealing time in nitrogen ambient on RF magnetron sputtered Y_2O_3 on Si substrate have been successfully investigated. XRD characterization disclosed the detection of Y_2O_3 and $Y_2Si_2O_7$ phases for all of the investigated samples. It was proposed that IL consisting of a SiO_2 and $Y_2Si_2O_7$ mixture was formed for all of the investigated samples. When PDA time was prolonged, thicker IL consisting of more $Y_2Si_2O_7$ was formed. The formation of thicker IL consisting of more $Y_2Si_2O_7$ has contributed to the improvement in J-V_g characteristics as PDA time is prolonged. The improvement in J-V_g characteristics as a function of time is also related to the reduction of Q_{eff}, D_{it}, and D_{total}.

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Chapter 78
Road User's Perception Towards Landslide Warning Signage

Mohd Razmi Zainudin, Mohd Fairuz Bachok, Mohd Fakri Muda, and Roslan Zainal Abidin

Introduction

Landslide that occurred alongside roads and highways can be expected in Malaysia every year. Table 78.1 shows the summary of selected landslide occurrence by year that took place in Malaysia and its consequences since year 2000. In Malaysia, most of landslides occurred on cut slopes or on embankments alongside roads and highways in mountainous area [1]. The hazards of landslide are that it could affect properties such as road, drainage and slope protection (damage) and vehicle (destroy) and human (life and injury). Road being closed due to the clearing works of earth material blockage is another consequence. The losses caused by these typical hazards could reach from thousand to a million ringgit. Almost RM 3 billion economic losses in the period of 1961–2007 are due to landslide occurrences, whereby fatalities are a major contributor which recorded near to RM 1 billion [2]. People life and people injury is the highest severity rating of landslide hazard [3]. The rating is developed from people's perceptions and cost implication.

The main step that had to be taken by the government to ensure that slopes alongside road are safe is to construct slope stabilisation. However, some cases such as failure of geosynthetic (geogrids) wall at Bukit Fraser [4], soil nailed at Gua Musang [5], crib wall with piled reinforced concrete at Kuala Lumpur [6] and shotcrete at Keningau [7] indicated that slope stabilisation is not a guaranteed solution to prevent slope failure. Design errors, construction errors and maintenance were the factors that contribute to the failure of slope stabilisation [8]. As alternative, the Public Works Department

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Table 78.1 Selected landslide occurrence alongside road and its consequences in Malaysia from 2000 to 2012

Year	Date	Location	State	Impact	Development
2000	13 April	KM 91.2 Jeli–Tanah Merah road	Kelantan	2 persons injured and 1 motorcycle damaged	Downslope
2001	8 April	Cameron Highlands road	Pahang	1 person killed and 1 car damaged	Upslope
2002	20 November	KM 18.0 Ulu Yam road	Selangor	1 car damaged	Downslope
2003	8 October	Gunung Raya road	Kedah	1 person killed	Upslope
2004	11 October	KM 302 Utara–Selatan highway	Perak	2 persons injured and 2 lorries, 8 cars, 1 motorcycle damaged	Upslope
2005	17 December	KM 42 Tapah –Ringlet road	Pahang	–	Upslope
2006	25 June	Sulaman–Karambunai road	Sabah	1 person killed	Downslope
2007	22 November	KM 64 Taiping –Kuala Kangsar	Perak	1 lorry damaged	Upslope
2008	4 December	Semantan road	Kuala Lumpur	11 cars damaged	Upslope
2009	21 January	KM 45 Bintulu–Tatau road	Sarawak	1 truck damaged	Downslope
2010	7 July	KM 17 Bahau–Rompin road	Negeri Sembilan	1 person injured and 1 car damaged	Downslope
2011	21 October	KM 13.9 Genting Sempah–Genting Highlands highway	Pahang	1 person injured and 1 car damaged	Upslope
2012	1 June	Bunga Cempaka Putih road	Pulau Pinang	3 cars damaged	Upslope

Source: newspaper (2000–2012)

(PWD) had taken initiative to place landslide warning signage (Fig. 78.1) at the risk slopes as a medium of awareness to the road users, so that they can take extra precaution especially in raining times when they travel alongside risk slopes. This is to ensure that they can avoid being a victim of landslide.

Unfortunately, to date, there are still people who become victims of landslides when travelling on the road. It becomes a question whether the measures taken or public awareness of landslides could be a possible factor. Public awareness can be considered to be or not to be an influencing factor. A study of undergraduate students [9], school students [10], teachers [11], officers [12] and residents [13] in Penang indicated that the group of residents, school students and undergraduate students has a good awareness on landslide disaster, while the group of teachers and officers has a moderate level of awareness. Lack of knowledge of the landslide is the main reason that contributes to the low awareness of this disaster; activities such as free intensive training courses, seminar, programme and education that could enhance the knowledge on landslide are suggested to be proposed regularly [11].

Fig. 78.1 Landslide warning signage

Awareness is known as part of the factor; however, the effectiveness of warning delivery by landslide warning signage is still unknown since no study been conducted to investigate this matter. The study aims to identify either landslide warning signage is effective medium which can consider not the failure factor of avoiding road users from being victims of landslide or need to be improved. Furthermore, it is hope that the finding of the study will provide an information towards landslide warning signage in order to know its weakness if proved ineffective, so that action can be taken to improve its function in the future.

Literature Review

Landslide is a natural process that shapes the surface of the earth, which involves the outward or downward movement of slope-forming material under the influence of gravity [8]. Landslide is also defined as the movement of a mass of rock, debris or earth down a slope [14]. The processes of mass movement are considered as a hazard when it threatens mankind. Landslide is more threatening compared to the other mass movement processes such as soil creep because landslide is capable of moving at high velocity and discretely and has clearly identifiable boundaries, often in the form of shear surfaces [15]. Risk of physical elements which affects by landslide are depend on range of impact mechanisms including burial, collision impact, earth pressures, differential shearing in tension, compression or torque, plastic deformation, object displacement and removal or deformation of valued ground [16].

When landslide occurs, the hazard to the physical elements could present as direct or indirect impacts. Direct impacts are effects from direct in touch by mass movement. The typical impacts from these mechanisms may include loss of life and injury on humans and animals, collapsed or damaged structures, uprooted or buried trees, rupture or distortion of a pipeline and extensively inundate productive

agricultural land. Smashed homes and other structures, washed-away roads and bridges, swept away cars, knocked– down trees and finally laid down thick deposits of mud, rock and other debris where they come to rest, obstructing drainages and roadways, are common possible direct impacts caused by landslide [17]. Indirect impacts may involve the interaction of landslides with other systems or processes, for example, fluvial systems and artificial or natural lakes, and it may be responsible for tsunami, coastal erosion, soil depletion and increased storm runoff [16]. However, direct impacts attract more attention since the effects can be seen physically, frequently occurred and often reported in mass media.

Mitigation is one of the components in landslide management framework. Essentially, reducing the risk of landslide impacts is the main purpose of this phase of the cycle that equates to the risk treatment. There are nine different approaches of mitigation options in landslide management framework, which range from 'hard' engineering to 'soft' planning and education measures [18]. The primary goal of mitigation is to reduce the number of deaths and injuries and economic costs, which can be achieved through nine major elements, spanning a continuum from research to the formulation and implementation of policy [19]. Increasing population and development expanding onto land that is more susceptible to landslide make mitigation not as an opinion but a compulsory option that should be adopted. All the mitigation options that had been listed were intensively adopted in Malaysia including slope stabilisation (physical methods) and landslide warning signage (warning system). The capability to minimise potential losses before landslide events and recover from landslides is a characteristic of a competent mitigation measure.

Landslide warning signage is used to warn road users of the possibility of landslide or rock fall at the certain distance of the road. So, the road users will take extra precaution when travelling at that particular distance in order to avoid being a victim of landslide or rock fall. Usually the landslide warning signage is placed nearby the identified prone landslide or rock fall area. This warning signage is categorised as direct weather-related warning since landslide or rock fall frequently occurs caused by rainfall. In some countries like the United Kingdom, the United States, Hong Kong and Croatia, besides the symbol of landslide warning, additional information such as the start and end of the hazard area, distance over which the hazard is extant, period of high risk (raining time) or even specific types of landslide are also attached to the signage. In road sections prone to landslide, setting up supervision and alert systems as a warning medium to road users in case landslides happen which could cause serious damages to pedestrian and vehicles around and also for immediate announcement for changing routes is advised [20].

The main function of traffic signage is to improve the quality of service of the road network. It is considered as the road users' support system because it increases the road users' awareness of situations and possible decisions that are ahead. As a result, recognition of signage is an important issue since road users' reaction depends on the information comprehended by the signage. Failure to recognise will create a situation of inaccurate judgement which leads to inaccurate reaction, indirectly jeopardising the safety of the road users themselves. Signage is a device that provides a visual message by virtue of its situation, shape, colour or pattern and

sometimes by the use of symbols or alpha-numeric characters [21]. Physical characteristics of traffic signage are not the only factors that influence the recognition of signage but viewing conditions also such as weather conditions (sunny, cloudy and rainy) and daytime period conditions (morning, evening and night) [22]. In addition, information attached at a signage is another factor which has a direct influence on road users' reaction [23]. Education, monthly income, gender and nationality have a significant effect on their understanding of traffic signage. Those that have a high level of education and high income and those that are male and Western were the best groups from each category [24]. Failure of signage to provide warning of an existing or a potential roadway hazard actually would possibly affect safety because when it is not clear, it may be ignored, and this will divert the road users' attention away in an effort to reflect the hazards [25]. On the other hand, it's essential to ensure the effectiveness of traffic signage as a device that could delivers the sufficient information to the road users for safe journey and attract their intention to understand information comprehends and reflect accurately as well.

Early warning is outlined as one of the strategic thrusts which aim to provide warning on slope hazards with purpose to reduce the damage caused by landslide [2]. Malaysia's experiences showed that despite all preventive measures that could possibly be taken, landslides are known to still occur without warning. However, installation of early warning system is believed from the fact that may avert or at least minimise economic and social losses from landslide disasters. Immediate response to landslide occurrence by an efficient, effective response and adopt recovery measures also important since its will limit the damage. Pre- (early warning) and post-landslide actions (emergency preparedness, response and recovery) are two components in landslide management framework that would minimise the losses if been effectively and systematically managed. Almost 4,000 risk slopes all over Malaysia have been identified by PWD through Slope Conditional Survey Inspection System, and there is no guarantee that these risk slopes will not fail since construction and maintenance of slope stabilisation need huge capital, so the pre- and post-landslide actions are essential.

Objectives

The research objectives of the study are as follows:

 (i) To investigate road users' perception towards landslide warning signage
(ii) To identify the weaknesses of landslide warning signage as a device in delivering warning to the road users

Material and Methodology

A questionnaire was used to gather information from the subjects. The questionnaire was designed by referring to the previous survey items [26–30]. Factors that influence recognition and understanding of traffic signage have also been

studied to make it more comprehensive. It is divided into four sections consisting of items that related to whether a landslide warning signage should be placed (Section A, seven items) and whether it provides sufficient information (Section B, six items), is able to attract (Section C, four items) and is appropriate (Section D, three items). All the items use a 5-point Likert scale, ranging from strongly disagree to strongly agree.

A pilot test was carried out in order to ensure that the respondents would be able to understand the instructions and each of the items without facing any difficulties in comprehension when filling up the questionnaire. Ten respondents were selected randomly and interviewed to gain feedback on the validity of the items. Since the questionnaire is using a Likert scale, the reliability tests using Cronbach's coefficient alpha were undertaken to assess the consistency and stability of the measurement scale. The coefficient alpha for the 20 items is 0.847, suggesting that the items have relatively high internal consistency and are acceptable. Exploratory type of research, the acceptable internal reliability coefficient or alpha should be 0.5 and above [31]. Reliability coefficient of 0.70 or higher is considered acceptable in most social science research situations [32].

Dimensional sampling method is adopted in the selection of the respondents. In the study, educational background and gender are the factors that have been considered because these are the significant factors that differentiate awareness of landslide and ability in recognition of traffic signage among the respondent category. Therefore, the respondent that has an educational background either from civil engineering, geology, geography, land survey, architecture, plantation or forestry and is a male only will be selected. High income and nationality factors have not been considered because they are not relevant. Respondents that had good awareness of landslide and high ability in recognition of traffic signage are believed can give a good feedback because they are aware about the situation and also could well understanding the items in the questionnaire is the reason why the study focus to the selected respondents. There were 134 respondents selected.

The analysis of data obtained from the questionnaire was divided to two parts and analysed using Statistical Package for the Social Science (SPSS). The first part of the analysis is to determine the mean score for each item based on the level of effectiveness (Table 78.2). A t-test was carried out as the second part of the analysis to evaluate road user's perception towards landslide warning signage. The confidence level set for this analysis was 95 % whereby the acceptance and rejection of the hypothesis depended on the p-value. H_i is accepted and H_o is rejected when $p \leq 0.05$. Hypotheses used were as follows:

Hypothesis 1

H_i: Landslide warning signage should be placed to warn landslide risk to the road users.

H_o: Landslide warning signage should not be placed to warn landslide risk to the road users.

Table 78.2 Level of effectiveness

Level of effectiveness	Score
Strongly disagree	1.0–1.99
Disagree	2.0–2.99
Not sure	3.0–3.99
Agree	4.0–4.99
Strongly agree	5.0

Hypothesis 2

H_i: Landslide warning signage provides sufficient information regarding the land-slide risk.

H_o: Landslide warning signage does not provide sufficient information regarding the landslide risk.

Hypothesis 3

H_i: Landslide warning signage is able to attract the attention of the road users.

H_o: Landslide warning signage is not able to attract the attention of the road users.

Hypothesis 4

H_i: Existing landslide warning signage is appropriate.

H_o: Existing landslide warning signage is inappropriate.

Result and Discussion

The analysis of items in questionnaire is according to the mean score, while for sections, it is according to the p-value. The main aim is to investigate road user's perception towards landslide warning signage and, indirectly, to identify the weakness of landslide warning signage in order to improve it in the future.

Majority of the respondents agreed that landslide warning signage is a device that is able to provide warning of landslide risk, thus alerting road user to take extra precaution (Table 78.3). They also agreed that landslide warning signage should be placed at risk slopes and will be the most useful landslide warning device especially during raining time. Even though, they know that they will facing a landslide risk after passing by landslide warning signage, the action that should be taken still undoubted, either reduce or increase speed is the right action.

Table 78.4 indicated that landslide warning signage provides specific information which could be used to understand in detail landslide risk such as position, distance and characteristics of risk slope. In case of landslide, most of the respondents agreed that there is no information to be referred on how to manage the situation of landslide.

Table 78.3 Mean score for items in Section A (landslide warning signage should be placed to warn landslide risk to the road users)

Item	Mean score
Landslide warning signage should be placed at the risk slopes	4.48
Slopes which been placed with landslide warning signage indicate the slopes had likely more risk of landslides compared to the slopes without landslide warning signage, therefore, road users need to be careful by always watch the slopes conditions when travelling alongside that particular slopes	4.10
Landslide warning signage is able to create awareness of the landslide risk	4.22
You would feel worried when passing through the landslide warning signage	4.01
You would be careful after passing through the landslide warning signage	4.28
You would be more careful after passing through the landslide warning signage especially during raining time	4.48
You would drive slower after passing through the landslide warning signage	3.91

Table 78.4 Mean score for items in Section B (landslide warning signage provides sufficient information regarding to the landslide risk)

Item	Mean score
Landslide warning signage may indicate where the start distance of risk	3.58
Landslide warning signage may indicate where the end distance of risk	3.36
Landslide warning signage may indicate risk slopes either developed at upslope or downslope of the road	3.22
Landslide warning signage is able to give warning of landslide risk to the road users on both directions of the road	3.72
Landslide warning signage can portray the characteristics of the risk slope	3.51
Landslide warning signage provides information about related agencies to be contacted in case when landslide occurs	3.28

Respondents agreed that current practice in placing the landslide warning signage at the place beside the road should be continued because there will be no problem in seeing the signage clearly while driving. However, they agreed that it is difficult to see clearly the signage during raining time and at night. It is suggested that the location where the signage was placed is not seen as a problem to attract the attention of road users but the physical characteristics of the signage (Table 78.5).

Table 78.6 indicated that existing landslide warning signage is inappropriate. Most of respondents believed that the landslide warning signage provides the information to ensure they are safe if landslide occurred and the action that should be taken to minimise the consequence during landslide. Respondents also agreed that the physical characteristics of the signage need to be changed to make it more attractive.

Landslide warning signage is agreed as a device that is able to warn landslide risk to the road users to take extra precaution and should be placed at the risk slopes. Some aspects are suggested to be added to the signage, so that sufficient information especially about landslide risk and if landslide occurred can be provided. Besides, some aspects also need to be changed to ensure that landslide warning

Table 78.5 Mean score for items in Section C (landslide warning signage is able to attract the attention of the road users)

Item	Mean score
Landslide warning signage is placed at the location beside the road which can be seen easily	4.33
Landslide warning signage can be seen clearly during sunny day (morning to evening and without rain)	4.09
Landslide warning signage can be seen clearly when it rains	3.51
Landslide warning signage can be seen clearly at night	3.39

Table 78.6 Mean score for items in Section D (existing landslide warning signage is appropriate)

Item	Mean score
Existing landslide warning signage is able to assist road users from becoming the victims of the landslide	3.52
Existing landslide warning signage provides the appropriate and sufficient information in order to avoid the threat of landslide and facilitate the management if landslide occurs	3.09
Existing landslide warning signage is able to attract the attention of the road users without having to change its physical characteristics (shapes, dimensions, texts and colours)	3.27

Table 78.7 p-value for sections to investigate road users' perception towards landslide warning signage

Hypothesis	p-value
Landslide warning signage should be placed to warn landslide risk to the road users	0.046
Landslide warning signage provides sufficient information regarding to the landslide risk	0.060
Landslide warning signage is able to attract the attention of the road users	0.053
Existing landslide warning signage is appropriate	0.071

signage could successfully attract road users in any conditions. Table 78.7 showed the strong evidence that existing landslide warning signage needs to be improved to increase its effectiveness. There is significant relation which indicates that existing landslide warning signage is inappropriate.

Conclusion

It is clear that from the road users' perception, landslide warning signage is a device that still needs to be placed at the risk slopes because it is able to provide landslide risk warning to the road users. However, they agreed that some improvements should be made to the landslide signage to increase its effectiveness since existing landslide warning signage is inappropriate.

The aspects suggested that should be given a priority to improve landslide warning signage are as follows:

 (i) The landslide warning signage should have a medium to indicate the risk slopes either developed upslope or downslope or both sides.
 (ii) The landslide warning signage should have a medium to provide information of related agencies to be contacted in case landslide occurs.
(iii) The landslide warning signage should have a medium to indicate the start and end of the risk slope.
(iv) The landslide warning signage should have physical characteristics that can be seen clearly in any conditions including raining time and at night.
 (v) The landslide warning signage should have a medium to portray the characteristics of the risk slope.
(vi) The landslide warning signage should have a medium that could warn the road users on both directions of the road.

It is also suggested that further study should be carried out to identify the right actions that should be taken before and after passing by landslide warning signage especially during high possibility of landslide occurrence. This is to ensure the road users can avoid or unless minima adversely impacted in case landslide occurred.

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Chapter 79
Fabrication and Characterization of Porous and Nonporous $Y_3CaBa_4Cu_8O_\delta$ Superconductor

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Introduction

The current carrying properties of $Y_xCaBa_4Cu_{5+x}O_\delta$ layered crystal structure can be improved by doping with various elements between divalent cations (Ca) by many orders of magnitude [1]. The doping of alkaline-earth metal not just increases the number of holes, but lessens the current blocking effect of grain boundaries which is significant for enhancing the performance of superconducting cables to be used in long-distance transportation of electric power by minimal losses [2]. Doping the trivalent Y site in superconducting Y123 with Ca boost the certain hole concentration or positive charge carrier density along the CuO planes since Ca^{2+} has lower electrovalences compared to Y^{3+}, thus inducing the increase of J_c and irreversibility field of the material [3].

The performance of superconductor properties has been compromised due to T_c degradation via chemical interactions between the doping additions. The previous studies reveal that the partial substitution of Y^{3+} by Ca^{2+} in YBCO limited to about 20 % of yttrium lowered the T_c for the orthorhombic samples. S.K. Bandyopadhyay et al. (1997) also rectified that the calcium or hole doping in the Y^{3+} site of YBCO reduces T_c, the resistivity, and the interlayer coupling strength [4].

R. Giri et al. [5] mention that the superconducting properties in particular T_c have been found to lessen with the doping activities. XRD results indicate that orthorhombicity of

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the system degraded varied to the doping level of Ca. The disorder in CuO_2 planes induced by Ca doping in $YBa_2Cu_3O_{7-d}$ due to overdoping decreases the T_c value [2]. The defection of orthorhombic ordering through the cation doping in the basal or {001} plane is critical to superconductivity. Orthorhombicity will be reduced due to overdoping, hence the effective overlap between Cu and oxygen in the CuO plane. The orthorhombic ordering of oxygen in the CuO chain of the basal plane governs the transition from tetragonal to orthorhombic structure which determines the superconductivity properties. Tetragonal structure tends to be the insulator [1].

In this study, it is essential to have the superconducting material with the minimum loss of T_c instead of maintaining the best superconducting performance via the alignment of crystal grain boundaries by careful control through annealing and quenching temperature rates. Practical high-temperature superconductors must be textured to minimize the reduction of the critical J_c at misoriented boundaries by pinning the proper amount of calcium into grain boundaries induced by the effect of nonporous and porous structure in $Y_3CaBa_4Cu_8Oy$ ceramics.

Methodology

All samples were prepared using conventional route, solid-state reaction method, which involves a series of heating and grinding. Firstly, an appropriate amount of high purity chemicals of yttrium oxide (Y_2O_3), barium carbonate ($BaCO_3$), copper oxide (CuO), and calcium carbonate is used to prepare pure bulk samples of $Y_xCaBa_4Cu_{5+x}O_\delta$ ($x=3$). The powder and ethanol were mixed in alumina jar and milled for about 24 h in order to have properly mixed powder. The mixed powder and ethanol were dried in an oven at 120 °C for 5 h. Then the mixed powder was pulverized using an agate mortar to ensure the chemicals are well homogeneously mixed and becoming fine powder. The powder was sintered in the box furnace at 930 °C for 5 h before pulverizing it again. The powder was then pressed into pellets in particle size 20 μm. For nonporous, 2 g of powder was pressed to get a pellet instead 1.8 g of powder, and 0.2 g of sucrose was weighed and mixed together with the 2 g of powder to get a porous pellet. The pellet and porous powder mixed with sucrose needed to be sintered at 400 °C for 2 h before the execution of final sintering at 950 °C for 10 h. The materials characterizations were carried out using the resistivity measurement system in order to determine the critical temperature, T_c, and critical current, J_c. The scanning electron microscopy (SEM) was used to observe the microstructure of samples.

Result and Discussion

The resistivity behavior of the samples against temperature range as shown in Fig. 79.2b reveals a "double-transition" character previously reported in Ca-doped YBCO. The doping of Ca results in a decrease in normal resistivity as well as the
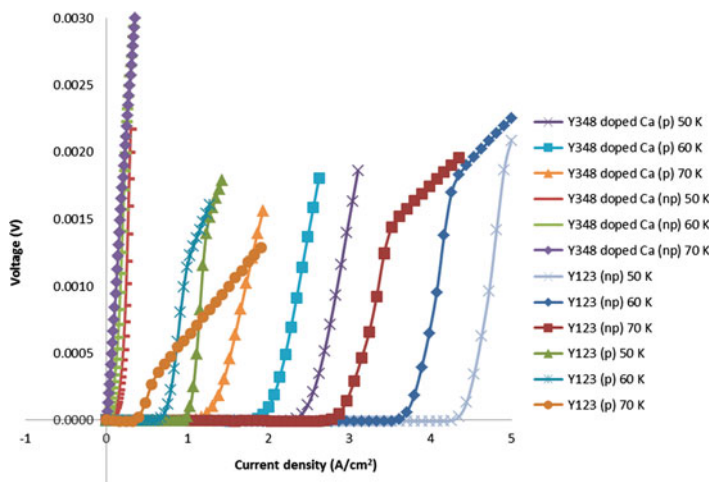
Fig. 79.1 Difference potential versus current of samples (**a**) Y₃CaBa₄Cu₈Oδ porous (*p*), (**b**) Y₃CaBa₄Cu₈Oδ nonporous (*np*), (**c**)YBa₂Cu₃Oδ nonporous (*np*), (**d**) YBa₂Cu₃Oδ porous (*p*)
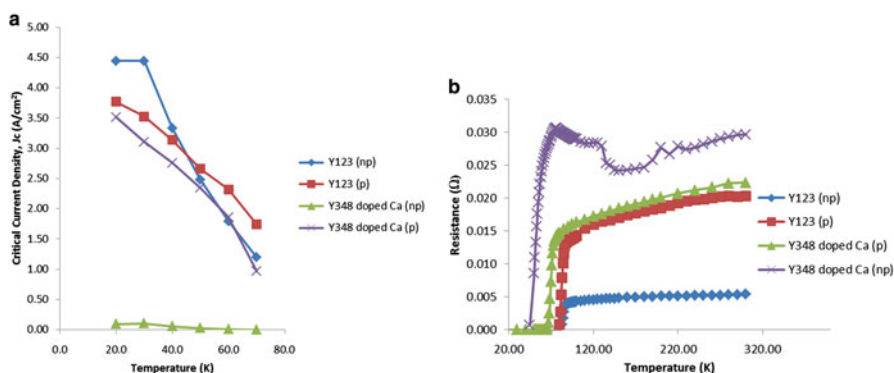

Fig. 79.2 (**a**) Critical current density versus temperature of samples. (**b**) Normalized resistance versus temperature of samples

superconducting transition temperature (T_c), around 67–65 K for porous samples significantly compared to nonporous sample. This is due to the fact that Ca doping in YBCO shrinks the misaligned region at the GBs, which is the cause of most electrical resistance, in width and height. The electrons encounter the most electrical resistance at the most misaligned regions, where the voltage barrier is wide and high. Doping YBCO with calcium causes these regions to shrink, thus inducing the current density flows in the region [2].

The maximum current that a wire can carry with zero resistance is known as its critical current density (J_c). The Y123 porous (undoped) sample shows the best
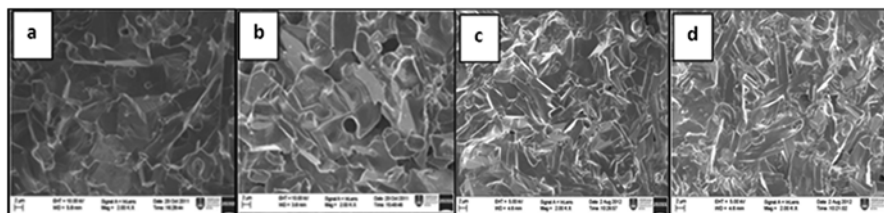
section of the sample for current transport (Jc), thus increasing the connectivity and homogenizing the surface quality of the grains. The improvement of Jc is attributed from grain connectivity and Jc distribution over the vast areas [8] (Fig. 79.1).

The grain boundaries of the samples were determined using scanning electron microscope. The pellet samples were used to determine the grain boundaries. The magnification applied was 2,000×. The range of grain boundaries of the samples was 2–6 μm. The bigger grain in the Y123 system relative to Y348 systems favors to enhance the Jc proliferation due to grain interconnection and alignment. The sample was seen uneven and in crooked shape compared to the nonporous surface in Fig. 79.3a, but roughened and separate grains are found in nonporous sample $Y_3CaBa_2Cu_8O_y$. The sucrose increases the porosity and grain boundaries (GB) of the pellets. Doping with Ca significantly influences grain microstructures. The porous $Y_3CaBa_2Cu_8O_y$ sample unveils the larger average grain size compared to nonporous sample by optical microscopy and SEM. Also, it presents increasing levels of impurities respective to Ca concentration and the continuity formation of grains, thus decreasing number of GB [9].

Conclusion

The effect of Ca doping on microstructure and electrical properties was investigated in nonporous and porous ceramics. The resistivity has been identified to decrease with porosity for both systems. The effect of Ca doping also reduces the value of T_c for most samples. Bigger grain size, minimum porosity, and less of grain boundaries is also founded with porous Y123 relative to Ca-doped Y348 systems causes Y123 porous system is the highest in terms of J_c. Existence in levels of impurities due to Ca concentration and the continuity formation of grains decrease the number of grain boundaries. The results reveal that porosity of samples induces the increasing of current density for porous structure. The optimum Jc is inducing on the range of Tc at 50 K and 60 K for Ca doping Y348. Jc distribution over the vast areas dominantly attributed due to grain connectivity via SEM which contribute to lessen the current blocking effect of grain boundaries.

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Chapter 80
Study on the Floristic Composition and Forest Structure of Heath Forest at Dungun Area in Terengganu

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Introduction

The heath forests occur predominantly along the east coast of Peninsular Malaysia where they extend down through Terengganu and Pahang and, from the aerial view, present a pattern of narrow strip parallel to the coast [1]. Heath forests, recognized by [2], are found growing near the coast on old raised sandy beaches with a podzolic profile. Only two small seminatural stands of heath forest remain in the east coast of Peninsular Malaysia. They are at Jambu Bongkok and Menchali [3]. The heath vegetation of Terengganu is a scenically unique vegetation reported to occur along the coastal plains of Kelantan and Terengganu, partly in Pahang, and part of Johor coast [4].

The canopy in heath forest is low, uniform, and usually densely closed with no trace of layering. A single emergent may occur and usually indicate extreme site conditions [5]. Heath forests grow on bleached white sands and are generally characterized by their short stature, slender trunks, thick leaves, and low species richness [6]. In the Menchali Forest Reserve, the heath dipterocarp has a generally lower stature with only a three-layered structure. The heath forest at the Jambu Bongkok Forest Reserve showed that the forest is of low stature, about 40 m, and there is a continuous canopy at about 25 m, occasionally broken by an emergent, which can reach 40 m, and the most dominant emergent is *Shorea materialis* [7].

The general floristic composition of heath forests as exemplified by the Jambu Bongkok Forest Reserve showed that the main components of the canopy and

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under canopy layers are *Aquilaria malaccensis*, *Canarium commune*, *Carallia axillaris*, *Dryobalanops aromatica*, *Barringtonia macrostachya*, *Bouea macrophylla*, *Syzygium* sp., *Pithecellobium jiringa*, and *Xerospermum* sp. The shrub layer is dominated by the thorny *Ziziphus oenoplia*, and others include saplings of *Dracaena umbritica*, *Mesua ferrea*, *Ochanostachys malaccensis*, *Vitex ovata*, and *Vitex pinnata* [7].

In the Rantau Abang Forest Reserve, Terengganu, a small patch of heath forest is dominated by well-adapted tree species such as Terentang (*Campnosperma*) and Nibung (*Oncosperma tigillarium*) (Palmae) on areas which are believed to be fertile freshwater swamp sites [4]. Trees and shrubs including *Syzygium grande*, *Syzygium gratum*, *Fagraea fragrans*, *Melaleuca cajuputi*, *Melastoma malabathricum*, *Rhodomyrtus tomentosa*, and *Vitex pinnata* were also recorded present in heath forest [8]. In areas frequently burned, *Anacardium occidentale*, *Fagraea fragrans*, *Melaleuca cajuputi* and *Melastoma malabathricum*, *Morinda citrifolia*, *Ploiarium alternifolium*, *Rhodomyrtus tomentosa*, and *Vitex pinnata* are the commonest [3].

Though heath forests are usually easy to recognize by their structure, they can vary widely in their composition (according to altitude, slope, soil depth, and water availability) and the ratio in which the species occur [9]. Sarawak and Brunei have about 80 different types of heath forests, with many more subtypes, based on their species composition [10]. The aim of this study was to characterize the floristic composition, structure, and density of heath forests in selected areas in Rantau Abang in Terengganu.

Materials and Methods

Eight plots were set at selected areas of heath forests at Tanjung Jara, Kg. Seberang Pintasan, and Kg. Rantau Abang in Terengganu (Table 80.1). In this study, each plot was subdivided into 10 subplots of 10 m × 10 m with an area of 0.01 ha. This subdivision was necessary to calculate the relative frequency (R_f) of every species enumerated in every plot. All trees with a diameter at breast height (dbh) of ≥ 5 cm (1.3 m from the ground) were measured. The dbh data is needed to determine the basal area and relative dominance (R_D) of the species. Voucher specimens of species were collected and identified by referring to the plant species collection in Universiti Kebangsaan Malaysia's Herbarium (UKMB) and later were deposited in the herbarium.

Density, abundance, frequency, basal area, and their relative measures for each species were calculated by referring to the ecological textbook from Brower and Zar [11]. The importance value (I_V) was calculated by summing the relative frequency (R_f) value, relative density (R_d) value, and relative dominance (R_D) value of each species in each plot which can range from 1 to 300 %. The importance value (I_V) of species is necessary in determining the importance of particular species in particular areas. The measurement of species diversity index was determined using Menhinick's Richness Index (R), Shannon-Weiner Diversity Index (H'), and Evenness Species Index (E).

Table 80.1 Description of the plot in each study locality in Rantau Abang

Plot	Plot size (m)	GPS location	Vegetation type
1	10 × 100	04° 47.77 N 103° 25.69 E	Secondary vegetation dominated by *Melaleuca cajuputi*
2	10 × 100	04° 47.90 N 103° 25.62 E	Secondary vegetation dominated by *Acacia auriculiformis*
3	10 × 100	04° 48.02 N 103° 25.90 E	Secondary vegetation dominated by *Acacia auriculiformis*
4	10 × 100	04° 48.25 N 103° 25.50 E	Secondary vegetation dominated by *Casuarina equisetifolia*
5	10 × 100	04° 51.25 N 103° 23.90 E	Secondary vegetation dominated by *Melaleuca cajuputi*
6	10 × 100	04° 51.26 N 103° 23.95 E	Secondary vegetation dominated by *Melaleuca cajuputi*
7	10 × 100	04° 48.46 N 103° 25.30 E	Secondary vegetation dominated by *Melaleuca cajuputi*
8	10 × 100	04° 48.45 N 103° 25.39 E	Secondary vegetation dominated by *Melaleuca cajuputi*

Results and Discussions

A total of 505 trees with a diameter at breast height (dbh) of ≥ 5 cm were recorded in eight plots with the total area of 0.8 ha belonging to 28 species in 28 genera and 22 families (Table 80.2). The species composition of the forest was simple compared with mixed dipterocarp forests. The diversity of this forest was very low. Myrtaceae was the most dominant family with a total number of 266 (52.67 %) tree individuals with 229 trees mainly contributed by *Melaleuca cajuputi* (Table 80.2).

Melaleuca cajuputi is the most dominant species by having an I_V of 105.82 % (Table 80.3). This species acts as an indicator for heath forests in the east coast area in Peninsular Malaysia. *Melaleuca cajuputi* was the locally dominant species in heath forests at Cherang Ruku, Semerak, and Kelantan [8]. Natural vegetation of bris soil is usually characterized by dominant *Melaleuca cajuputi* (Gelam) in the low-lying areas, *Rhodomyrtus tomentosa* (Kemunting), *Ficus deltoidea* (Mas Cotek), *Garcinia hombroniana* (Beruas), mixed Myrtaceae, and sedges and grasses along the coast of Terengganu [4]. The codominant species which have the second largest I_V was *Acacia auriculiformis* (Leguminosae) with an I_V of 62.69 % (Table 80.3). *Acacia* is the fire-resistant species with good regenerative powers through coppicing, thus giving it the competitive advantage to dominate the plot.

The I_V ranks species in a way as to give an indication on which species come out as an important element [12]. Based on the I_V, eight associations have been quantified using the highest and second highest I_V, respectively (Table 80.4). The classification of forest association by using the dominant and codominant I_V has been conducted in the study of structure and floristic composition of forest formation at Gunung Janing Barat, Endau Rompin [13].

Table 80.2 Percentage of species and trees by families in the study area

No.	Family	No. of species	%	No. of trees	%
1	Myrtaceae	2	6.90	266	52.67
2	Leguminosae	2	6.90	83	16.44
3	Verbenaceae	1	3.45	21	4.16
4	Guttiferae	2	6.90	20	3.96
5	Casuarinaceae	1	3.45	17	3.37
6	Pandanaceae	1	3.45	17	3.37
7	Rubiaceae	2	6.90	11	2.18
8	Anacardiaceae	3	10.34	10	1.98
9	Lecythidaceae	1	3.45	9	1.78
10	Palmae	1	3.45	8	1.58
11	Sapindaceae	1	3.45	8	1.58
12	Loganiaceae	1	3.45	7	1.39
13	Myricaceae	1	3.45	6	1.19
14	Violaceae	1	3.45	5	0.99
15	Combretaceae	1	3.45	4	0.79
16	Rhizophoraceae	1	3.45	3	0.59
17	Aquifoliaceae	1	3.45	3	0.59
18	Rutaceae	1	3.45	2	0.40
19	Myrsinaceae	1	3.45	2	0.40
20	Moraceae	1	3.45	1	0.20
21	Opiliaceae	1	3.45	1	0.20
22	Sapotaceae	1	3.45	1	0.20
	Total	28	100.0	505	100.0

In this study area, we found that there is floristic evidence of recent fire, and this is supported by the presence of species such as *Acacia auriculiformis*, *Vitex pinnata*, *Cyprus* sp., *Dianella ensifolia*, *Rhodomyrtus tomentosa*, and *Gleichenia linearis* which usually occurred after the forest experienced disturbance. This degraded forest thus provided a conducive habitat for the successful establishment of exotic introduced species of *Acacia auriculiformis*. The ability of *Acacia auriculiformis* to extend from the monsoon vine forest to the *Melaleuca* alliance can be attributed to several factors such as its hardseededness and subsequent ability to regenerate after fires, an ability to grow in exposed open sites, tolerance of adverse soil condition (especially periodic waterlogging), and its rapid early growth rate [14]. It is also possible that other genera such as *Melaleuca* and *Eucalyptus*, which are current-day ecological associates or neighbors of *A. auriculiformis*, evolved under similar environmental conditions [15].

Menhinick's Richness Index showed that the value of species richness is in the range between 0.56 and 2.20. The Evenness Species Index which was used in analyzing the species domination in each plot has a value that ranges from 0.35 to 0.86.

Table 80.3 List of relative dominance (R_D), relative density (R_d), relative frequency (R_f), and importance value (I_V) of all species

No.	Species	R_D (%)	R_d (%)	R_f (%)	I_V/300 % (%)
1	*Melaleuca cajuputi*	37.06	45.35	23.41	105.82
2	*Acacia auriculiformis*	26.94	16.24	19.51	62.69
3	*Casuarina equisetifolia*	10.59	7.33	11.71	29.63
4	*Vitex pinnata*	7.80	4.16	5.85	17.81
5	*Syzygium grande*	3.42	3.37	3.90	10.69
6	*Chassalia chartacea*	1.61	3.37	3.90	8.88
7	*Buchanania arborescens*	1.56	3.37	3.41	8.34
8	*Ploiarium alternifolium*	1.25	1.78	3.41	6.45
9	*Pandanus* sp.	1.24	1.58	2.44	5.26
10	*Myrica esculenta*	1.21	1.58	2.44	5.23
11	*Barringtonia asiatica*	0.80	1.58	1.95	4.33
12	*Guioa* sp.	0.77	1.39	1.95	4.11
13	*Oncosperma tigillarium*	0.76	1.19	1.95	3.90
14	*Ilex* sp.	0.74	1.19	1.46	3.39
15	*Anacardium occidentale*	0.70	0.99	1.46	3.15
16	*Terminalia catappa*	0.62	0.79	1.46	2.87
17	*Fagraea fragrans*	0.56	0.59	1.46	2.62
18	*Morinda citrifolia*	0.38	0.59	1.46	2.44
19	*Rinorea* sp.	0.29	0.59	0.98	1.86
20	*Ficus benjamina*	0.28	0.59	0.98	1.85
21	*Garcinia cowa*	0.26	0.59	0.98	1.83
22	*Gynotroches axillaris*	0.23	0.40	0.98	1.60
23	*Bouea macrophylla*	0.23	0.40	0.49	1.11
24	*Rapanea* sp.	0.23	0.20	0.49	0.91
25	*Melicope lunu-ankenda*	0.12	0.20	0.49	0.80
26	*Champereia manillana*	0.12	0.20	0.49	0.80
27	*Pouteria obovata*	0.12	0.20	0.49	0.80
28	*Desmodium heterocarpon*	0.11	0.20	0.49	0.80
	Total	100.00	100.00	100.00	300.00

Greater species richness and an even relative abundance are indicative of good community diversity [16]. The highest value of the Shannon-Weiner Diversity Index (H') is 1.04, while the lowest value is 0.27. Species diversity was significantly influenced by the forest structure and species composition because forest ecosystems vary greatly from place to place mainly due to the variation in biogeography, habitat, and disturbance ([17] and [18]).

These forest stands are of low stature, with a maximum height of 12 m, and its physiognomy is characteristically brownish green as mostly reflected by *Melaleuca cajuputi* trees. The forest stands have one canopy layer but occasionally broken by emergents of *Acacia auriculiformis* which can reach 11–12 m. The tree crowns

Table 80.4 Classification of forest association based on importance value (I_V)

Plot	Forest association	Dominant and codominant species	% (I_V)
Plot 1	*Melaleuca cajuputi-Acacia auriculiformis* association	*Melaleuca cajuputi*	134.58
		Acacia auriculiformis	54.38
Plot 2	*Acacia auriculiformis-Melaleuca cajuputi* association	*Acacia auriculiformis*	112.73
		Melaleuca cajuputi	76.74
Plot 3	*Acacia auriculiformis-Syzygium grande* association	*Acacia auriculiformis*	158.85
		Syzygium grande	62.60
Plot 4	*Casuarina equisetifolia-Acacia auriculiformis* association	*Casuarina equisetifolia*	115.23
		Acacia auriculiformis	69.19
Plot 5	*Melaleuca cajuputi-Fagraea fragrans* association	*Melaleuca cajuputi*	229.11
		Fagraea fragrans	28.96
Plot 6	*Melaleuca cajuputi-Syzygium grande* association	*Melaleuca cajuputi*	51.18
		Syzygium grande	48.15
Plot 7	*Melaleuca cajuputi-Acacia auriculiformis* association	*Melaleuca cajuputi*	148.59
		Acacia auriculiformis	86.62
Plot 8	*Melaleuca cajuputi-Pandanus* sp. association	*Melaleuca cajuputi*	116.81
		Pandanus sp.	61.79

are small and only reach about 2–4 m. The main components of the canopy were *Melaleuca cajuputi, Acacia auriculiformis, Syzygium grande,* and also *Casuarina equisetifolia*.

Conclusion

The flora composition in each plot did not differ much in terms of the number of species and the number of trees but was slightly different in the number of individuals in plots. Eight associations were formed according to the highest and second highest I_V. All these associations are heterogeneous forests comprising of different floristic compositions. The floristic composition of tree species of these forests indicated that they are degraded heath forests, and the presence of species such as *Acacia auriculiformis*, *Vitex pinnata*, *Cyprus* sp., *Dianella ensifolia*, *Rhodomyrtus tomentosa*, and *Gleichenia linearis* suggested that these degraded heath forests have experienced being burned in the past. This degraded forest thus provided a conducive habitat for the successful establishment of exotic introduced species of *Acacia auriculiformis*. The presence of *Pandanus odoratissimus*, *Casuarina equisetifolia*, and *Oncosperma tigillarium* also showed that these forests are part of beach vegetation.

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Chapter 81
Effect of Salinity on Growth and Cytotoxicity of Extracts from a Marine-Derived *Penicillium* sp. (LY1L5)

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Introduction

Marine-derived fungi may be defined as fungi – be they obligate or facultatively marine – that are isolated from the marine environment [1]. It is not always clear, however, whether all these isolates actually grow in this saline environment or are itinerants. For those who are active in the marine world, then osmoregulatory mechanisms must be in place. Osmoregulation is energetically costly, and it has been postulated that such fungi exhibit decreased amounts or rates of secondary metabolite production in the presence of salt [2]. Salt-dependent strains of marine-derived fungi for metabolite production have been described for *Penicillium* spp. [2]. Some studies have indicated that the production of metabolites from marine-derived fungi is sensitive to seawater concentration [3, 4]. This would have implications in drug discovery programmes using marine-derived organisms. In this study, a marine-derived *Penicillium* sp. (isolate LY1L5) showing cytotoxicity was assessed for their tolerance to salinity (0, 2, 4, 6, 8 and 10 % sea-salt concentration) with respect to their growth and cytotoxic metabolite production.

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Materials and Methods

Isolate LY1L5 was obtained from an unidentified marine invertebrates from Lyttelton Harbour, New Zealand, using adapted isolation techniques [4]. The original cultivation conditions on peptone yeast glucose agar (PYGA) medium, with temperature 25 °C, pH 7.0±0.2 and 4 % sea salt that produced the cytotoxic activity, were used as a basis to study the response of salinity to growth and production of metabolites in isolate LY1L5. Salinity in this study is expressed as sea-salt concentration (%) incorporated in the media.

The isolate was cultivated on PYGA medium (pH 7.0±0.2), and a salinity range of 0, 2, 4, 6, 8 and 10 % was used. Cultures were incubated at 25 °C, and the colony diameter (three replicates) was measured every 2 days for 30 days. Cultures were harvested after 30 days' incubation. Resultant cultures were extracted with ethyl acetate (EtOAc), and the dried extracts were dissolved in the HPLC grade methanol (MeOH) at a concentration of 1 mg/mL prior to the submission for bioassay. The extracts (1 mg/mL) were assayed for cytotoxicity against P388 cells and their metabolite production assessed by HPLC. The presence of cycloaspeptide A and α-cyclopiazonic acid was confirmed by their UV characteristics using the in-house HPLC-UV/Rt library database [5].

Results and Discussions

Cultural Characteristics and Morphology

Isolate LY1L5 was identified as *Penicillium* sp. based on the colony and morphological characteristics shown in Fig. 81.1. Cultures on Czapek medium 20–25 mm diameter on 10 days at 25 °C, mycelium white, reverse yellow or brownish. Cultures on PYGA (4 % sea salt) medium 30–35 mm diameter after 10 days at 25 °C, mycelium black, reverse greyish. Cultures on PYGA (0 % sea salt) medium 25–30 mm diameter after 10 days at 25 °C, mycelium white, reverse yellow or brownish. Stipes and metulae with smooth walls, conidiophores with two-stage-branched, biverticillate on PYGA (4 % sea salt) medium. Phialides four to eight per metulae, ampulliform, $4.0–6.0 \times 2.0–2.5$ μm; conidia spheroidal, spinose, 1.5–2.0 μm diameter, in chains with small connectives between the conidia.

Metabolite Profile

Penicillium sp. (LY1L5) produced both cycloaspeptide A and α-cyclopiazonic acid as confirmed by their UV characteristics. Its metabolite profile was compared with those *Penicillium* spp. reported to produce cycloaspeptide A (five species) and α-cyclopiazonic acid (six species) (see Table 81.1). The comparison showed that none of the 11 *Penicillium* spp. produced both cycloaspeptide A and α-cyclopiazonic acid [6, 7].
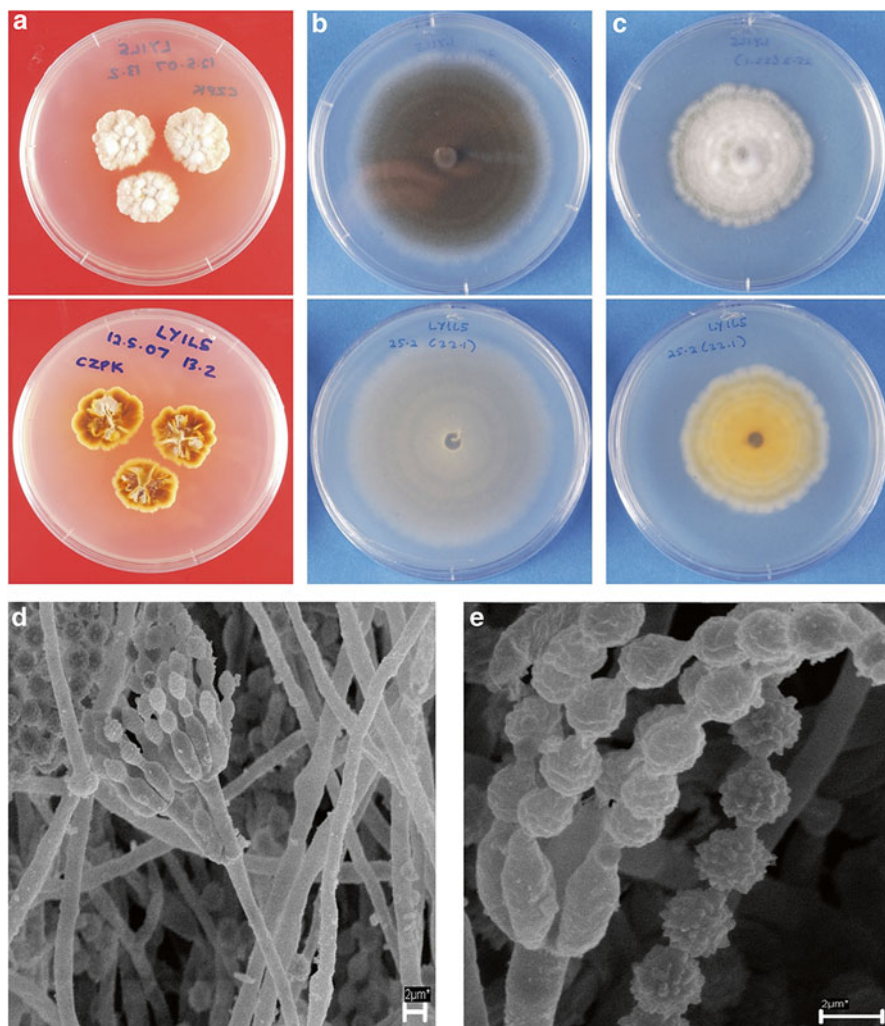
Fig. 81.1 Colony and morphological characteristics of *Penicillium* sp. (LY1L5); (**a**) colonies on Czapek medium at 25 °C, 10 days; (**b**) colonies on PYGA (4 % sea salt) medium at 25 °C, 30 days; (**c**) colonies on PYGA (0 % sea salt) medium at 25 °C, 30 days; (**d–e**) SEM of conidiophores and conidia on PYGA (4 % sea salt) medium at 25 °C, 10 days; (**d**) conidiophores; (**e**) conidia

Effect of Salinity on Growth and Production of Metabolites

The growth of *Penicillium* sp. (LY1L5) was enhanced in the presence of salt (Fig. 81.2), but the growth decreased at 10 % salinity. Growth rate declined after 18–20 days' incubation. The cytotoxicity of extracts is shown in Table 81.2. This isolate showed better IC$_{50}$ values at salinity of 4 and 6 %, but was not active in

Table 81.1 Comparison of secondary metabolite profile of *Penicillium* sp. (LY1L5) with the reported *Penicillium* spp. producing cycloaspeptide A and α-cyclopiazonic acid

Penicillium spp.	Cycloaspeptide A	α-cyclopiazonic acid
Penicillium sp. (LY1L5)	+	+
P. jamesonlandense	+	
P. ribeum	+	
P. lanosum	+	
P. soppii	+	
P. algidum	+	
P. camemberti		+
P. commune		+
P. dipodomyicola		+
P. griseofulvum		+
P. patulum		+
P. palitans		+
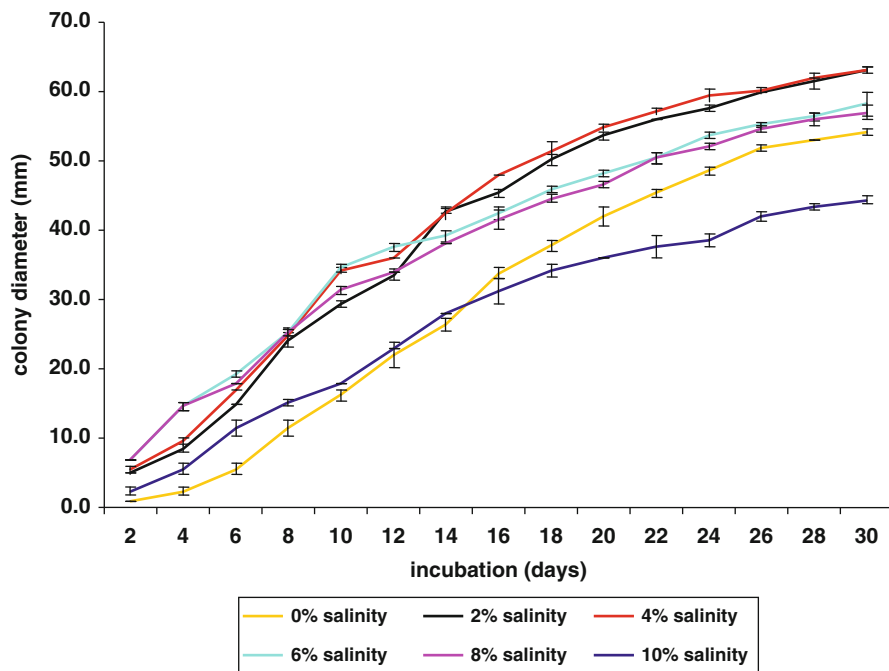
Fig. 81.2 Effect of salinity on growth of *Penicillium* sp. (LY1L5) on PYGA medium (pH 7.0±0.2; 25 °C)

the absence of salt. All extracts showed traces of cycloaspeptide A. Traces of the cytotoxic α-cyclopiazonic acid were detected only in five active extracts (F5975-B, F5975-C, F5975-D, F5975-E and F5975-F) but none in the inactive extract (F5975-A).

Table 81.2 Effect of salinity on cytotoxicity of *Penicillium* sp. (LY1L5) on PYGA medium (pH 7.0 ± 0.2; 25 °C; 30 days)

Salinity (%)	Extracts	Cytotoxicity against P388 cells IC$_{50}$ (ng/mL)	ELSD traces of cycloaspeptide A	ELSD traces of α-cyclopiazonic acid
0	F5975-A	>12,500	+	–
2	F5975-B	7,976	+	+
4	F5975-C	6,664	+	+
6	F5975-D	6,664	+	+
8	F5975-E	7,741	+	+
10	F5975-F	9,837	+	+

Discussions

The effect of salinity on the growth of a marine-derived *Penicillium* sp. (LY1L5) reflects the observations made on an algal-derived *P. dravuni* [8] that also showed greater growth with increasing salinity up to a level of 10 % NaCl. A study on a sponge-derived isolate of *Penicillium* sp. showed that growth was not affected by seawater concentrations [3]. The effect of salinity on bioactivity of marine-derived *Penicillium* spp. has been described where three *Penicillium* spp. exhibited increasing antimicrobial activity with increasing concentrations of artificial seawater [2]. A few studies have been reported on the effect of salinity on bioactivity of other marine-derived fungi. Three marine-derived *Aspergillus* spp. and an unidentified marine fungus showed enhanced antibacterial activity in the presence of seawater [3].

Cycloaspeptide A has only been found in five species of psychrotolerant *Penicillium*, namely, *P. ribeum* [7, 9], *P. algidum* [10], *P. jamesonlandense*, *P. lanosum* and *P. soppii* [7]. It was noted in this study that the ELSD traces of cycloaspeptide A in isolate LY1L5 were more prominent than the cytotoxic α-cyclopiazonic acid at all ranges of salinity (0–10 %). The consistency in cycloaspeptide A production by this isolate was similar to those reported for the cold-tolerant strains of *Penicillium*. Based on this, isolate LY1L5 is suggested to have a closer association with the groups of *Penicillium* that produced cycloaspeptide A. Isolate LY1L5 has small, spinose conidia unlike the α-cyclopiazonic acid producers that have bigger, smooth-walled conidia. Similarly, isolate LY1L5 could not be matched with other cycloaspeptide A-producing *Penicillia*. Hence, further work needs to be conducted to identify the species of isolate LY1L5.

Conclusion

The results from this study showed that salinity affected the growth of *Penicillium* sp. (LY1L5); however, a more extensive study needs to be done to obtain more comprehensive results because growth may also be dependent upon other parameters

such as temperature whether or not adaptation by the fungi to salinity has occurred. The findings also showed that naturally occurring metabolites of marine-derived microorganisms have a great potential to produce metabolites enabling the discovery of new bioactive metabolites and hence merit future studies.

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Chapter 82
Physical and Optical Properties of PBT:Nd^{3+} Glass System

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Introduction

The interesting fact about the glass is that it acquires many unique properties such as high hardness and transparent and excellent corrosion resistance. Recently, lanthanide-doped glasses or, in particular, Nd^{3+} ion-doped tellurite glasses have been a great deal of interest due to their potential applications in many optical devices such as upconversion lasers, sensors, telecommunications, display devices, biological labeling, and solar near-infrared concentration for photovoltaic exploitation [1].

Due to some of their important characteristic features, such as high refractive index, low phonon maxima, and low melting point, tellurite glasses are very promising materials for laser and nonlinear applications in optics [2]. It is known as a conditional glass former that needs modifier ions to form the glassy state easily. The role of modifier oxides in the vitreous transition of tellurite melts is extremely important unlike traditional glass former such as P$_2$O$_5$, SiO$_2$, and B$_2$O$_3$ [3].

In upconversion (UC) phenomenon, two or more low-energy excitation (absorbed) photons turn out in one higher-energy (emitted) photon. Different materials have different ranges for UC emission. Rare earth materials show upconversion from near infrared to UV/visible range. These materials can be used for various applications as upconversion phosphors, fluorescent labels, infrared detectors, 3D display, etc. Different combinations of optically active rare earth materials can serve the purpose of upconversion in required range for a special application. A suitable

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host material is another necessity for good crystallization as well as UC emission. Oxide glass has shown excellent physical and chemical stability, and hence, they are quite suitable to work as host matrix [4].

The objectives of the present work are to study the absorption and luminescence spectra of Nd^{3+}-doped tellurite glass. The detailed analysis of emission spectra excited by continuous wave (cw) as well as their energy level is discussed and presented.

Experimental Procedure

Nd^{3+}-doped PBT glass of the system $80TeO_2$-$(10-x)B_2O_3$-$10PbO$-xNd_2O_3 ($x = 0$, 0.5, 1.0, 1.5, 2.0, 2.5 mol%) has been prepared by conventional melt-quenched techniques. The batches of 10 g sample is form from the starting materials TeO_2 (99.9 % purity), PbO (99 % purity), B_2O_3 (99.8 % purity), and Nd_2O_3 (99.99 % purity). The powder is well mixed to ensure the homogeneity of the samples before being melted in a furnace box at temperature of 1,000 °C for 30 min. After the required viscosity was achieved, the molten is then casted on a preheated metal plate before being annealed at 500 °C for 5 h to avoid thermal shock. Samples are being allowed to cool down slowly to room temperature in the furnace. The samples are then polished for the physical and spectroscopic measurement.

For the XRD characterization, some of the samples were crushed into powder using an agate pestle mortar. The density was measured at room temperature by Archimedes method, as the distilled water is used as the immersion liquid. The absorption spectra of PBT:Nd^{3+} glasses were recorded in the range of 400–900 nm intervals using Shimadzu 3,101 UV-VIS-NIR scanning spectrophotometer. Meanwhile, the emission spectra were identified using photoluminescence spectrophotometer in the range of 200–900 nm.

Results and Discussion

Apparently, the glasses are in a good quality as visualized as they show no sign of devitrification. Physically, it is found that the glass shows clear and transparent behavior in nature. The glass system tends to alter the coloration of the glass from light green to dark green. Table 82.1 shows the results of densities and molar volumes for PBT:Nd^{3+} glasses. As depicted in Fig. 82.1, the density shows increment trend from 5.1447 to 5.2830 g/cm³ with respect to Nd^{3+} ion content. It might be due to the molecular weight of neodymium, which is higher than boron. The similar trends of results have also been obtained by Azman et al. [5]. Meanwhile, increment in density has a strong relation to the variation in molar volume. An addition of Nd (atomic radii ~ 2.06) to replace B (atomic radii ~ 0.87) will increase the free volume of the steps networking [6], the molar volume is found to increase from 30.51 to

Table 82.1 Density and molar volume of TeO₂-B₂O₃-PbO-Nd₂O₃ glasses

Sample	Density, ρ [g cm^{-3}]	Molar volume, V_m [cm^3 mol^{-1}]	Remarks
S1	5.1447	30.51	Light green
S2	5.1448	30.77	Light green
S3	5.1487	31.00	Light green
S4	5.2372	30.73	Green
S5	5.2682	30.81	Dark green
S6	5.2830	30.97	Dark green
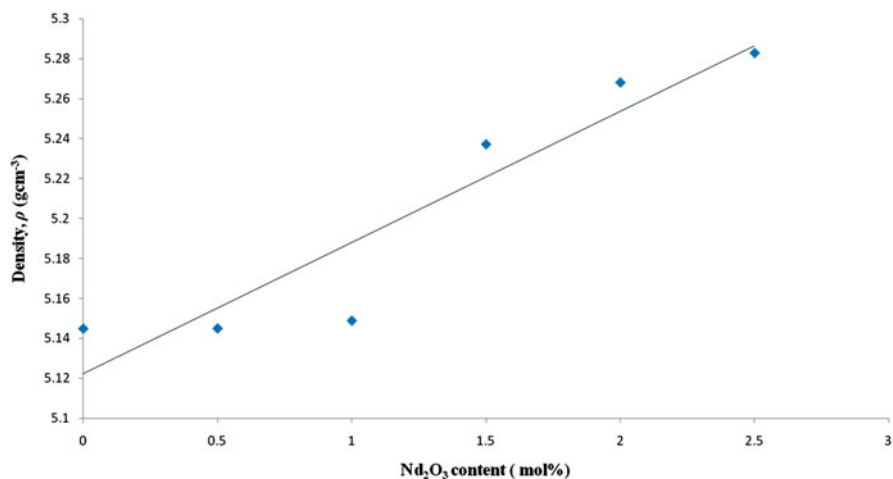
Fig. 82.1 A plot of density, ρ, against Nd₂O₃ (mol%) content

31.0 cm³/mol as the Nd³⁺ ions increase from 0 to 1.0 mol%. However, the results dropped slightly from 31.0 to 30.73 cm³/mol as the Nd³⁺ content varies from 1.0 to 1.5 mol% before starting to increase from 30.73 to 30.97 cm³/mol in the range between 1.5 and 2.0 mol% of Nd³⁺. Overall, the molar volumes increase with respect to mol % of Nd³⁺ content (Fig. 82.2).

Figure 82.3 shows XRD patterns of Nd³⁺-doped borotellurite glass system. From the results, the patterns of all samples show broad humps over the region 20–37° for 2θ values, which confirm the amorphous nature in the glass characteristics since no peaks will be observed in the diffraction pattern [7, 8].

Figure 82.4 shows a result of absorption spectra of PBT:Nd³⁺ ion glass ranging from 400 to 900 nm. As depicted in Fig. 82.4, the borotellurite glasses show a strong absorption in the range 500–550 nm and 650–700 nm by which the most intense transition is centered at 584 nm attributed from $^4I_{9/2}$ to $^4G_{5/2}$ transition. For all glass samples, six excited levels are observed around 11,389 cm^{-1}, 12,422 cm^{-1}, 13,387 cm^{-1}, 14,641 cm^{-1}, 17,123 cm^{-1}, and 19,048 cm^{-1} which correspond to the transition from ground state of $^4I_{9/2}$ to the excited state of $^4F_{3/2}$, $^4F_{5/2}$, $^4F_{7/2}$, $^4F_{9/2}$, $^4G_{5/2}$,
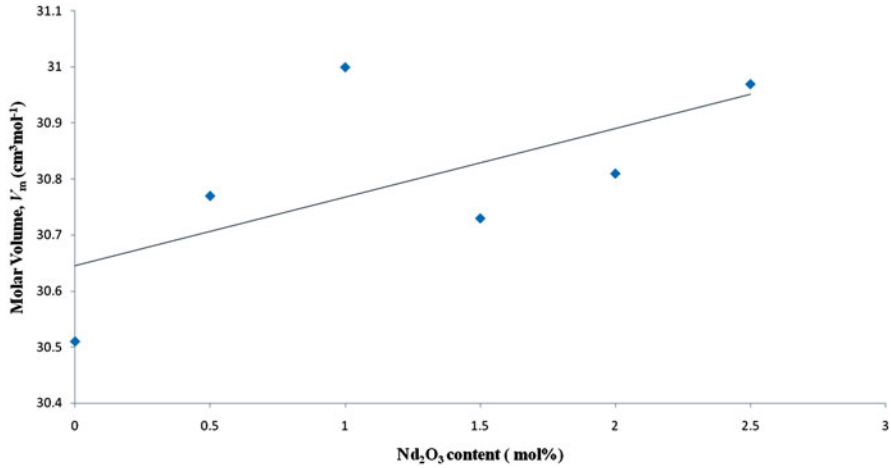
Fig. 82.2 A plot of molar volume, V_m, against Nd_2O_3 (mol%) content
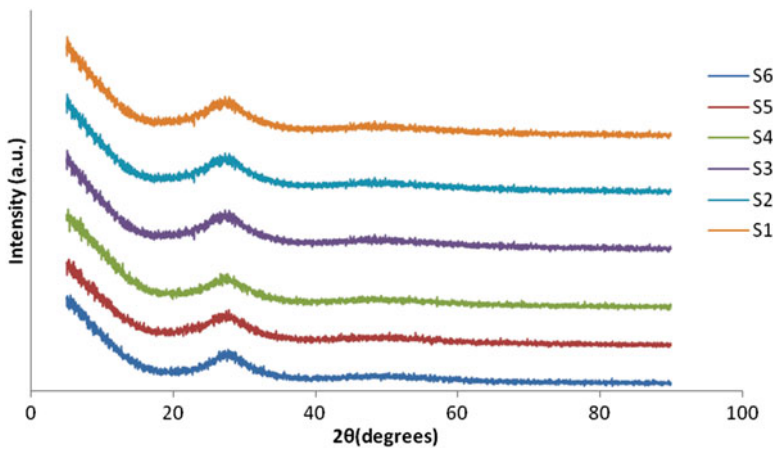
Fig. 82.3 XRD pattern of borotellurite glass system

and $^4F_{9/2}$, respectively. These results are in agreement with Soulard et al. [9] who found the similar absorption peaks of Nd^{3+}-doped glass [9]. It is clearly seen as the very strong band between 550 and 850 nm wavelength which is due to the host glass absorption. The absorption spectra show the same features for each glass sample, and there is no difference in the peaks as observed.

Figure 82.5 shows typical upconversion emission and photoluminescence spectra for Nd^{3+}-doped lead borotellurite glass. From the result, it is clearly seen that there are four distinctive emission bands centered at 485, 560, 605, and 689 nm which are assigned to the transition of $^4G_{9/2} \rightarrow {}^4I_{9/2}$, $^4G_{5/2} \rightarrow {}^4I_{9/2}$, $^2H_{11/2} \rightarrow {}^4I_{9/2}$, and $^4F_{7/2} \rightarrow {}^4I_{9/2}$, respectively. From these emission bands, a possibility of the blue,
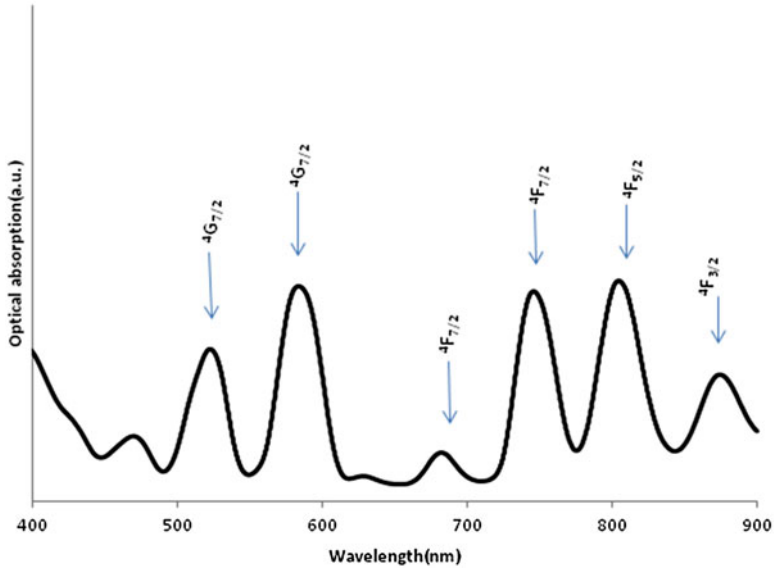
Fig. 82.4 A typical absorption spectra of PBT:Nd^{3+} ion glass
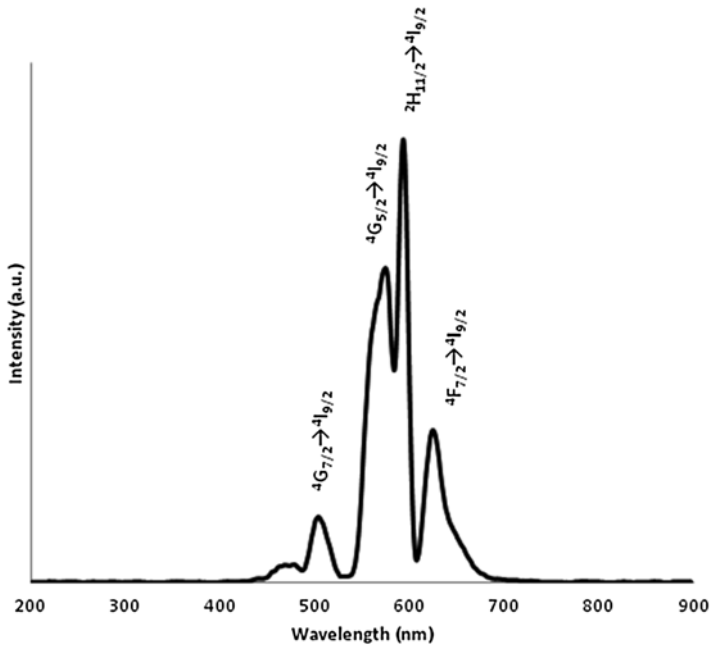
Fig. 82.5 A typical luminescence spectrum of the PBT:Nd^{3+} ion glass under excitation at 584 nm

Fig. 82.6 Energy level diagram of upconversion luminescence of the Nd^{3+}-doped PBT glass under the 584 nm excitation

green, and red emission should be noticed. From these spectra, three emission peaks are found in the visible region with strong emission spectra centered at 485 nm ($^4G_{9/2} \rightarrow {}^4I_{9/2}$), 560 nm ($^4G_{5/2} \rightarrow {}^4I_{9/2}$), and 605 nm ($^2H_{11/2} \rightarrow {}^4I_{9/2}$). Meanwhile, a weak emission spectrum centered at 689 nm ($^4F_{7/2} \rightarrow {}^4I_{9/2}$) peak is observed in the near-infrared (NIR) region.

A mechanism of the upconversion process for the Nd^{3+}-doped PBT glass process could be explained from the energy level diagram in Fig. 82.6. From Fig. 82.6, a resonant pump photon at 584 nm promotes the ion population from the $^4I_{9/2}$ ground state to the $^4G_{5/2}$ excited state level through the ground-state absorption (GSA) process. Then the excited Nd^{3+} ions are non-radiatively relax to the metastable $^2H_{11/2}$ before a second pump photon resonantly excites the Nd^{3+} ions to the $^4G_{7/2}$ excited level. The ions that populated the $^4G_{7/2}$ are unstable by which some of the ions are relaxed non-radiatively to their respective energy level. The radiative emission spectra are found centered at 485 nm, 560 nm, 605 nm, and 689 nm which correspond to the transition from $^4G_{9/2} \rightarrow {}^4I_{9/2}$, $^4G_{5/2} \rightarrow {}^4I_{9/2}$, $^2H_{11/2} \rightarrow {}^4I_{9/2}$, and $^4F_{7/2} \rightarrow {}^4I_{9/2}$, respectively. These emission spectra are observed in the visible range that yielded strong blue, green, and red emission spectra [10].

Conclusion

Nd^{3+}-doped lead borotellurite (PBT:Nd^{3+}) glasses have successfully been synthesized by using conventional method. Amorphous nature of the host glass was confirmed by XRD. The glass density and the molar volume show increment trend with the increase of Nd$_2$O$_3$ content, respectively. From the studies, five significant absorption peaks centered at 525 nm, 584 nm, 683 nm, 747 nm, 805 nm, and 878 nm wavelengths have been observed. Meanwhile, the spectral emission peaks are found to center at 485 nm, 560 nm, 605 nm, and 689 nm, respectively; thus, the yellow, green, and red spectra could be expected.

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Chapter 83
On the Ochiai Index with Hurwicz Criterion in Ranking Fuzzy Numbers

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Introduction

In a fuzzy environment, the ranking of fuzzy numbers (FNs) plays an important role in practical use and has become a prerequisite procedure for a decision-making problem. In fuzzy decision analysis, FNs are employed to describe the performance of alternatives, and the selection of alternatives will eventually lead to the ranking of corresponding FNs. However, ranking of FNs is not an easy task since FNs are represented by possibility distribution and they can overlap with each other.

Various methods for ranking fuzzy numbers (RFNs) have been developed such as distance index by [1], signed distance by [2, 3], area index by [4], and centroid index by [5]. However, no method can rank FNs satisfactorily in all cases and situations [6]. Some methods are limited to normal and trapezoidal shapes of FNs and only consider neutral decision-makers' view. There are also methods that cannot distinguish the ranking of FNs having the same mode and symmetric spread, and some methods produce non-discriminate and nonintuitive results.

In this paper, a new method for RFNs based on Ochiai index and Hurwicz criterion is proposed. Ochiai is a similarity measure index and Hurwicz is a criterion for decision-making that compromises between the optimistic and pessimistic criteria. Thus, the proposed ranking method considers all types of decision-makers' view such as optimistic, neutral, and pessimistic which is crucial in solving decision-making problems.

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This paper is organized as follows. Section "Preliminaries" contains basic concepts and notations used in the remaining parts of the paper. In section "New Method for Ranking Fuzzy Numbers," the new ranking method based on Ochiai index and Hurwicz criterion is proposed. Two observations on the new ranking method are presented in section "Observations on the Ochiai with Hurwicz Criterion Ranking Index." Section "Numerical Examples" presents some numerical examples to illustrate the advantages of the proposed method. The paper ends with a conclusion in section "Conclusion."

Preliminaries

In this section, some basic concepts and definitions on FNs are reviewed from the literature.

Definition 1

A fuzzy number is a fuzzy set in the universe of discourse X with the membership function defined as [7]

$$\mu_A(x) = \begin{cases} \mu_A^L(x) & , a \le x \le b \\ w & , b \le x \le c \\ \mu_A^R(x) & , c \le x \le d \\ 0 & , \text{otherwise} \end{cases}.$$

where $\mu^L{}_A : [a,b] \to [0,w]$, $\mu^R{}_A : [c,d] \to [0,w]$, $w \in (0,1]$, $\mu^L{}_A$ and $\mu^R{}_A$ denote the left and the right membership functions of the fuzzy number A.

The membership function μ_A of a fuzzy number A has the following properties:

1. μ_A is a continuous mapping from the universe of discourse X to $[0,w]$.
2. $\mu_A(x) = 0$ for $x < a$ and $x > d$.
3. $\mu_A(x)$ is monotonic increasing in $[a,b]$.
4. $\mu_A(x) = w$ for $[b,c]$.
5. $\mu_A(x)$ is monotonic decreasing in $[c,d]$.

If the membership function $\mu_A(x)$ is a piecewise linear, then A is called as a trapezoidal fuzzy number with membership function defined as

$$\mu_A(x) = \begin{cases} w\left(\dfrac{x-a}{b-a}\right) & , a \le x \le b \\ w & , b \le x \le c \\ w\left(\dfrac{d-x}{d-c}\right) & , c \le x \le d \\ 0 & , \text{otherwise} \end{cases}$$

and denoted as $A = (a, b, c, d; w)$. If $b = c$, then the trapezoidal becomes a triangular fuzzy number denoted as $A = (a, b, d; w)$.

Definition 2

Let A_1 and A_2 be two fuzzy numbers with $A_{1_\alpha} = \left[a_\alpha^-, a_\alpha^+ \right]$ and $A_{2\alpha} = [b_\alpha^-, b_\alpha^+]$ be their α-cuts with $\alpha \in [0, 1]$ [8]. The fuzzy maximum of A_1 and A_2 by the α-cuts method is defined as

$$\left[MAX \left(A_1, A_2 \right) \right]_\alpha = \left[\max \left(a_\alpha^-, b_\alpha^- \right), \max \left(a_\alpha^+, b_\alpha^+ \right) \right].$$

The fuzzy minimum of A_1 and A_2 is defined as

$$\left[MIN \left(A_1, A_2 \right) \right]_\alpha = \left[\min \left(a_\alpha^-, b_\alpha^- \right), \min \left(a_\alpha^+, b_\alpha^+ \right) \right].$$

Definition 3

Let $A_1 = (a_1, b_1, c_1, d_1; h_1)$ and $A_2 = (a_2, b_2, c_2, d_2; h_2)$ be two trapezoidal fuzzy numbers [9]. The fuzzy maximum of A_1 and A_2 by the second function principle is defined as

$$MAX \left(A_1, A_2 \right) = \left(a, \ b, \ c, \ d; \ h \right)$$

where

$h = \min\{h_1, \ h_2\}$, $T = \{\max(a_1, a_2), \max(a_1, d_2), \max(d_1, a_2), \max(d_1, d_2)\}$, $T_1 = \{\max(b_1, b_2), \max(b_1, c_2), \max(c_1, b_2), \max(c_1, c_2)\}$, $a = \min \ T$, $b = \min \ T_1$, $c = \max \ T_1$, $d = \max \ T$, $\min \ T \leq \min \ T_1$ and $\max \ T_1 \leq \max \ T$.

The fuzzy minimum of A_1 and A_2 is defined as

$$MIN \left(A_1, A_2 \right) = \left(a, \ b, \ c, \ d; \ h \right)$$

where

$h = \min\{h_1, \ h_2\}$, $T = \{\min(a_1, a_2), \min(a_1, d_2), \min(d_1, a_2), \min(d_1, d_2)\}$, $T_1 = \{\min(b_1, b_2), \min(b_1, c_2), \min(c_1, b_2), \min(c_1, c_2)\}$, $a = \min \ T$, $b = \min \ T_1$, $c = \max T_1$, $d = \max \ T$, $\min \ T \leq \min \ T_1$ and $\max \ T_1 \leq \max \ T$.

Definition 4

The cardinality of a fuzzy number A in the universe of discourse X is defined as [10]

$$|A| = \int_X \mu_A \left(x \right) dx.$$

New Method for Ranking Fuzzy Numbers

The new ranking method is developed based on [11] with similarity measure index defined as

$$S_O(X,Y) = \frac{f(X \cap Y)}{\sqrt{f(X \cap Y) + f(X - Y)}\sqrt{f(X \cap Y) + f(Y - X)}}$$

and reduced to $S_O(X,Y) = \dfrac{f(X \cap Y)}{\sqrt{f(X)}\sqrt{f(Y)}}$ or known as Ochiai index.

Typically, the function f is taken to be the cardinality function. The objects X and Y described by the features are replaced with FNs A and B which are described by the membership functions. The fuzzy Ochiai is defined as

$$S_O(A,B) = \frac{|A \cap B|}{\sqrt{|A|}\sqrt{|B|}},$$

where $|A|$ denotes the scalar cardinality of fuzzy number A. $\cap$ and $\cup$ are the t-norm and s-norm, respectively. The fuzzy Ochiai ranking index with Hurwicz criterion is presented as follows:

Step 1: For each pair of the FNs A_i and A_j, find the fuzzy maximum and fuzzy minimum of A_i and A_j. The fuzzy maximum and fuzzy minimum can be obtained by the α-cuts method for normal FNs and the second function principle for non-normal FNs.

Step 2: Calculate the evidences of $E(A_i \succ A_j)$, $E(A_j \prec A_i)$, $E(A_j \succ A_i)$ and $E(A_i \prec A_j)$ which are defined based on fuzzy Ochiai index as

$$E\left(A_i \succ A_j\right) = S_O\left(MAX\left(A_i, A_j\right), A_i\right),$$

$$E\left(A_j \prec A_i\right) = S_O\left(MIN\left(A_i, A_j\right), A_j\right),$$

$$E\left(A_j \succ A_i\right) = S_O\left(MAX\left(A_i, A_j\right), A_j\right),$$

$$E\left(A_i \prec A_j\right) = S_O\left(MIN\left(A_i, A_j\right), A_i\right),$$

where $S_O\left(A_i, A_j\right) = \dfrac{|A_i \cap A_j|}{\sqrt{|A_i|}\sqrt{|A_j|}}$ is the fuzzy Ochiai index and $|A_i|$ denotes the scalar cardinality of fuzzy number A_i.

To simplify, C_{ij} and c_{ji} are used to represent $E(A_i \succ A_j)$ and $E(A_j \prec A_i)$, respectively. Likewise, C_{ji} and c_{ij} are used to denote $E(A_j \succ A_i)$ and $E(A_i \prec A_j)$ respectively.

Step 3: Calculate the total evidences $E_{total}(A_i \succ A_j)$ and $E_{total}(A_j \succ A_i)$ which are defined based on the Hurwicz criterion concept as

$$E_{total}\left(A_i \succ A_j \right) = \beta C_{ij} + \left(1 - \beta \right) c_{ji} \tag{83.1}$$

$$E_{total}\left(A_j \succ A_i \right) = \beta C_{ji} + \left(1 - \beta \right) c_{ij} \tag{83.2}$$

$\beta \in [0, 0.5)$, $\beta = 0.5$ and $\beta \in (0.5, 1]$ represent pessimistic, neutral, and optimistic criteria, respectively.

To simplify, $E_O(A_i, A_j)$ and $E_O(A_j, A_i)$ are used to represent $E_{total}(A_i \succ A_j)$ and $E_{total}(A_j \succ A_i)$, respectively.

Step 4: For each pair of the FNs, compare the total evidences in Step 3 which will result the ranking of two FNs A_i and A_j as follows:

1. $A_i \succ A_j$ if and only if $E_O \left(A_i , A_j \right) > E_O \left(A_j , A_i \right)$ ⠀⠀⠀⠀⠀⠀⠀⠀(83.3)
2. $A_i \prec A_j$ if and only if $E_O \left(A_i , A_j \right) < E_O \left(A_j , A_i \right)$ ⠀⠀⠀⠀⠀⠀⠀⠀(83.4)
3. $A_i \approx A_j$ if and only if $E_O \left(A_i , A_j \right) = E_O \left(A_j , A_i \right)$ ⠀⠀⠀⠀⠀⠀⠀⠀(83.5)

Observations on the Ochiai with Hurwicz Criterion Ranking Index

The ranking results of the proposed method were observed based on the values of d_{ij}, β_{ij}, n_{ij} and Equations (3.1), (3.2), (3.3), (3.4), and (3.5), with $d_{ij} = C_{ij} - c_{ji} - C_{ji} + c_{ij}$, $n_{ij} = c_{ij} - c_{ji}$ and $\beta_{ij} = \dfrac{c_{ij} - c_{ji}}{d_{ij}}$. The observation can be divided into six cases as follows.

Case 1:

Let $d_{ij} \neq 0$, $\beta = \beta_{ij}$ and $\beta_{ij} \in [0, 1]$.

Since $\beta_{ij} = \dfrac{c_{ij} - c_{ji}}{d_{ij}}$ we have

$$\beta = \frac{c_{ij} - c_{ji}}{d_{ij}} = \frac{c_{ij} - c_{ji}}{C_{ij} - c_{ji} - C_{ji} + c_{ij}},$$

$\beta(C_{ij} - c_{ji} - C_{ji} + c_{ij}) = c_{ij} - c_{ji}$, and rearranging the equation will give

$\beta C_{ij} + (1 - \beta) c_{ji} = \beta C_{ji} + (1 - \beta) c_{ij}$ which implies $E_O(A_i \succ A_j) = E_O(A_j \succ A_i)$

and, therefore, $A_i \approx A_j$.

Thus, if $d_{ij} \neq 0$, $\beta = \beta_{ij}$ and $\beta_{ij} \in [0, 1]$, then $A_i \approx A_j$.

Case 2:

Let $d_{ij} \neq 0$, $\beta > \beta_{ij}$ and $\beta_{ij} \in (-\infty, 1)$.

Since $\beta_{ij} = \dfrac{c_{ij} - c_{ji}}{d_{ij}}$ we have $\beta > \dfrac{c_{ij} - c_{ji}}{d_{ij}} = \dfrac{c_{ij} - c_{ji}}{C_{ij} - c_{ji} - C_{ji} + c_{ij}}$.

For $d_{ij} < 0$,
$\beta(C_{ij} - c_{ji} - C_{ji} + c_{ij}) < c_{ij} - c_{ji}$, and rearranging the inequality will give
$\beta\, C_{ij} + (1 - \beta)c_{ji} < \beta\, C_{ji} + (1 - \beta)c_{ij}$ which implies $E_O(A_i > A_j) < E_O(A_j > A_i)$
and, therefore, $A_i < A_j$.
For $d_{ij} < 0$,
$\beta(C_{ij} - c_{ji} - C_{ji} + c_{ij}) > c_{ij} - c_{ji}$, and rearranging the inequality will give
$\beta\, C_{ij} + (1 - \beta)\, c_{ji} > \beta\, C_{ji} + (1 - \beta)\, c_{ij}$ which implies $E_O(A_i > A_j) > E_O(A_j > A_i)$
and, therefore, $A_i > A_j$.
Thus,

1. If $d_{ij} > 0$, $\beta > \beta_{ij}$ and $\beta_{ij} \in (-\infty, 1)$, then $A_i > A_j$.
2. If $d_{ij} < 0$, $\beta > \beta_{ij}$, and $\beta_{ij} \in (-\infty, 1)$, then $A_i < A_j$.

Case 3:

Let $d_{ij} \neq 0$, $\beta < \beta_{ij}$ and $\beta_{ij} \in (0, +\infty)$.

Since $\beta_{ij} = \dfrac{c_{ij} - c_{ji}}{d_{ij}}$ we have $\beta < \dfrac{c_{ij} - c_{ji}}{d_{ij}} = \dfrac{c_{ij} - c_{ji}}{C_{ij} - c_{ji} - C_{ji} + c_{ij}}$.

For $d_{ij} > 0$,
$\beta(C_{ij} - c_{ji} - C_{ji} + c_{ij}) < c_{ij} - c_{ji}$, and rearranging the inequality will give
$\beta\, C_{ij} + (1 - \beta)\, c_{ji} < \beta\, C_{ji} + (1 - \beta)\, c_{ij}$ which implies $E_O(A_i > A_j) < E_O(A_j > A_i)$
and, therefore, $A_i < A_j$.
For $d_{ij} < 0$,
$\beta(C_{ij} - c_{ji} - C_{ji} + c_{ij}) > c_{ij} - c_{ji}$, and rearranging the inequality will give
$\beta\, C_{ij} + (1 - \beta)\, c_{ji} > \beta\, C_{ji} + (1 - \beta)\, c_{ij}$ which implies $E_O(A_i > A_j) > E_O(A_j > A_i)$
and, therefore, $A_i > A_j$.
Thus,

1. If $d_{ij} > 0$, $\beta < \beta_{ij}$, and $\beta_{ij} \in (0, +\infty)$, then $A_i < A_j$.
2. If $d_{ij} < 0$, $\beta < \beta_{ij}$, and $\beta_{ij} \in (0, +\infty)$, then $A_i > A_j$.

Case 4:

Let $d_{ij} = 0$ and $n_{ij} > 0$.
Then, for all $\beta \in [0, 1]$,

$$\beta d_{ij} < n_{ij} .$$

Since $d_{ij} = C_{ij} - c_{ji} - C_{ji} + c_{ij}$ and $n_{ij} = c_{ij} - c_{ji}$, then
$\beta(C_{ij} - c_{ji} - C_{ji} + c_{ij}) < c_{ij} - c_{ji}$, and rearranging the inequality will give

$\beta C_{ij} + (1-\beta)c_{ji} < \beta C_{ji} + (1-\beta)c_{ij}$ which implies $E_O(A_i \succ A_j) < E_O(A_j \succ A_i)$ and, therefore, $A_i \prec A_j$.

Thus, if $d_{ij} = 0$ and $n_{ij} > 0$, then for all $\beta \in [0, 1]$, $A_i \prec A_j$.

Case 5:

Let $d_{ij} = 0$ and $n_{ij} < 0$. Then, for all $\beta \in [0, 1]$,

$$\beta d_{ij} > n_{ij}.$$

Thus, $\beta(C_{ij} - c_{ji} - C_{ji} + c_{ij}) > c_{ij} - c_{ji}$, and rearranging the inequality will give $\beta C_{ij} + (1-\beta)c_{ji} > \beta C_{ji} + (1-\beta)c_{ij}$ which implies $E_O(A_i \succ A_j) > E_O(A_j \succ A_i)$ and, therefore, $A_i \succ A_j$.

Thus, if $d_{ij} = 0$ and $n_{ij} < 0$, then for all $\beta \in [0, 1]$, $A_i \succ A_j$.

Case 6:

Let $d_{ij} = 0$ and $n_{ij} = 0$.
Then, for all $\beta \in [0, 1]$,

$$\beta d_{ij} = n_{ij}.$$

Thus, $\beta(C_{ij} - c_{ji} - C_{ji} + c_{ij}) = c_{ij} - c_{ji}$, and rearranging the equation will give $\beta C_{ij} + (1-\beta)c_{ji} = \beta C_{ji} + (1-\beta)c_{ij}$ which implies $E_O(A_i \succ A_j) = E_O(A_j \succ A_i)$ and, therefore, $A_i \approx A_j$.

Thus, if $d_{ij} = 0$ and $n_{ij} = 0$, then for all $\beta \in [0, 1]$, $A_i \approx A_j$.

The ranking result of the proposed method can be classified as having two main observations which are Observations 4.1 (covers cases 1–3) and 4.2 (covers cases 4–6). The two main observations are presented as follows.

Observation 4.1

For two FNs A_i and A_j with $d_{ij} \neq 0$, the ranking results for Ochiai index are as follows:

1. If $d_{ij} \neq 0$ and $\beta = \beta_{ij}$, then $A_i \approx A_j$.
2. If $d_{ij} > 0$ and

    (a) $\beta > \beta_{ij}$, then $A_i \succ A_j$.

    (b) $\beta < \beta_{ij}$, then $A_i \prec A_j$.

3. If $d_{ij} < 0$ and

    (a) $\beta > \beta_{ij}$, then $A_i \prec A_j$.

    (b) $\beta < \beta_{ij}$, then $A_i \succ A_j$.

Observation 4.2

For two FNs A_i and A_j with $d_{ij}=0$, the ranking results for Ochiai index are as follows:

1. If $n_{ij}>0$, then for all $\beta \in [0,1]$, $A_i \prec A_j$.
2. If $n_{ij}<0$, then for all $\beta \in [0,1]$, $A_i \succ A_j$.
3. If $n_{ij}=0$, then for all $\beta \in [0,1]$, $A_i \approx A_j$.

Numerical Examples

In this section, four sets of numerical examples are presented to illustrate the validity and advantages of fuzzy Ochiai ranking index. For two FNs A_1 and A_2, $d_{12}=C_{12}-c_{21}-C_{21}+c_{12}$, $\beta_{12} = \dfrac{c_{12}-c_{21}}{d_{12}}$, and $n_{12}=c_{12}-c_{21}$ and C_{12}, c_{21}, C_{21} and c_{12} denoted the evidences $E(A_1 \succ A_2)$, $E(A_2 \prec A_1)$, $E(A_2 \succ A_1)$ and $E(A_1 \prec A_2)$ respectively.

Example 1

Consider the FNs in [12], i.e., $A_1=(0.1, 0.3, 0.5)$ and $A_2=(0.2, 0.3, 0.4)$.

Since A_1 and A_2 have the same mode and symmetric spread, a number of the existing ranking methods cannot discriminate them, such as [1–5, 13–16]. However, [12, 17–21, 22] produce $A_1 \prec A_2$. By the proposed method, we obtain $d_{12}=0.098>0$ and $\beta_{12}=0.5$.

$$A_1 \prec A_2 \quad , \beta \in [0,0.5)$$

Thus, by Observation 4.1 the ranking order is produced as $A_1 \approx A_2 \quad , \beta = 0.5$,

$$A_1 \succ A_2 \quad , \beta \in (0.5,1]$$

where $A_1 \prec A_2$ for pessimistic decision-makers, $A_1 \approx A_2$ for neutral decision-makers, and $A_1 \succ A_2$ for optimistic decision-makers. The ranking result is affected by decision-makers' perspective, and this shows that the proposed method has strong discrimination ability.

Example 2

Consider the FNs in [15], i.e., $A_1=(0.3, 0.5, 0.9)$ and $A_2=(0.155, 0.645, 0.8)$. References [1, 4] rank them as $A_1 \prec A_2$, while [12, 15] produce $A_1 \succ A_2$. By the proposed method, we obtain $d_{12}=-0.006<0$ and $\beta_{12}=0.833$, and by Observation 4.1

$$A_1 \succ A_2 \quad , \beta \in [0,0.833)$$

the ranking order is produced as $A_1 \approx A_2 \quad , \beta = 0.833$. Both neutral and pes-

$$A_1 \prec A_2 \quad , \beta \in (0.833,1]$$

simistic decision-makers rank $A_1 \succ A_2$ while optimistic decision-makers rank them

in three different results. The result shows that the equal ranking does not necessarily occur for neutral decision-makers.

Fig. 83.1 Fuzzy numbers in Example 3
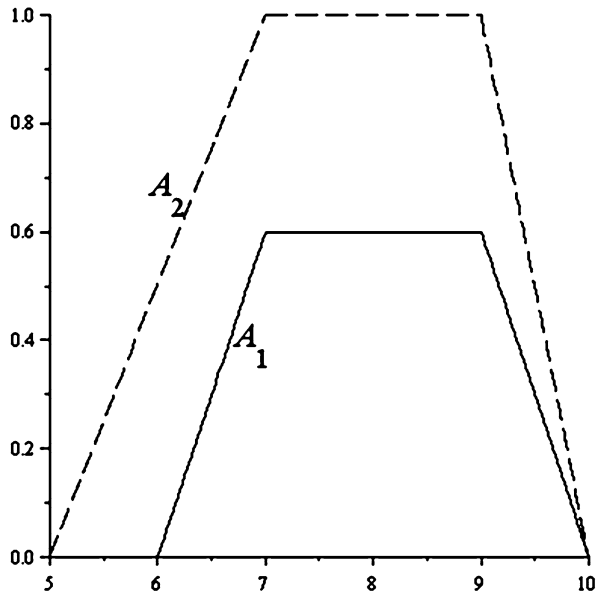
Example 3

Consider the FNs in [5], i.e., $A_1 = (6, 7, 9, 10; 0.6)$ and $A_2 = (5, 7, 9, 10; 1)$ as shown in Fig. 83.1.

Some of the existing ranking methods such as [2, 3, 15, 16, 23–25] can only rank normal FNs and, thus, fail to rank the FNs A_1 and A_2. Moreover, [1, 5] rank them as $A_2 \prec A_1$, while [4] ranks them as $A_1 \prec A_2$. By the proposed method, $d_{12} = 0.434 > 0$ and $\beta_{12} = 0.350$, thus, obtain the ranking result as $A_1 \prec A_2$ for $\beta \in [0, 0.350)$, $A_1 \approx A_2$ for $\beta = 0.350$ and $A_1 \succ A_2$ for $\beta \in (0.350, 1]$. Similarly, the ranking result is affected by decision-makers' perspective.

Example 4

Consider the FNs in [24], i.e., $A_1 = (1, 2, 5)$ and $A_2 = (1, 2, 2, 4)$ as shown in Fig. 83.2, with the membership function of A_2 defined as $\mu_{A_2}(x) = \begin{cases} \sqrt{1 - (x-2)^2} & , [1, 2] \\ \sqrt{1 - \dfrac{1}{4}(x-2)^2} & , [2, 4] \\ 0 & , \text{else} \end{cases}$.

Some of the existing ranking methods such as [12, 17, 18] can only rank trapezoidal FNs and, thus, fail to rank the FNs A_1 and A_2. By using the proposed method, we have $d_{12} = -0.015 < 0$ and $\beta_{12} = 3.88$. Therefore, the ranking order is $A_1 \succ A_2$ regardless of the decision-makers' perspective, as shown in Table 83.1. The ranking result of the proposed method is consistent with human intuition and other ranking methods in Table 83.1.
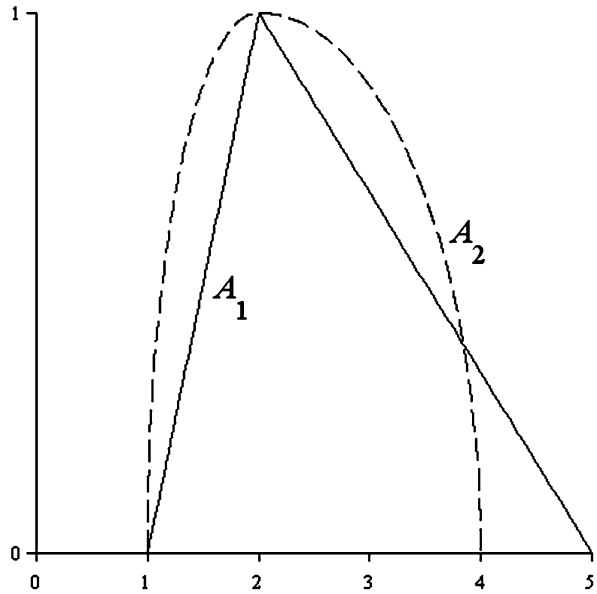
Fig. 83.2 Fuzzy numbers in
Example 4

Table 83.1 Ranking results of Example 4

Method	Fuzzy numbers	Index value	Ranking results
Proposed method	(d_{12}, β_{12})	$(-0.015, 3.88)$	$A_1 \succ A_2$, $\beta \in [0, 1]$
[2]	A_1	3.162	*
	A_2	*	
[17]	A_1	*	*
	A_2	*	
[18]	A_1	0.371	*
	A_2	*	
[26]	A_1	0.274	$A_1 \succ A_2$
	A_2	0.190	
[24]	A_1	0.2154	$A_1 \succ A_2$
	A_2	0	
[16]	A_1	2.5	$A_1 \succ A_2$
	A_2	2.360	
[4]	A_1	1.245	$A_1 \succ A_2$
	A_2	1.182	
[1]	A_1	2.717	$A_1 \succ A_2$
	A_2	2.473	
[15]	A_1	0.890	$A_1 \succ A_2$
	A_2	0.806	

*, the ranking method cannot calculate the ranking value.

Conclusion

This paper presents a new method for RFNs using Ochiai index and Hurwicz criterion. Two observations that can simplify the ranking procedure are produced. The observations have rendered the proposed ranking index as an advantageous method since the ranking results can be obtained for all continuous values of $\beta \in [0, 1]$. The proposed method can overcome certain shortcomings that exist in the previous ranking methods such as can rank both non-normal and general shapes of FNs and can discriminate the ranking of FNs having the same mode and symmetric spreads which fail to be ranked by the previous ones. The proposed method can be highly applied in solving decision-making as it has strong discrimination ability which is a crucial criterion in solving decision-making problems.

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Chapter 84
Suitability of Sewing Thread on Different Types of Sheer Fabrics

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Introduction

Sewing threads are the most essential components of sewing [1], other than fabrics. In the apparel and clothing industry, sewing threads play a major role in the sewing process considering the consumed quantities [6] for all sewing operations needed to produce garments. The process of making garments consists of multiple operations that require sewing threads to be used using different types of sewing machines by operators or sample makers. Though it represents a very small portion of the retail selling price of end products and almost invisible on the fabric, garment performance is dependent on the use of sewing threads [2]. As such, the selection of sewing threads for the use of specific fabric types is compulsory to ensure that any problems related to seam failures can be minimized either during the sewing process or after wear and tear of garments. Numerous past researches have highlighted the importance of the correct selection of sewing threads for the purpose of producing garments; otherwise the seam performance will deteriorate in the finished garments [3] and most notably in sheer fabrics. In the fashion industry, wide selections of sheer fabrics are preferred by designers in women's clothing for specific line development. Many sheer fabrics are fragile, thin, and delicate; thus, seam slippage is a frequent problem that occurs in the seam line of sewn garments. Loosely constructed fabrics with smooth and slick surface can also cause seam slippage. Consequently, when the yarns in the fabric are pulled out of the seam, it is considered an irrepairable damage, and thus it may affect the life span of a garment in terms of its appearance and serviceability. The characteristics of the sheer fabric, which is very lightweight and transparent, made the sewing operation sometimes

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very critical to manufacturers as without a proper selection of sewing thread for this type of fabric, the appearance and performance of the seams may easily get affected particularly when the load or tension is lower than the required tension which will tear the fabric [5]. Thus, it is important to understand the suitability of sewing threads in order to reduce risks associated to seam slippage in sheer fabrics.

Materials and Methods

The fabrics selected for the study are chiffon, voile, and organza fabrics which range from 0 to 50 g/m^2 in weight woven in plain weave structures. The sewing thread used for the study was 100 % polyester with 28 Tex, 31 Tex, and 33 Tex of thread size. All tests for the analysis of sewing thread and fabric properties were carried out according to ASTM and MS ISO test method in order to investigate the properties of those materials. Microscopic view of fabrics was analyzed to understand the structure and compactness of yarn in the fabrics used. Each fabric sample was cut and sewn with superimposed seam SSa-1 (plain seam) using lockstitch 301 stitch types as per Konwa KW-622i sewing machine with needle number 11 for needle size in three different stitch densities, i.e., 7, 10, and 13 stitches, per inch. Figure 84.1 shows illustration of superimposed seam SSa-1 and stitching line of the seam.

Five rectangular specimens of warp and weft direction with length of 200 mm and width 100 mm were cut and folded in half with the face inward by putting the two shorter edges together. A seam was stitched parallel at a distance of 20 mm of the fold. An ISO 13936-2:2004 standard test method was carried out on the seam slippage strength of the five sewn rectangular specimens. This test is to determine the performance of the seam in terms of the average maximum tensile force of woven fabrics by using SDL Testometric Strength Tester. Figure 84.2 shows illustration of a seam slippage test to be carried out using the above-mentioned tester.

The clamps of the tensile testing machine were set at a distance of 100 mm. The sample was secured symmetrically in the clamps with the seam midway between and parallel to edges of the two clamps. The load was gradually increased at constant rate of 50 mm/min extension. When the maximum force is achieved, the load was stopped automatically and reduced to 5 N. This procedure was repeated with the remaining samples for warp direction and weft direction. The evaluation is carried out using the maximum force applied in unit of Newton. The test was repeated with different Tex of sewing threads and different types of fabric and stitch length.
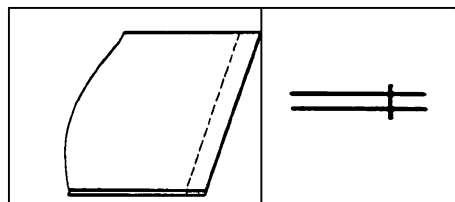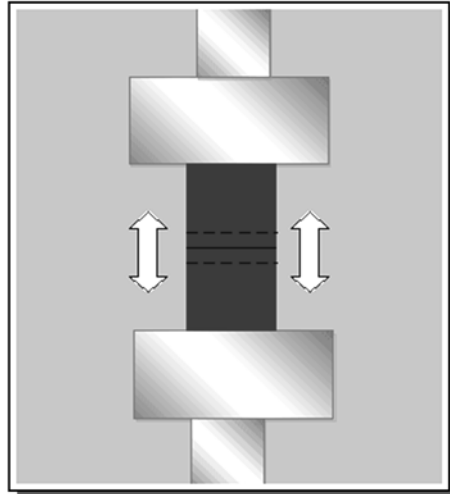

Fig. 84.1 Seam type SSa-1

Fig. 84.2 Seam slippage test

Results and Discussion

Properties of Sewing Thread and Fabrics

The properties of sewing thread with different thread sizes and fabrics used in the study were measured and presented in Tables 84.1 and 84.2, respectively.

Microscopic View of Fabric

Figure 84.3 shows the microscopic view of chiffon, voile, and organza fabrics. From the microscopic view of the three different types of sheer fabrics, the differences can be analyzed by the compactness of yarns in the fabric. Chiffon has higher compactness, followed by voile and organza. This is due to the different gap arrangement and positioning of the yarns next to each other in the fabric.

Result of Seam Slippage Test (Maximum Tensile Force)

Figures 84.4, 84.5, and 84.6 show the result of maximum tensile force using 7 spi, 10 spi, and 13 spi stitch length.

The suitability of threads size for each stitch length varies for all fabrics. Graphical analysis shows that thread with 33 Tex is suitable to be used for sewing chiffon fabric using both 10 spi and 13 spi. Thread with 31 Tex is suitable for voile fabric using both 7 spi and 10 spi. However, 28 Tex thread size is the most suitable

Table 84.1 Thread properties

Properties of sewing thread				
Thread size (Tex)		28	31	33
Weight (g)		3.11	3.38	3.52
Single yarn strength and elongation	Force (g)	183.2	164.0	189.6
	Elongation (mm)	77.8	73.6	85.0
	Elongation (%)	15.6	14.7	17.1
	Yarn strength (g/tex)	6.54	5.29	5.72
Appearance grade	A	A	B+	

Table 84.2 Fabric properties

Properties of fabric	Chiffon		Voile		Organza	
Width (inches)	45.71		59.08		59.85	
Thickness (mm)	0.160		0.134		0.179	
Weight (g/m^2)	50		47		20	
Density (threads/inch^2)	Warp	Weft	Warp	Weft	Warp	Weft
	114	91	83	70	109	78
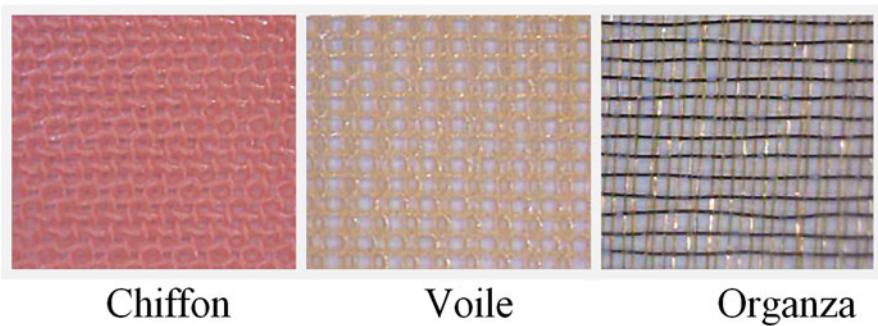
Fig. 84.3 Microscopic view of chiffon, voile, and organza fabrics

	Warp A (Chiffon)	Weft A (Chiffon)	Warp B (Voile)	Weft B (Voile)	Warp C (Organza)	Weft C (Organza)
28 Tex	175.72	181.02	180.04	181.92	59.06	153.36
31 Tex	180.60	170.56	181.80	181.28	79.04	134.40
33 Tex	180.64	180.90	181.00	181.22	69.90	146.24
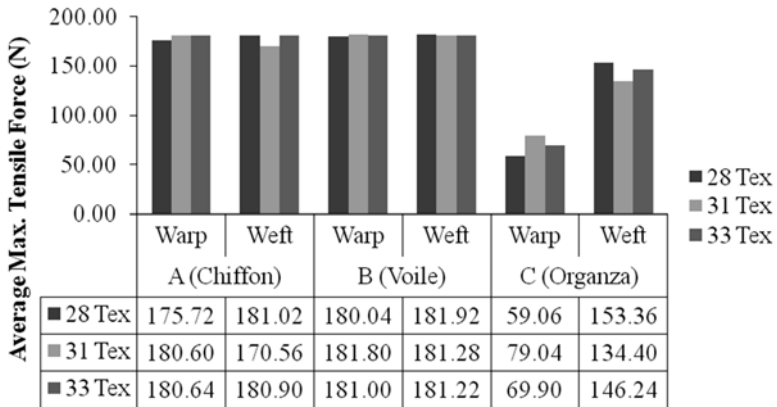
Fig. 84.4 Maximum tensile force (7 spi)

	Warp	Weft	Warp	Weft	Warp	Weft
	A (Chiffon)		B (Voile)		C (Organza)	
■ 28 Tex	180.70	182.28	180.88	181.48	68.54	122.40
■ 31 Tex	180.08	182.24	182.34	182.34	66.38	138.82
■ 33 Tex	181.06	182.02	180.72	181.94	74.34	146.46
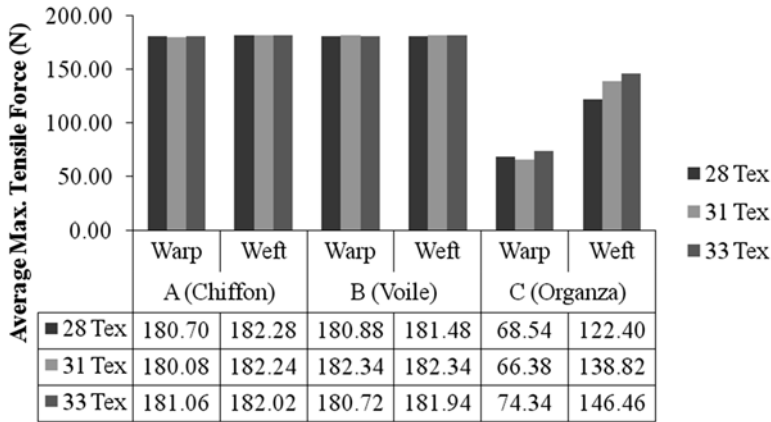
Fig. 84.5 Maximum tensile force (10 spi)

	Warp	Weft	Warp	Weft	Warp	Weft
	A (Chiffon)		B (Voile)		C (Organza)	
■ 28 Tex	180.76	203.06	181.54	181.02	66.16	103.24
■ 31 Tex	180.74	181.02	179.96	182.10	58.10	127.22
■ 33 Tex	181.56	182.64	179.94	183.24	73.98	144.32
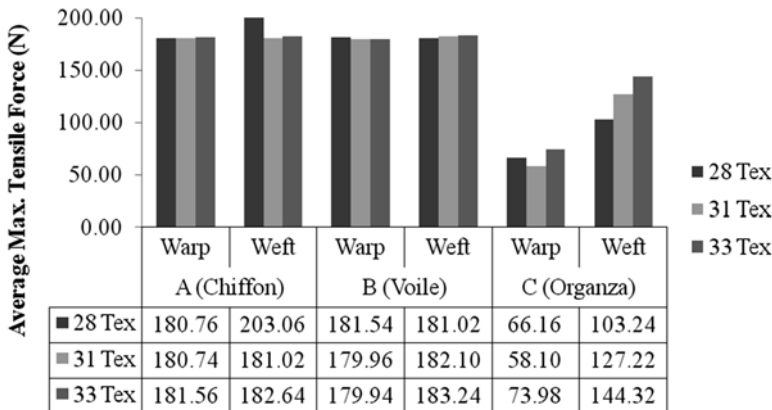
Fig. 84.6 Maximum tensile force (13 spi)

thread to be used with 13 spi of the same fabric. Organza fabric is suitable to be sewn with 33 Tex of thread size using 10 spi and 13 spi. On the other hand, the most suitable thread size to be used is thread 31 Tex with shorter SPI, which is 7 spi used in the study.

Properties of Sheer Fabric and Effect on Thread Size and Stitch Length

It has been observed that from Figs. 84.4, 84.5, and 84.6, the maximum tensile forces of different thread sizes have minor difference and increment as the Tex increased. The main reason is due to the fact that coarser yarn possesses higher force than finer yarn as higher tensile force is required for coarser yarn. This result

was supported by Mukhopadhyay et al. [7], which mentioned that the higher breaking load of fabric stitched with coarser yarn is higher than the fabric stitched with finer yarn. It is found that the thickness and force to break the seam are influenced by the higher friction and penetration incurred to the fabric. The needle penetration and high friction required for coarser yarn reduced the strength of the fabric. It is found that the maximum tensile force increased as the stitch length increased. Bahera and Chand [4] described that the combination of low weight fabrics and coarse ticket number threads usually led to high slippage. In this study, the use of similar fabric with finer ticket number shows that the trend of slippage is reversed, whereas lower weight fabric with high linear density of thread gives low slippage to fabric.

According to Mukhopadhyay et al. [7], higher stitch length provides better gripping to the sewn fabrics. However, the results of maximum tensile force achieved did not show the increment, respectively, to all types of fabric. This finding is against the norm of the tradition theory and supported by Wang et al. [9] on the influence of stitch length to stitch properties of knitted products. According to them, as the stitch length is increased, the frequency of needle punching per unit length of fabric is also increased. The fabric tensile strength is thus decreased due to the local damages of fabrics caused by the needle striking the pulling and cutting of sewing thread. They assumed that there is a certain amount of seam strength reduction. When the stitch length is increased, thread consumption would be higher which assumes to have a higher tensile strength of thread. However, this cannot compensate the seam strength reduction. As a result, stitch tensile strength is decreased when stitch length is increased. The result from this study also confirmed the finding by Wang et al. [9], as voile and organza fabrics tend to slip with more stitches used per inch along a seam line.

The findings could be also affected by the compactness of the fabric as shown in Fig. 84.3. Maximum tensile force of organza fabric in warp direction has great difference for all stitch length as compared with other readings. The tensile force is lower in the warp direction because the number of weft yarn which held the sewing thread in a seam is lower as compared to the weft direction. This is proven by Ramachandaran et al. [8] who stated that it is the weft threads in the fabric that are loaded along with the sewing thread composing the seam. In the weft direction, the number of warp ends to take the load is higher with every stitch, and this results in higher tensile force. This is also the reason for the increase in maximum tensile force with increase in stitch length. This is because there are fewer ends to share the load per stitch as the SPI increased.

Conclusion

From the study, the maximum tensile force increases as the size of thread increases. Different types of sheer fabrics gave different values on sewing thread performance based on the compactness of the fabric. Different stitch length also influences the tensile force of the fabric. Stitch tensile force decreases when the stitch length increases specifically in the use of voile and organza that are lighter compared to

chiffon. The suitability of thread size 33 Tex for chiffon fabric has been identified to influence seam performance against load imposed to the stitching line of lockstitch seam by using 13 spi. Meanwhile, for voile fabric, thread size of 31 Tex seems suitable to be used and sewn with 7 spi and 10 spi. The investigation on organza fabric has proven that sewing thread of 31 Tex is suitable to be used with 7 spi. The outcome of this research will guide designers and tailors in choosing the suitable sewing conditions for sheer fabrics specifically chiffon, voile, and organza fabrics.

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Chapter 85
Simulating the Effect of Feed-In Tariff on Renewable Energy Penetration: A System Dynamics Approach

Salman Ahmad Akhwanzada, Razman bin Mat Tahar, and Jackie Cheng

Introduction

Generally around the world, electricity is generated using fossil fuels. In particular, coal-fired power generation has the highest share in the fuel mix. Using fossil fuels has the drawback of harmful emissions like CO_x, NO_x, and SO_x, which leads to global climatic change. Therefore, it is the top concern of countries around the world to diversify the fuel mix for electricity generation by introducing natural gas and renewable energy sources (RES). Comparing with other technologies, RES technologies are capital intensive. To offset high investment cost, more than 75 countries and regions around the world have introduced a mechanism called feed-in tariff (FIT). These countries include Germany (the pioneer country), France, Switzerland, and Canada, from the developed world to Thailand, Taiwan, and India, from fast developing world. The aim of FIT policy is to increase RES installed capacity.

The FIT policy has two basic characteristics: guaranteed fixed prices and long contractual period for electricity produced from renewable energy source (RES-E). These FIT prices are characterised per kWh of electricity (energy) produced. These prices vary for different technologies, range of capacities, and length of contracts [1]. The technological, financial, and contract period diversity in FIT policy is assumed to stimulate the various segments of society to for a rapid RES-E deployments [2]. There has been some opposition and reservation in using FIT as a support mechanism. The major one being that it fails to promote competition in the market [3].

Sixty-seven percent of electricity is produced from fossil fuels in Malaysia. Large hydropower plant is the only renewable source which has got some significant share. RE was introduced in power supply sector through Five Fuel Diversification strategy in 1999 [4]. Since then various developmental projects like SREP, SURIA100 have been undertaken to boost RES-E. In the 8th and 9th

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Malaysian Plan (MP), it was targeted to have around 5 % of RES-E. However, less than 1 % of the target was met. Further, in the 10th MP, RES-E is included on the assertion of meeting increasing electricity demand, global commitment to reduce emissions particularly from power sector, and steering the country towards a green economy. It is planned to have 985 MW of RE capacity. In 2011, government introduced FIT scheme for RES-E deployments after seeing its benefits in other countries. The Sustainable Energy Development Agency (SEDA) was established to run the affairs. The target for solar photovoltaic (PV) was set at 65 MW. The goal of this study is to evaluate impact of FIT and its structure on the solar PV deployment in Malaysia.

Methodology and Data

A computer modelling and simulation methodology of system dynamics (SD) is employed in this study. The choice of SD is due to its long history of dealing with energy issues [5] and the most recent in renewable energy [6, 7]. Secondly, SD provides a mechanism in which complex issues can be explored effectively, highlighting the interdependencies of variables in feedback fashion. The feedback capability of SD is of special interest to policymaker for evaluation of their decisions in a simple nontechnical fashion.

Methodology

The qualitative model of the solar PV assessment is shown in Fig. 85.1. It consists of four sectors interlinked with each other. The interactions of these sectors generate the dynamics of solar PV investments.

The quantitative SD for the problem model consists of the differential equations and algebraic relations. This provides a mathematical setting of the model. The relationships are coded in a software package called iThink® 9.0.3 for simulation purpose. SD quantitative model makes use of stock and flow variables. Stocks are accumulation of flow variables. To perform other calculations, auxiliaries are used. In Fig. 85.2, rectangles show stocks, while valves represent flows, and circles illustrate auxiliaries. A portion of quantitative model is shown in Fig. 85.2. This sub-model constitutes the 'solar PV capacity' part of the conceptual model depicted in Fig. 85.1.

The differential equation for a stock, *PV operational capacity*, is

$$\text{PV operational capacity}(t) = \text{PV operational capacity}(t-dt) +$$
$$\text{INTEGRAL}\left(\text{PV construction completion} - \text{PV retirements}\right)^* dt \qquad (85.1)$$
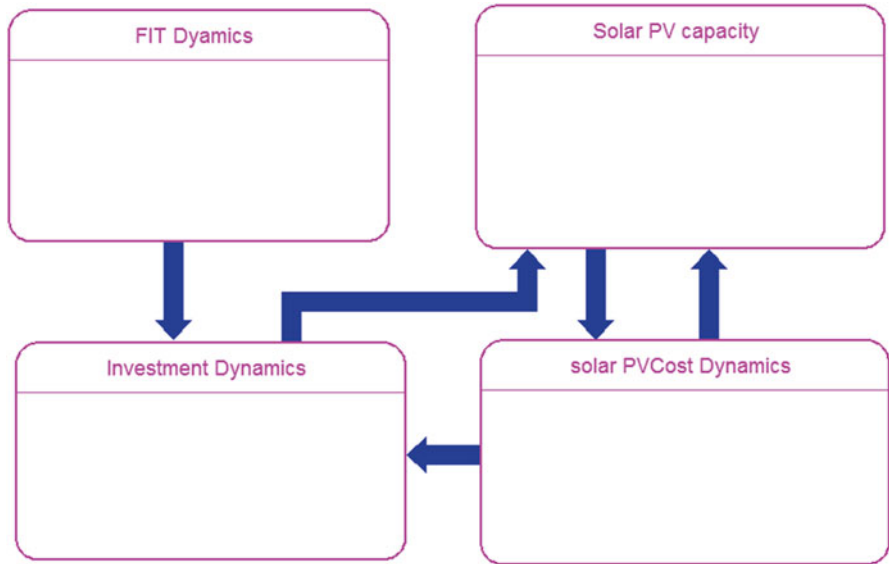
Fig. 85.1 The FIT assessment model. As our focus is on the problem itself, modelling details have been avoided in this paper
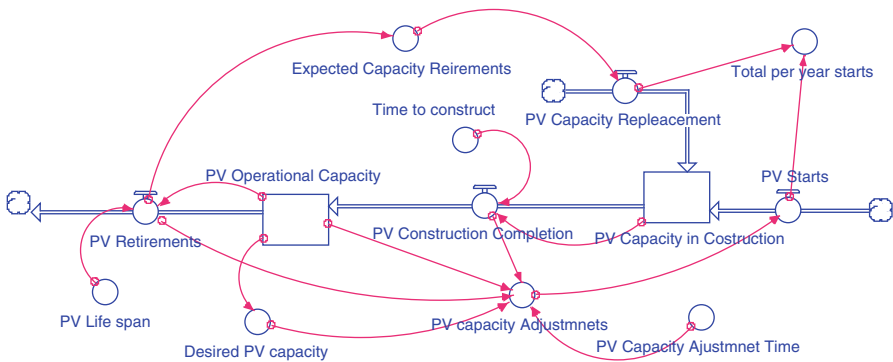

Fig. 85.2 Quantitative model of solar PV capacity construction

The flow equation for *PV retirements* has the form

$$\text{PV retirements} = \text{PV operational capacity} / \text{PV lifespan} \qquad (85.2)$$

All the stock and rate equations in the complete model follow the structure of Eqs. 85.1 and 85.2, respectively.

Data

To maintain the consistency model with reality, the data used is from authentic governmental agency and from published literatures. For FIT rate and duration, we used data from the SEDA. The cost of solar PV system in Malaysia from solar resource potential [8] and technology learning factor from REN 21 [9] is found varies from 1170 kWL/kWp to 1600 kWh/kWp [10, 11], whereas the initial capacity from the solar PV life space is 30 years for the construction duration 1.5 years [12].

Scenarios

In this study three scenarios are simulated to explore the total solar PV capacity which will be coming on line after the implementation of FIT policy. The focus is on initial FIT rate offering.

In the first scenario (S1), a high initial FIT rate of 1.23 RM/kWh is used; in the second (S2), a medium rate of 1.09 RM/kWh is used; and in the final scenario (S3), a lowest rate of 0.85 RM/kWh is used. The simulations are carried out for all three scenarios from 2012 to 2050. This long time period is included due to see the affect of retiring capacity, and the completion of FIT policy.

Analysis of Simulation Results

The model simulation shows that in S1 a total of 1,148 MW of solar PV capacity becomes operational, while in S2 total operational capacity reduces to 862 MW, and a further reduction to 526 MW is observed in S3. The lowering of solar PV capacity suggests that the success of FIT policy is highly sensitive to the initial FIT rate. On the expenses incurred to support the policy, the model shows that S1 is the most expensive option. It incurs a total expenditure of around 5 billion RM followed by 3.5 billion RM for S2 and, the least, 1.7 billion RM for S3. On the cost of CO_2 abatement, S1 is the most expensive option, while S3 is the least. The respective costs for S1, S2, and S3 are 0.036 RM/kg, 0.032 RM/kg, and 0.026 RM/kg.

Conclusion

An FIT policy assessment model has been developed in this study. The model uses system dynamics simulations to explore the total solar PV capacity that can be brought on line during the period from 2012 to 2050.

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Chapter 86
Problems on Commercialisation of Genetically Modified Crops in Malaysia

Tengku Norbaya Binti Tengku Azhar and Kamariah Binti Ismail

Introduction

The genetic modification (GM) technology is a method of transferring a fraction of DNA sequences coded on a particular gene into particular organism to induce genetic composition and alter the phenotype of the organism. Hence, it will produce desired traits of transgenic organism [1]. However, in innovation process, a lot of issues such as the safety level of the product, commercialisation strategies and policy framework must be deliberated. In many corporations and institutions, the lack of understanding towards certain issues such as the technical constraints, intellectual property (IP) protection and public acceptance makes the product from this potential technology fail to penetrate the market. [2] indicated that until the report is written, Malaysia still does not have its own GM crops. The use of the six factors as the framework in this study was reflected to the issues discussed in previous study by [3, 2, 4–8] and [9].

Data Collection and Analysis

This study was classified as an explanatory qualitative study. The recruitment of the respondents in this study was using the non-probability and snow ball sampling method. In this study, ten respondents were interviewed. All of the

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respondents have different academic background, mainly from biotechnology field and law and management, and come from diverse organisations such as the Malaysia Research and Development Institute (MARDI), Malaysia Palm Oil Board (MPOB), Ministry of Agriculture (MOA) and Ministry of Natural Resources and Environment (NRE) and certain local universities such as UKM, UiTM, UTM and UPM. Besides, both primary and secondary data from numerous of sources were used in this study. Two modes of interview were used in this study: the face-to-face and telephone interview. Based on the outlined factors, ten in-depth semi-structured interviews were conducted with the respondents within 30 min to an hour of interview. For data analysis, the NVIVO computer software was used to analyse the qualitative data. The first process in the data analysis was the data transcribe continued with open coding process where the emerging themes from the raw data will be identified. After reviewing the literature and previous study, the concepts and the categories of the themes which are referred as nodes were identified.

Framework of the Study

As adoption of problem of transgenic crops in Malaysia environment, six major dimensions of problems such as the human capital and other capital requirement, biosafety regulation, institutional roles, intellectual property, technical constraints and public acceptance were applied to the Monsanto model as proposed by [10]. The compilation of the model with six (6) dimension factors forms the framework as shown in Fig. 86.1.
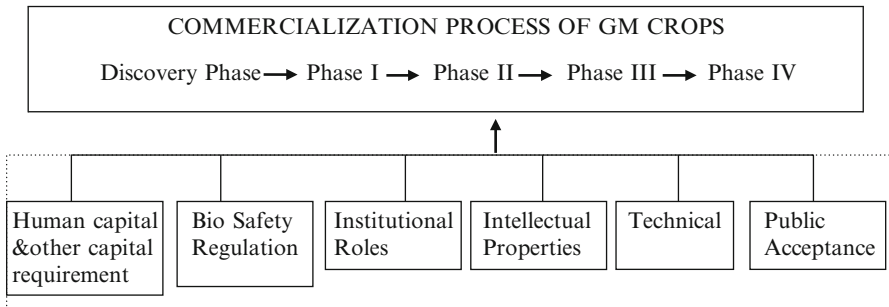

Fig. 86.1 Framework of the study

Results and Discussion

Issues on Human Capital and Other Capital Requirements

As the feedback from eight respondents, the issues on human capital and other capital requirements were based on limitation of facilities, limited number and inexperience of researchers, limited funding and grant and high cost of product development. As overall, human capital and other capital requirement were the most important factor that had intense concern by the respondents with 90 % feedback as whole. The above factors also had a significant effect towards the development of other factors such as the biosafety regulations, intellectual property (IP) protection, technical constraints and public acceptance. The most critical issues were based on the limitation of expertise in various fields, less experience and the limitation of funding and grants.

Issues on Biosafety Regulation

From the interview of the four respondents, it was found out that the issues on biosafety regulation were based on the deficiency of the law, lack of biosafety knowledge and ineffective implementation of the law. The respondent feedbacks towards this factor were only 40 % and least significant compared to other factors. The findings also revealed that the issues on the above factors were depending on the human capital, other capital requirement and institutional roles which convoluted to the issues on limited funding and grant and limited number and inexperience of the researcher.

Issues on Institutional Roles

From the interview of the nine respondents, it was found that the issues on institutional roles were entrenched to the collaboration issues, less intention on commercialisation of the product and inefficient resource allocation and ineffective capacity building. Institutional roles were also the most important factor which affects the GM crop development with 90 % feedback of the respondents. The most crucial issues eagerly discussed under this factor were the collaboration issues of the public, private and international institution. Other issues such as inefficient resource allocation and ineffective capacity building were the major causes of the issues raised on human capital and other capital requirement factor, the biosafety regulation, intellectual property (IP) protection, technical constraints and the public acceptance.

Issues on Intellectual Property (IP) Protection

From the interviews of four respondents, it was found that the issues on intellectual property (IP) protection were based on the lack of IP protection specifically for the transgenic crop, lack of knowledge and intention on intellectual property (IP) protection and ownership issues on intellectual property (IP). Intellectual property (IP) protection also was the least important factor with 40 % feedback by the respondents. The findings also showed that the issues on institutional roles, human capital and other capital requirement had a significant impact on the issues of the above factor in terms of collaboration to form adequate and clear regulation for the IP protection.

Technical Issues

From the interview of six respondents, it was found that the issues on technical aspect can be viewed by classifying it according to the stages of the development which are the discovery phase (gene and trait identification), phase I (proof of concept) and phase II (early development). In the discovery phase, six respondents revealed that the issues were based on the screening procedures and gene expression. The gene expression issue relied on the gene silencing scenario, and it depends on the quality of the inserted genes, which required the stability of the transgene and other constructed genes such as the marker genes and the promoter. In addition, improper screening approach such as the polymerase chain reaction (PCR) and the expression study affect the detection process on the gene expression. In phase I, five respondents revealed that the issues were based on the ineffective approaches for crop transformation such as the failure on targeting the gene that caused the random transformation and the superfluous expression of the gene. For gene optimisation, incomplete application on the selection medium approach failed to isolate the model plant which carried the transgene. In phase II, a respondent commented on the lack of some detailed data to proceed with contained field trial approach. Without the expert in the field trial like the risk assessment and management expertise and agronomist, some of the gained data was inaccurate and consequently distract the next procedures of the development. As a whole, it was found that the technical constraint gained 60 % feedback from the respondents. Besides, the findings also revealed that the technical issues were affected by the issues of lacked of expertise and knowledge as discussed before in human capital and other capital requirement issue.

Public Acceptance Issues

As a whole, the public acceptance factor gained 50 % feedback with critical issues such as knowledge and awareness, risk concern, benefit concern, ethic concern and labelling which was consistent with the previous research as cited in literature. However, the findings had not determine other issues as outlined in literature review such as the trust in government and positive attitudes towards science and media. The findings also revealed the dependency of the issues in public acceptance with the issues of participation of the public and NGO in decision-making process for the product development. Less consideration of the institution to educate the public about the existence of the product put a risk on the public acceptance towards the product.

Stages and Trait Development

According to the findings, different institutions work on different types of trait at different stages of the development. The Government Research Institutes (GRIs) such as MARDI and MPOB commonly worked on crops like rice, papaya and palm oil which can be classified as the main commodity crops in Malaysia. However, the universities are doing research on other crops like tobacco, eggplant and Basamina sp. which have less national interest. The trait concern also differs, but majority from the findings was focused on quality improvement in terms of their chemical composition and the shelf life. Generally, the findings show that most of the researchers were conducting their research at the early stages of the development: discovery phase, phase I and phase II.

Conclusion

As a conclusion, all the six factors were significant to the GM crop development. Numerous issues were revealed which corresponded to the six factors. However, the issues were only based on the early phase of the GM development parallel to its current development stage in Malaysia. Overall, the most crucial factor that affects the development as well as other factors was the institutional roles. The issues under this factor showed close relatedness affecting the other five factors: human capital and other capital requirement, biosafety regulation, intellectual property protection (IPP), technical constraints and public acceptance. Finally, a model was proposed based on the findings of the study. The model was a combination of Monsanto model with the six major factors as discussed before. The model also presented the relatedness between the discussed factors. The model is presented in Fig. 86.2.
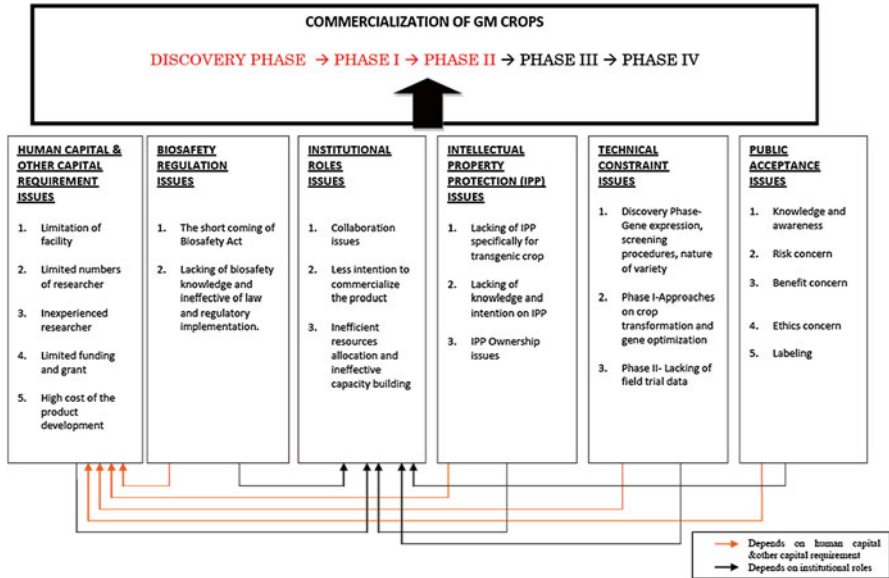
Fig. 86.2 Tengku Norbaya model on problems on commercialisation of GM crops in Malaysia

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Chapter 87
Potential Identification of Compacted Soil as Alternative Material in Cold-Formed Steel Column

Mohd Mawardi Bin Mohd Kamal, Mohd Syahrul Hisyam Bin Mohd Sani, and Fadhluhartini Binti Haji Muftah

Introduction

The excessive use of industrial materials due to the increasing demand for construction has been a cause of environmental destruction and global warming. Therefore, the uses of nonindustrial materials have been reconsidered. Nonindustrial materials are materials manufactured using simple, quick processes with low embodied energy, using raw materials. We will refer here to unfired clay soil, as the exclusively called "soil" does not have a standard composition. In order to minimize the uses of industrial materials, concrete will be replaced by compacted soil in retaining walls and foundation structure.

The type of soil that will be used is clay, and the main group of crystalline materials of clay that will be chosen is kaolinite. This type of clay would improve the soil characteristics by compaction [1]. This technique improves the soil quality by reducing the quantity of voids between grains, thus producing a form of mixture thanks to cohesion. It also increases the strength, lowers the compressibility, and reduces the flow rate of water (permeability) of soil by rearranging its fabric. The soil fabric is forced into a dense configuration by the mechanical effort used in compaction [2]. If a small amount of water is added to a soil that is then subjected to this technique, the soil will be compacted to a certain unit weight. If the moisture content of the same soil is gradually increased and compaction is done in the same way, the dry unit weight of compaction will gradually increase. This is because water behaves as a lubricant between the soil particles, and under compaction it helps rearrange the solid particles into a denser state [3]. The knowledge of the optimum water content and the maximum dry unit weight of soils is very important for this technique, as in this state the strength of the soils is at its maximum. The reason we choose kaolinite

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as our raw material is that it is the only binder that ensures strength and stabilization [4]. The chemical properties of kaolinite is another reason why we choose it as the raw material. This is because it has a natural substance occurring in great abundance in nature, and it has a structure that consists of one silica sheet and one alumina sheet bonded together into a layer of about 0.72 nm thick and stacked repeatedly. The layers are held together by hydrogen bonds. With these chemical properties, kaolinite proves the best raw material to be used since it shows no effect once this raw material is held together with steel [5].

The cold-formed steel structure, or light gauge steel, is becoming popular nowadays in the construction industry. This is because of its advantages, for example, it has a high strength-to-weight ratio, it is thinner and lightweight, and it is available in a variety of shapes. Hence, cold-formed steel is studied for its use in retaining walls and foundation or column structure in buildings. The disadvantage of cold-formed steel is that it is extremely sensitive to local, distortional, and lateral torsional buckling when a structure is built entirely upon it. The sensitive issues of cold-formed steel are being focused upon, and this new material has been recommended to be established in the construction industry. Compacted soil is being used to fill in cold-formed steel sections. Compacted soil is the alternative material to bind with cold-formed steel to produce high-strength material and avoid construction failure. Finally, the study identified the potential of compacted soil as an alternative material to fill in cold-formed steel sections.

Experimental Work

The main focus of this research was on laboratory work, which consists of three laboratory tests. The first laboratory test was to determine the specific gravity of clay in order to ensure this type of clay was in the kaolinite group. This test was carried out by using the density bottle [6]. The second laboratory test for this research was the standard Proctor test [6], which is a standard laboratory test that we chose for the evaluation of maximum dry unit weights and optimum moisture contents. This testing was used to determine the maximum strength of this clay which has optimum moisture content and zero air-void ratio. The unconfined compression test [6] was the last laboratory test in this research. The purpose of this test was to determine the maximum compressive strength of clay. This test was carried out after the optimum moisture content of this clay was recorded, and the percentage of water for optimum moisture content will be used as the reference for this test.

A study of the material in comparison with residual soil is important to evaluate the properties of both materials. Residual soil is also one of the alternative low-cost materials for replacing steel structures, composite structures, or reinforced concrete structures. Residual soil is investigated for its basic properties such as density and specific gravity.

Results and Discussion

1. Clay in the kaolinite group

Based on the data for determining the specific gravity of this clay as shown in Table 87.1, the result of G_s is reported as 2.57 [6], which falls in the group of the mineral kaolinite [7].

Therefore, this clay is the most suitable material to be used in this research, as we need to use the clay from the kaolinite group. For the second laboratory test, which is the standard Proctor test, the result is shown in Fig. 87.1.

Table 87.1 Result of the specific gravity test for kaolinite clay

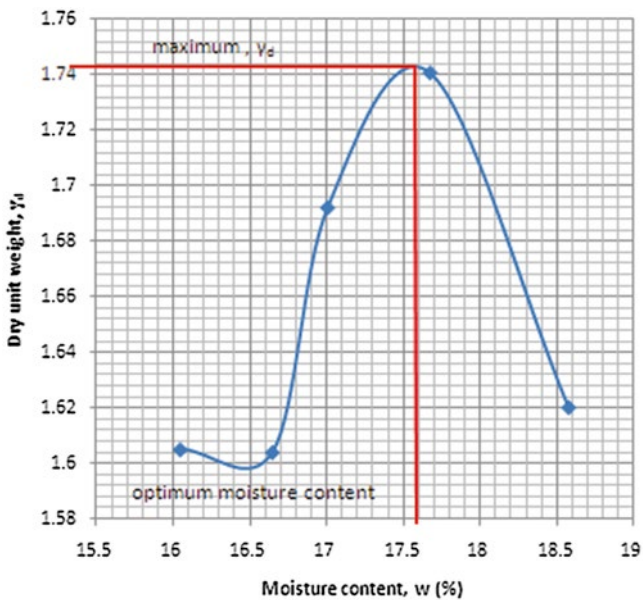|	Density bottle no.		
Basic properties	1	2	3
Mass of dry soil used (g)	227.53	221.6	190.8
Mass of water used (g)	848.82	922.7	914.7
Mass of water to fill density bottle (g)	936.74	1,008.7	988.5
Temperature (°C)	27	27	27
Specific gravity (mg/m³)	2.58	2.56	2.58
Average specific gravity (mg/m³)	2.57		

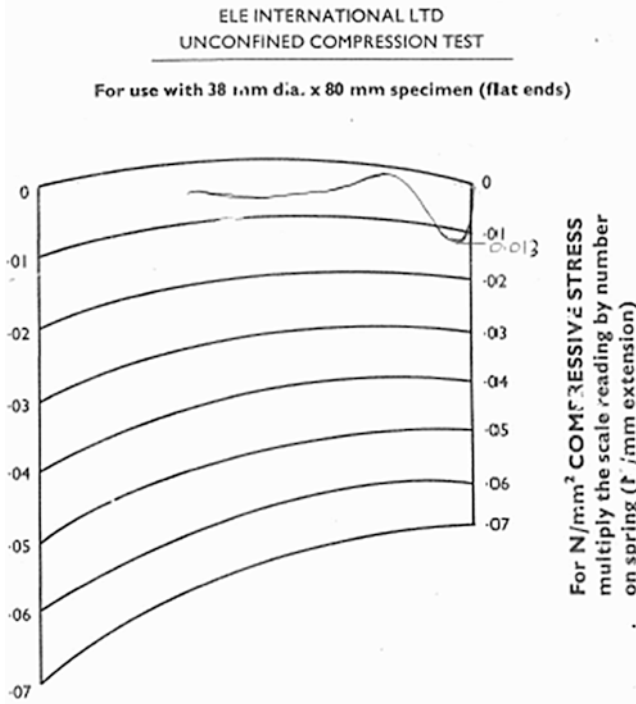**Fig. 87.1** Standard Proctor test result for kaolinite clay

Fig. 87.2 Unconfined compressive stress test for kaolinite clay

By taking the maximum dry unit weight and the optimum moisture content from Fig. 87.1, we can determine the maximum strength of this clay by obtaining the exact volume of water based on the result that we have by using Eq. 87.1 [1]:

$$w = \frac{W_w}{W_s} \times 100\% \qquad (87.1)$$

Thus calculating, the volume of water required to be added in 5.5 kg of soil is approximately 924 ml in order to obtain the optimum moisture content and the maximum dry unit weight of this clay for its use in the last laboratory test, which is to determine the unconfined compressive strength of the clay with the optimum moisture content.

The result for the unconfined compressive strength test using a 38 mm diameter × 88 mm specimen is shown in Fig. 87.2.

Based on Fig. 87.2, we multiply 0.013 by 6 as the coefficient of the spring, and the unconfined compressive strength of the clay is calculated to be 78 kN/m², which means it has medium consistency, as 78 kN/m² falls in the range of 48–96 kN/m² for medium consistency [7].

Table 87.2 Result of the specific gravity test for residual soil

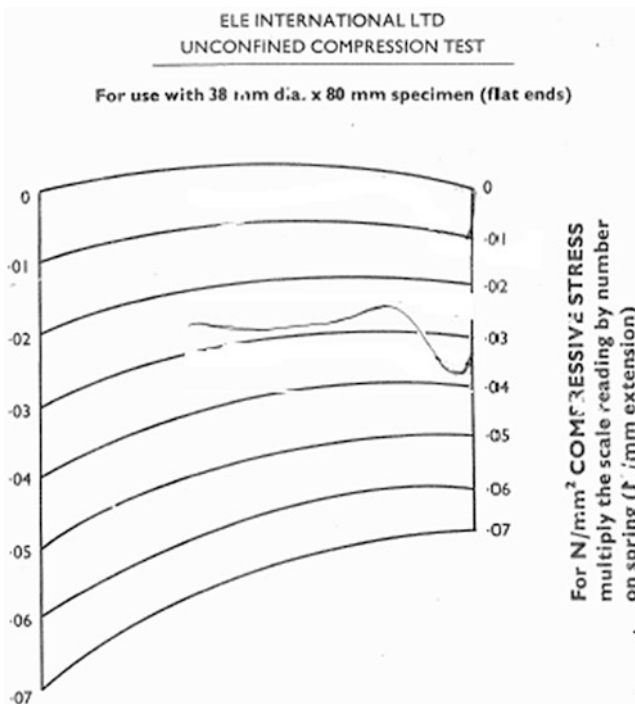| Basic properties	Density bottle no.		
	1	2	3
Mass of dry soil used (g)	9.5	8.5	9.0
Mass of water used (g)	46.0	46.0	46.0
Mass of water to fill density bottle (g)	49.5	49.5	50.0
Temperature (°C)	27	27	27
Specific gravity (mg/m³)	2.71	2.43	2.25
Average specific gravity (mg/m³)	2.46		

Fig. 87.3 Unconfined compressive stress test for residual soil

2. Residual soil

Based on the data for determining the specific gravity of the residual soil as shown in Table 87.2, the result of G_s is about 2.46. The difference between the clay and residual soil with respect to G_s is calculated to be 0.11, which shows a deduction of 4.28 %.

The result of the unconfined compressive strength test using the 38 mm diameter × 88 mm specimen is shown in Fig. 87.3.

Based on Fig. 87.3, we multiply 0.038 by 8 as the coefficient of the spring, and the unconfined compressive strength of the residual soil is calculated to be 304 kN/m^2, which means it has strong consistency [7]. The difference between the clay and residual soil is recorded to be 226 kN/m^2.

Conclusion

The objective of this research was achieved as it was concluded that the value of compressive strength for kaolinite clay shows an optimum moisture content and maximum dry unit weight condition. The specific gravity of kaolinite clay was found to be higher when compared with residual soil. With a high specific gravity, kaolinite clay is very suitable self-compacted form when in contact with cold-formed steel. Cold-formed steel that is thick and lightweight is suitable for combining with high-specific-gravity kaolinite clay that plays as a role of a binder in composite structures. The unconfined compressive strength of kaolinite clay is calculated to be low when compared with residual soil. Medium consistency is desired for contact with cold-formed steel sections. High consistency of the soil is not desirable for it be used as a fill-in material as it increases the production cost.

Furthermore, this is the breaking point for future research in the use of this nonindustrial material as it has suitable compressive strength, that is, 78 kN/m^2 for a small specimen, and high specific gravity.

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Chapter 88
Persona Design Analysis of Digital Storybook for Remedial Students

Rahmah Lob Yussof, Hafiza Abas, and Tengku Nazatul Shima Tengku Paris

Introduction

User-centered design (UCD) brings software engineering (SE) and human–computer interaction (HCI) areas close to each other. UCD processes concentrate on users through the planning, design, and development of a software product. Unfortunately UCD techniques often fail to identify uses, needs, and problems that users have to contend with [1]. Whereas in SE and HCI areas, the main focus is on products with high quality. According to [1], the quality concepts of HCI give emphasis to the user experience using the software. Reference [2] stated, from a usability perspective and their experiences in software engineering projects, there are three challenges that arise in requirements engineering: (i) requirements of the user are often neglected; (ii) users, tasks, and context of use are not thoroughly connected to the requirements; and (iii) communication about future users is difficult. The above obstacles can be tracked with the insufficient use of user descriptions. Therefore, persona technique could be useful to give positive influence that consolidates the different perspectives on users and convey them in an understandable way.

Reference [3] defined persona as a specific and precise representation of actual user that is used throughout the design process. Personas are mostly used to help

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parties involved in the project to understand, illustrate, and clarify user's goals as well as behavior, attitudes, and motivation [4]. According to [5], persona is used to help the designers and programmers to see and understand clearly the user's needs and requirements. The use of persona is primarily for assisting designers and programmers to focus on users' needs in product development. Reference [6] also reported the successful use of persona with participatory methods and scenario-based design. In this paper, the researchers specify the persona technique in the initial stage of digital storybook development for remedial students.

Storytelling is one of the interesting elements that should be broadened in education syllabus. Students can enrich their vocabulary and understand grammar in a natural way by listening and enjoying the stories. The stories convey a message that can be interpreted by people with other views and perspectives [7]. Stories are part of human culture to pass histories, values, and entertainment. Besides, students can enrich their vocabulary and understand grammar in a natural way by listening and enjoying the stories that consist of background, plots, and characters. The stories explore abstract ideas, emotions, life situations, and people's perspectives [8] and enhance literacy development [9]. One of the ways to disseminate stories is through storytelling.

As technology advances, ways to tell and listen to stories will also change. Digital storytelling is one of the multimedia technologies that can be used to convey the story. It carries texts, colorful graphics, audio, video, and interactivity which make reading session fun and enjoyable. Based on the questionnaire checklist, observations, and interviews made from January until June 2009 in one of the government schools, we found out that remedial students have problems in engaging and focusing during learning sessions. Since remedial students have problems in learning such as short attention in study engagement and concentration, thus storytelling using digital storybook is one of the ways to help them to engage and motivate them in reading environments. Thus, this paper presents a design analysis on how persona might help to find and describe the user's key requirements and support the memory of the user's needs in designing relevant digital storybook for remedial students.

Research Background

The Purpose of the Study

We worked on digital storybook development to motivate remedial students and at the same time providing them with an enjoyable experience and keeping them constantly engaged in the learning session. The findings can be useful to curriculum developers for teaching remedial students to read in the Bahasa Melayu subject, especially for remedial students. Specifically, the study objectives are:

1. What is the remedial students' behavior before, during, and after reading session?
2. What are their reading levels?
3. What are their difficulties in reading?
4. What are the other problems with language components such as listening skills, writing, and speaking?

Getting the accurate information of users is the key factor to build the above study objectives. Thus, the benefits of persona are considered as a design tool in our study. Reference [10] emphasized the benefits of persona in his book as follows:

1. Persona brings focus to help the researchers to define the target audience of the product whereby a persona enables a team to focus their efforts on a specific group of users.
2. Persona builds empathy to help the researchers to live in the users' shoes. They will feel as the users do.
3. Persona encourages consensus where it helps the researchers to create one shared vision of their users' needs.
4. Persona creates efficiency to help the researchers to think about issues of users and features in the early stages to avoid these issues from arising in the project at a later stage.
5. Persona leads to better decisions to help the researchers make decisions based on the users' needs.

In this paper we report on findings with regard to the use of the persona technique in developing digital storybook for remedial students.

Bahasa Melayu as a Teaching and Learning Language to Read

Malaysia's national language is Bahasa Melayu. It is widely used in teaching and learning at schools in Malaysia. Students are obliged to pass the Bahasa Melayu subject in order to further their studies at university level or pursue their careers with the government. Bahasa Melayu is a "what you spell is what you pronounce" (WYSIWYP) language. It has 7 single words with one-syllable pattern, 11 single words with two-syllable patterns, 19 single words with three-syllable patterns and 12 single words with four- and more syllable patterns [11].

Bahasa Melayu itself is one of the subjects in Malaysian primary and secondary schools. It is a compulsory subject to pass in order to go for further education and one of the requirements for working with the government. Thus, it is important for the students to master the language in order to excel in their studies. Besides, Bahasa Melayu is widely used in daily life from formal to nonformal activities. It is also a language that unites all the races in Malaysia.

Remedial Students With Dyslexia

Remedial students are chosen as target users due to the fact that currently in Malaysia there is no courseware in learning how to read in Bahasa Melayu for remedial students. They are students who have learning disabilities and dyslexic problems. Reference [12] referred learning disabilities as a general term that refer to a heterogeneous group of disorders caused by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities. It gives the effect to the brain's ability in order to receive, process, analyze, or store information. Basically, students with learning disabilities also have problems in reading. At least 80 % of students with learning disabilities have problems in reading [13] or about 3.5 % of the school population [14].

According to [11] dyslexia is a condition for those who suffer a neurological and developmental condition. It also gives problems in writing, motor skills, spelling, decoding activities, memory, cognition, and mathematics. There are four types of factors affecting the reading abilities of students:

1. Neurological/biological factors
2. Cognitive factors (phonological processing, naming speed, working memory, metacognitive factors, and atomicity)
3. Behavioral factors (patterns of errors in reading and spelling, writing difficulties, time management difficulties, extra time to complete work, inaccuracies in copying, avoidance of writing, and discrepancies in performances in curricular activities)
4. Environmental/contextual factors

Persona Technique as a Design Tool

According to [15] despite persona widespread application, it has met criticism. The criticism is related with the persona creation process which uses qualitative methods only. Furthermore, it is subjective to the developer's own preference and the development teams' general consensus. [10, 15] propose to explore both qualitative and quantitative methods which can create a more reliable persona technique. As a result, in this research, we explore the persona technique such as interviews, observation, and quantified participatory method.

Data Collection

We used the following three methods to collect users' data, interview, observations, and participatory questionnaire checklist. The data collection had been conducted from January 2009 to June 2009 from five students from the remedial class in one

Table 88.1 Steps and implementation in the interview process

Steps	Implementation
Identify participants	Remedial students
What is the type of interview?	In person
What are the facilities needed?	Facilities are provided. It is conducted in a special room in their school
Check and test your equipment	Voice recorder, interview form, and checklist
What do you use to design an interview schedule and related topics to discuss?	A form, an interview schedule form, and checklist of topics to be discussed
Do you need a letter of authorization?	Yes. The authorization letter is from the Ministry of Education
Is the user being given adequate time for each question and response?	Yes
Are you following an interview protocol?	Yes

school in Bandar Baru Bangi, Selangor, Malaysia. Reading analysis is based on remedial curriculum topics from Kementerian Pelajaran Malaysia (KPM).

Interviews

Interviews are used to promote the intellectual understanding and not to produce a personal change [16]. It is developed to obtain deep, rich data using qualitative investigation perspective [17]. In this study there are three formats for interview design that will be summarized referring to [18] approach, informal conversational interview, general interview guide approach, and standardized open-ended interview. Reference [18] outline the informal conventional interview as "… entirely on the spontaneous generation of questions in a natural interaction, typically one that occurs as part of ongoing participant observation fieldwork" (p. 239). The researcher will rely on the interaction to guide the interview process [19]. However, this type of interview is unstable and unreliable because of the problems in classifying and analyzing the data [17].

The second approach is the general interview guide approach which is more structured compared to informal conversational interview [18]. It allows the researchers to develop rapport, ask question, and change question based on participant feedback. According to [19] "… to ensure that the same general areas of information is collected from each interviewee; this provides more focus than the conversational approach, but still allows a degree of freedom and adaptability in getting information from the interviewee."

The third approach is the standardized open-ended interview which allows participants to contribute more detailed information. However, it has difficulty in coding the data [17]. But this situation will reduce researcher's biases in their study [18]. The interviewing process for remedial students is conducted based on [20] steps as in Table 88.1.

Table 88.2 Methods, sources, and data collection

Methods	Source	Data
Persona information sheet	Remedial students	Biography. This helps the process of interview observation and participatory method
Interviews	Remedial students	Identify the interest, hobbies, favorite colors, speaking, and listening problems
Observations	Researchers	Behavior before, during, and after reading session
		Characteristics and manners during teaching and learning session
Participatory method	Researchers	Speaking skills
		Writing skills
		Listening skills
		Level of reading

Table 88.3 Timeline of research methodologies

Date	Instruments
Jan 2009	Persona information sheet
Jan 2009	Observation 1 and Users' Participation 1
Feb 2009	Observation 2 and Users' Participation 2
March 2009	Observation 3 and Users' Participation 3
April 2009	Interview 1
May 2009	Interview 2
June 2009	Observation 4 and Users' Participation 4

Table 88.2 explains the methods, the data sources, and the details which are collected during the interview and observation process, while Table 88.3 shows the timeline of research methodologies which is related to given instrument during the interviews, observation process, and quantified participatory method.

Observation

Observation allows data to be collected in a natural setting and is useful for describing complex social interactions [21]. The observation of remedial students ranged from 30 to 60 min. Field notes of nonverbal behavior and communication process were collected during and after the observation process. The remedial students did not know about the observation process. Researchers acted as teacher assistants in the class. Table 88.4 shows the observation checklist form during the observation process.

Quantified Participatory Method

To justify the criticism of qualitative persona technique, we suggest quantified participatory method. We designed questionnaires based on [22] which include information as follows:

Table 88.4 Observation checklist

Components	Checklist	Notes
Language	Has difficulty modulating voice	
	Limited vocabulary	
	Using lots of fillers (i.e., eh, oh, um, and err)	
	Confuse with the similar sound	
	Has difficulty understanding instructions or directions	
	Flat and monotonous voice	
Basic reading skills	Frequently loses place while reading	
	Confuse similar-looking word pattern	
	Demonstrates poor memory for printed words	
	Has weak comprehension of ideas and themes	
	Reads slowly	
	Guesses at unfamiliar words	
	Substitutes words while reading	
	Avoids reading	
Written language	Ability to write own name	
	Ability to write capital ABCs	
	Ability to write numbers 1–10	
	Ability to copy shapes	
	Messy handwriting	
	Incomplete words/sentences	
	Writing has many cross-outs and erasers	
	Has problems in space between letters	
	Has problems with spacing between words	
	Has trouble staying "on the line"	
	Copies inaccurately	
	Poor spelling	
Listening	The student has hearing problem	
	Always ignores teacher when his name is called	
	Has a short attention span	
	Difficulty staying focused	
	Easily distractible, especially by noise	
	Always misinterprets questions or requests	
	Able to follow only one or two instructions in a sequence	
	Has difficulty understanding in discussions	
	Becomes sleepy when listening to speakers or reading	
Social emotional	Shy to read	
	Stress in the reading session	
	Tries to avoid reading session being grumpy	
	Has difficulty dealing with pressure	
	Unable to deal with unexpected challenges	
Attention	Always fails to pay close attention to details	
	Always makes careless mistakes in schoolwork	
	Has difficulty sustaining attention in work tasks	
	Has difficulty organizing tasks or activities	
	Loses things consistently that are necessary for tasks/activities	
	Always distracted by outside influences	
	Always forgetful in daily activities	

Table 88.4 (continued)

Components	Checklist	Notes
Gross and fine motor skills	Has limited success with activities that demand eye-hand coordination	
	Unable to grasp pencil easily	
	Has poor handwriting	
Other notes	Always confuse with left and right	
	Unable to differentiate the sound distance	
	Has trouble reading charts and maps	
	Slow in learning new games	
	Unable to master puzzle	

Table 88.5 Single word with two-syllable pattern with examples

Single word with two-syllable pattern	Examples
V + CV	*Ibu* (mother), *ubi* (tapioca), *api* (fire)
CV + CV	*Buku* (book), *buka* (open), *bola* (ball), *baju* (shirt), *pasu* (vase), *kaki* (feet)
CV + CVC	*Telur* (egg), *sikat* (comb), *kapal* (boat), *mulut* (mouth), *bakul* (basket)
CVC + CV	*Lampu* (lamp), *sendi* (joint), *benda* (things)

Abbreviations: C, consonant; V, vowel.

1. Persona's biographic background
2. Specific goals or needs or attitudes
3. Specific knowledge or proficiency
4. Context of usage

In order to develop the digital storytelling, a few studies have been done in order to understand Bahasa Melayu. Hence, in this research we use the above questionnaires to find the students' syllable patterns and their reading level. The authors chose the four simple single words with two-syllable patterns which match the remedial students' reading level. Table 88.5 shows some examples of single words with two-syllable patterns.

Findings

Remedial students have problem in understanding what they read. Hence, researchers have reduced the language level and used fewer words in designing and developing the digital storytelling.

Table 88.6 Characteristics, behavior during reading session, and interest for five remedial students

Summary of their characteristics	Summary of their behavior during reading session	Summary of their interest
Playful, less confidence, emotional, passive, daydreaming	Short focus between 1 and 3 min, less attention, bored, no interest in reading, like to talk about other things	Drawing, watching television, playing games, playing doll, singing, prefer comics

Table 88.7 Reading disabilities and language component problems for five remedial students

Language components	Problems
Speaking	80 % have no problems in speaking, 10 % have problems in switching T to K and K to T, 10 % switching G to D
Writing	The highest error rate. Switching between words, holding pencils wrongly, spatial problems between words
Listening	Can obey one simple instruction at a time, daydreaming
Spelling	The highest error rate. Making wild guesses and trying to remember the word graphic patterns
Level of reading	Low level, can read simple sight word such as *buku* (book), *bola* (ball). 90 % in CV + CV level and letter naming. 10 % can read CV + CVC, CVC + CV

Abbreviations: C, consonant; V, vowel.

Table 88.8 Reading analysis based on remedial curriculum topics

Topic/student	Student A	Student B	Student C	Student D	Student E	Mean
Small letter	3	3	3	3	3	3
Capital letter	3	3	3	3	3	3
Spell CV	3	3	3	2	3	2.8
Spell CVC	1	1	3	2	2	1.8
Read CV + CV	2	2	3	2	2	2.2
Read CV + CVC	1	1	3	1	1	1.4
Read short sentences	1	3	3	2	1	2
Understand short sentences	1	3	3	3	3	2.6
Understand short comprehension	1	1	1	1	1	1

5 = very skillful, 4 = skillful, 3 = moderate, 2 = unskillful, 1 = very unskillful

This section will focus on:

1. Characteristics, behavior during reading session, and students' interest. Table 88.6 shows the summary of five students from the remedial class in one school in Bandar Baru Bangi, Selangor, Malaysia.
2. Reading disabilities and language component problems related to these five students in Table 88.7.
3. Reading analysis based on remedial curriculum topics from Kementerian Pelajaran Malaysia (KPM) summarized data is in Table 88.8.

Table 88.9 Characteristics, behavior, and language components of remedial students during teaching and learning Bahasa Melayu session

Item	Result
Characteristics	Mischievous
	Sensitive and emotional
	Inactive
	Absent-minded
	Daydreaming
Behavior during teaching and learning session	Can focus between 1 and 3 min
	Get bored easily
	Show no interest in reading
	Reading is a stressful session
	Like to chat and gossip
Level of reading	Very low
	Can read simple sight word such as "buku"(book) and "bola" (ball)
	90 % are still in letter-naming phase and CV + CV level
	10 % can read CV + CVC, CVC + CV
Speaking	80 % have no problems in speaking, 10 % have problems in switching T to K and K to T, 10 % switch G to D
Writing	The highest error rate. Switching between words, holding pencils wrongly, spatial problems between words
Spelling	The highest error rate. Making wild guesses and trying to remember the graphic patterns of the words
Listening	Can focus only at one simple instruction at a time

Abbreviations: C, consonant; V, vowel.

The information from the above findings will be used in designing and developing digital storytelling for remedial students. The digital storytelling designer must use various techniques, methods, and approaches in order to help these students in having fun and getting engaged in learning to read. Hence, in this paper researchers establish color psychology in line with affective engineering.

The observations and interviews conducted from January 2009 to June 2009 and the findings from Table 88.6 until Table 88.8 on the remedial students' level of reading in the Bahasa Melayu are summarized in Table 88.9.

From Table 88.9, these students are identified to have learning disabilities and have problems not only in reading but also related to other language components such as listening, spelling, writing, and speaking. Previous research stated that at least 80 % of students with learning disabilities have problems in reading [23]. They have problems with brain abilities such as to receive and process information, understand, analyze, or even store short-term and long-term memory. In terms of behavior factors, it involves patterns of errors in reading, seeking for extra time to finish work, copying exercises, avoiding writing, and getting tired easily. For this reason, information of users' needs and users' requirement are crucial for the development of Bahasa Melayu digital storybook for remedial students.

Conclusion

The main purpose of the research is to identify the following questions: (i) What is the remedial students' behavior before, during, and after reading session? (ii) What are their reading levels? (iii) What are their difficulties in reading? (iv) What are the other problems with language components such as listening skills, writing, and speaking? This study reports on the use of persona technique which combines interviews, observation, and quantified participatory method to describe the user's key requirements and needs and convey them in an understandable way. This technique supports the design of relevant digital storybook for remedial students. We conclude that users matter. The persona design analysis helps us to come out with the development of digital storybook according to users' abilities and their interests. In fact, persona plays an important role in the design process by allowing the researchers understand the users' preference better.

With the help of good design process, it is believed that the future generation, especially the disabled students, can learn to read in Bahasa Melayu in a fun and enjoyable way through storytelling and available technology.

Future Work

The findings from persona design process of digital storytelling serve as a guideline in the development phase for developers to develop the system that can support remedial students' needs with fun elements that make them engaged. They also serve as the guidelines for teachers and researchers in future teaching and learning research.

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Chapter 89
Impact of Applying Radiant Barrier Fitted Beneath the Roof in Hot and Humid Climates

S.B. Azraai, M.I. Ali, S.S. Salleh, and O. Asaroon

Introduction

Typical linked dwelling in Malaysia has high discomfort level due to warm air due to heat released by brick and mortar wall during the night and solar heat penetration through roof, walls and windows and stagnant air without sufficient circulation. The easiest solution is to use air-conditioning units to lower the temperature and humidity and provide air circulation. This solution, however, increases the consumption of electrical energy tremendously which is not in line with sustainable development and energy conservation policy.

Suman and Srivastava [1] had studied the influence of thermal insulation on conductive heat transfer through roof ceiling construction. They conduct the experiment to determine performance of roof ceiling heat insulators. They had found that the roof with polystyrene performed better than fibreglass. Caren Michels et al. [2] had conducted the theoretical and experimental comparison of heat flux reduction in roofs with using reflective thermal insulators. They use polished aluminium foils, black canvas and expanded polystyrene as heat thermal insulators. They found that the polished aluminium is the best heat insulator compared to the others. The theoretical and experimental efficiency results are slightly different. Abraham and George [3] affirm the cooling effect of reflective material shield covering the top side of metal sheet roofing. The barrier was fabricated from a shiny thick metal foil whose reflectivity is very high. The case involved a building in a desert area in Mali, Africa. The temperature of the roof with barrier falls by approximately 25 % as compared with the roof without barrier.

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In modern building shading technique, Divulder et al. [4] had unfold the thermal behaviour of a commercial building under the shading of single skin tensile membrane. The membrane shade is capable of inducing large-scale air movement and associated effects on both heat exchange and comfort conditions within the enclosed space besides being a barrier to solar heat. As the colour of the membrane is normally white, it reflects high percentage of solar heat into the open space.

Yoshiro and others [5] had compared four traditional Japanese houses with three houses modified to modern construction and one maintained in its original construction. They established that the traditional Japanese single storey farm house built in 1875 with thatched roof and wood board wall without modification falls within comfort zone and the others do not.

The objective of the research is to analyse the temperature profiles with and without applying staggered air-bubble packed aluminium foil in the model house.

Experimental Setup

The staggered air-bubble packed aluminium foils as heat insulator have been chosen to reduce the heat transfer through the roof. The staggered air-bubble packed aluminium foils are fitted beneath the roof. The experiments have been conducted to analyse the heat spectrum with and without thermal reflective aluminium foil in a model house. Figure 89.1 shows the model house used in conducting the experiment. Figure 89.2 shows the schematic of a test cell. The model house consists of a

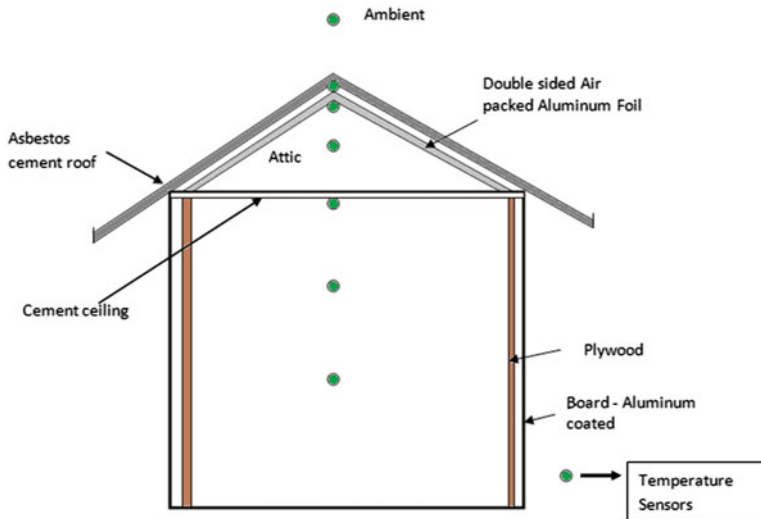**Fig. 89.1** A test cell at the Faculty of Mechanical Engineering, UTeM

Fig. 89.2 Schematic of a test cell

door and three windows. The eight-channel thermocouple integrated with data logger interfaced with personal computer is used to measure temperatures. The seven point sensor temperatures have been recorded at an interval of 10 min for a week. The outdoor and indoor air temperature differences were calculated in determining the effectiveness of the aluminium foil.

Results and Discussion

Temperature Profiles in Test Cell Without Fitting Aluminium Foils

Figure 89.3 shows the temperature variation with time. The ambient, roof and indoor air temperatures were recorded using data logger. All the temperatures were recorded below 30°C from 12 am to 8 am. After 8 am, the roof temperature starts increasing until reaching the maximum temperature of 49.7 °C at 1 pm. The maximum ambient temperature of 37.5 °C has been observed at 2 pm. The indoor air temperature gradually increases until reaching the maximum value of 37.7 °C at 5 pm. Indoor air temperature is increased due to heat transfer from the solar radiation through windows, wall and roof. The other factor contributing to the indoor air temperature rise is no fresh air circulation through opening because all the three windows are closed during the experiment. Indoor air temperature is decreased approximately by 11 °C from 5 pm to 9 pm. At 9 pm, the indoor air temperature dropped to 27° due to heat transfer to the surrounding.
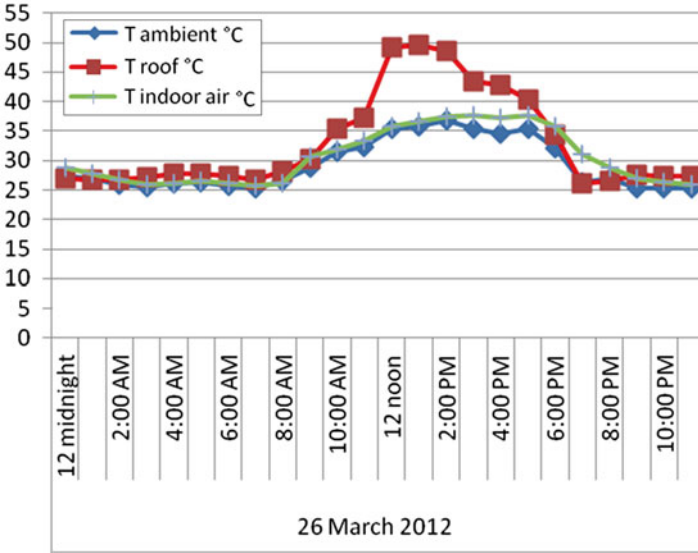
Fig. 89.3 Temperature profiles in test cell for 1 day

Comparison of Thermal Performance with and Without Fitting Aluminium Foils

Figure 89.4 shows the average indoor and outdoor air temperature difference with and without applying aluminium foils from 12 noon to 6 pm for four consecutive days.

The average outdoor and indoor air temperature differences with and without using aluminium foils are 1.78 °C and 2.49 °C, respectively. The average indoor air temperature drops by 0.71 °C with using aluminium foils. It is seen that the usage of aluminium foils reduces the indoor air temperature. The aluminium foils have reflected the solar radiation through the roof.

Conclusion

The average indoor air temperature drops by 0.71 °C with using aluminium foils. The application of aluminium foil in a building is necessary in reducing the air-conditioning cooling load.
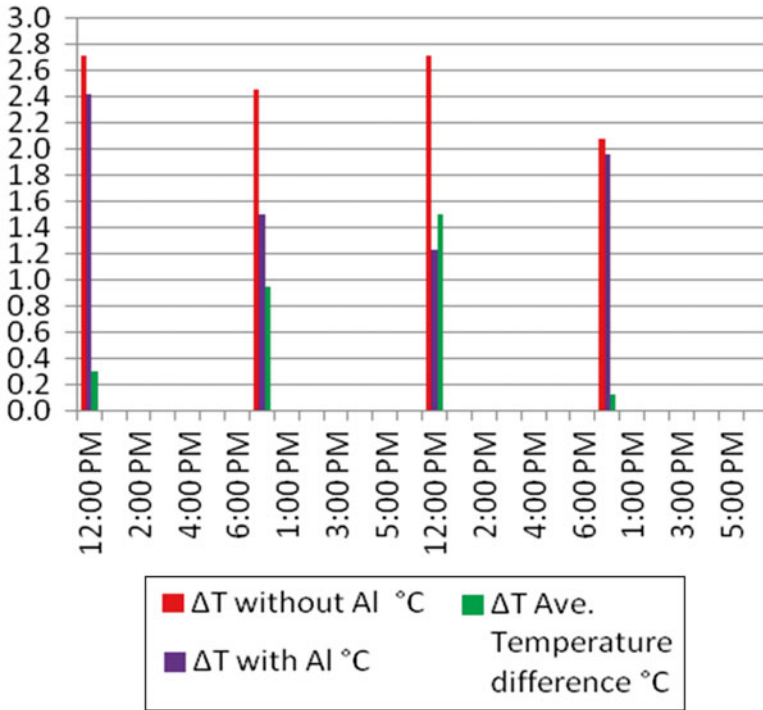
Fig. 89.4 Temperature difference with and without aluminium foil

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Chapter 90
Study of the Effects and Interaction of Operational Parameters on the Fabrication of Silver Nanoparticles (AgNPs)-Loaded Chitosan-Polylactic Acid-Based Films Using Full Factorial Design

S. Aznizan, M.N. Abu Seman, and C.K.M. Faizal

Introduction

For decades, plastic for packaging has been used increasingly in various sectors. However, polymers had several limitations for certain applications when compared with traditional material such as alloys or ceramic. The limitations such as the toxic elements from plastic and the easy growth of bacteria gave some problems in packaging, especially in medical and food packaging [1]. So, the objectives of this research are to fabricate films for plastic packaging application from chitosan/PLA/AgNPs (silver nanoparticles) nanocomposite to replace traditional packaging, improve mechanical strength, and enhance the antimicrobial properties. The purpose of combination between chitosan and polylactic acid is to improve the mechanical properties of chitosan, especially its brittleness. The valuable applications of the antimicrobial effects of silver nanoparticles had made this field of research work widely investigated. They may adhere to the cell wall and then disrupt the cell wall permeability and respiration of cell. In addition, the silver nanoparticles could damage the cell when they penetrate and interact with phosphorus and sulfur that are contained in the DNA and protein compound [2]. More explorations on these antimicrobial properties in the blended films were investigated [3]. Currently, we focus more on the mechanical properties of chitosan/PLA/AgNP complexes by using full factorial design. The two factors were the concentration of polyethylene glycol (PEG) 400 and the ratio of polylactic acid (PLA)/chitosan. It was found that polyethylene glycol (PEG) 400 used as plasticizer strongly influences the mechanical properties of the films [4].

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Experimental

Materials

Chitosan flakes from crab shells were purchased from Fisher Scientific; polyethylene glycol (PEG) 400 (CAS number, 25322-68-3), polylactic acid (PLA) (pellet form), silver nitrate (CAS number, 7761-88-8), chloroform (CAS number, 67-66-3), and acetic acid (CAS number, 64-19-7) were supplied from Sigma-Aldrich. Nutrient broth and Mueller-Hinton agar powder were products of Oxoid and supplied by Thermo Scientific. Tea ground (Boh tea) was manufactured from Cameron Highlands, Malaysia.

Synthesis of Silver Nanoparticles

To prepare the tea extract, 5 g of tea ground was boiled in 500 ml water and filtered through a 0.2 μm membrane filter. Then, 2 ml of 0.1 M $AgNO_3$ was mixed with 10 ml of tea extract and incubated at room temperature (25 °C); the solution was stirred with 50 rpm to ensure thorough mixing for about 24 h. The presence of synthesized silver nanoparticles in the solution was detected by the observation of the color change from light brown to dark brown. The silver nanoparticles were separated and concentrated by repeating four times the centrifugation of mixture at 10,000 rpm for 10 min. The supernatant was altered by distilled water each time.

Film Preparation

The method of chitosan/PLA blend film was prepared as described by [4] with some modifications. To prepare blend films of chitosan and PLA, solutions of chitosan and PLA were mixed separately in different solutions before blending. One percent (*w/v*) PLA was dissolved in chloroform and 1 % (*w/v*) chitosan was dissolved in 1 % (*v/v*) acetic acid and both of them were stirred under magnetic stirring for 2 h, respectively. The various concentrations of PEG 400 (in % *w/w*) were then added into both solutions separately and stirred for 1 h. Then both solutions were blended homogeneously with added concentration of silver nanoparticles (23.08 %) (*w/w*). The various composition ratios of chitosan/PLA and concentration of PEG 400 were listed in Table 90.1. The preparation was filtered and degassed under room pressure (101.325 kPa). The blend films were prepared by casting on glass Petri dishes (2.5-*mm* thickness) and evaporated at 35 °C for 18 h.

Table 90.1 Experimental matrix (2² full factorial designs with four central points) for the results and the evaluation of the tensile properties of films

Factors	Variables	Unit	Low (−1)	Medium (0)	High (+1)
A	Concentration PEG	(%)	0	15	30
B	Ratio PLA/chitosan	(%)	0/100	50/50	100/0

Standard order	Run order	A	B	Tensile strength (Mpa)	Elongation at break (%)
1	3	−1	−1	8.3324	9.6062
2	1	−1	−1	8.6360	9.6062
3	11	−1	−1	8.7851	8.6087
4	6	+1	−1	5.6942	13.4044
5	2	+1	−1	5.0709	12.6385
6	10	+1	−1	5.1385	13.6605
7	7	−1	+1	3.2737	2.6070
8	15	−1	+1	3.5333	3.2918
9	14	−1	+1	2.6250	2.6069
10	13	+1	+1	4.9475	5.9102
11	8	+1	+1	4.4644	6.6413
12	16	+1	+1	4.6808	5.1840
13	9	0	0	7.0898	18.1042
14	4	0	0	5.8687	17.8384
15	5	0	0	8.2738	23.4974
16	12	0	0	7.0272	22.1349

Tensile Measurement

The analysis of mechanical properties of the blended films was carried out by using tensile machine (Shimadzu Model Autograph AG-X instrument) according to ASTM D882 standard [5]. Tensile strength (MPa) and elongation at break (%) were involved in this mechanical analysis. Five films were stored at 25 °C for 24 h before measurement was conducted. The analyzed area of films (gauge length = 50 mm) was uniaxially stretched at a constant velocity of 500 mm/min in which the width and thickness of the films were measured before testing. The results of the experiment were computer recorded.

Experimental Design

A 2² Full Factorial Design with Four Center Points

For the best optimization process, factorial design could reduce the thorough number of experiments, employed to conclude the effect and interaction of each factors on response [6]. However, in this present study, the only effect and

interaction of concentration of PEG and ratio of PLA/chitosan had been evaluated in terms of the tensile strength and elongation at break as responses. The factors such as concentration of silver nanoparticles were held constant during the whole of experiments. A 2^2 full factorial design with four center points had been designed and employed. Due to systematic trends in the factors, the experiments were done in random order to reduce errors. The Design-Expert 7.1.6 software package (Stat Ease Inc., Minneapolis, USA) was applied to carry out the experimental data and to accomplish the statistical analysis at a 95 % confidence interval.

Results and Discussion

Design of Experiment by FFD

Table 90.1 shows the levels and ranges of analysis process parameters (A, concentration of PEG, and B, ratio of PLA/chitosan) influencing the responses (tensile strength and elongation at break) and the response results observed in the experiment. The effect of factor was determined as the difference in response produced by an alteration in the level of factor [7].

Concentration of PEG and ratio of PLA/chitosan affected the process in the experiment significantly. The effects and interactions of different factors were analyzed by using the software Design-Expert 7.1.6. The coded mathematical model for 2^2 factorial designs could be given as

$$\text{Tensile strength}\left(\text{MPa}\right) = +5.43 - 0.43 \times A - 1.51 \times B + 1.21 \times AB$$

$$\text{Elongation at break}\left(\%\right) = +7.81 + 1.76 \times A - 3.44 \times B - 0.22 \times AB$$

where A and B were the concentration of polyethylene glycol (PEG) (%, w/w) and the ratio of PLA/chitosan (%), respectively. Then, AB was an interaction between the concentration of polyethylene glycol (PEG) and the ratio of PLA/chitosan.

Analysis of Variance (ANOVA)

The interacting factors influencing the responses were determined by accomplishing the analysis of variance (ANOVA). The ANOVA displayed the absolute standardized effect at a 95 % confidence interval for both the tensile strength and elongation at break responses. The main and interaction effects of each factor had P-values <0.05 that were considered as significant [8]. From Table 90.2, for both responses, models and curvature showed significant P-values. With respect to the tensile strength response, the P-value for factors $A = 0.0269$, $B = <0.0001$, and $AB = <0.0001$ had

Table 90.2 ANOVA results of the tensile strength (MPa) and elongation at break (%) data obtained from the 2^2 full factorial designs for the blend films

Source	Sum of squares	DF[a]	Mean square	F-value	P-value	Contribution (%)
Response: tensile strength (Mpa)[b]						
Model	47.1892	3	15.7297	45.6589	<0.0001 **Significant**	
A	2.2440	1	2.2440	6.5137	0.0269	3.8
B	27.3984	1	27.3984	79.5298	<0.0001	46.45
AB	17.5467	1	17.5467	50.9332	<0.0001	29.75
Curvature	8.0006	1	8.0006	23.2235	0.0005 **Significant**	13.57
Residual	3.7896	11	0.3445			6.43
Cor total	58.9794	15				
Response: elongation at break (%)[c]						
Model	179.7555	3	59.9185	24.3754	<0.0001 **Significant**	
A	37.1436	1	37.1436	15.1104	0.0025	5.45
B	142.0256	1	142.0256	57.7774	<0.0001	20.84
AB	0.5863	1	0.5863	0.2385	0.6349	0.086
Curvature	474.7634	1	474.7634	193.1385	<0.0001 **Significant**	69.66
Residual	27.0396	11	2.4582			3.97
Cor total	681.5585	15				

[a]DF degrees of freedom; A and B are as defined in Table 90.1
[b]R-squared = 0.9257 and Adj R-squared = 0.9054
[c]R-squared = 0.8692 and Adj R-squared = 0.8336

significant influence on this response. While the P-value for only factors $A=0.0250$ and $B=<0.0001$ had significant influence, interaction factor $AB=0.6349$ had no significant influence on elongation at break response.

When the values of the sum of squares (SS) increase, the significance of the corresponding factor increases too [9]. The data showed that values of SS for factors A (concentration of PEG) and B (ratio of polylactic acid/chitosan) were both significant for tensile strength and elongation at break responses which are $A=2.2440$ and $B=27.3984$ for tensile strength response and $A=37.1435$ and $B=142.0255$ for elongation at break response. However, the interactions between both factors (AB) were only significant for tensile strength response which $AB=17.5467$ for tensile strength response and not significant with less SS value of $AB=0.5863$ for elongation at break response.

From the % of contribution data, factors A, B, and AB were significant for tensile strength response, their relative importance being $A=3.8$ %, $B=46.45$ %, and $AB=29.75$ %, respectively. With elongation at break response, only A and B were important factors with $A=5.45$ % and $B=20.84$ % contribution.

In addition, the relationship between the important factors and the response was not linear, but probability of a curvature still showed the significant values which are 0.005 and <0.0001 (13.57 % and 69.66 % contribution) for tensile strength and elongation at break responses, respectively.

The importance of the adjusted R (Adj R-squared) term was approaching to the coefficient of determination (R-squared), which indicates that nonsignificant terms
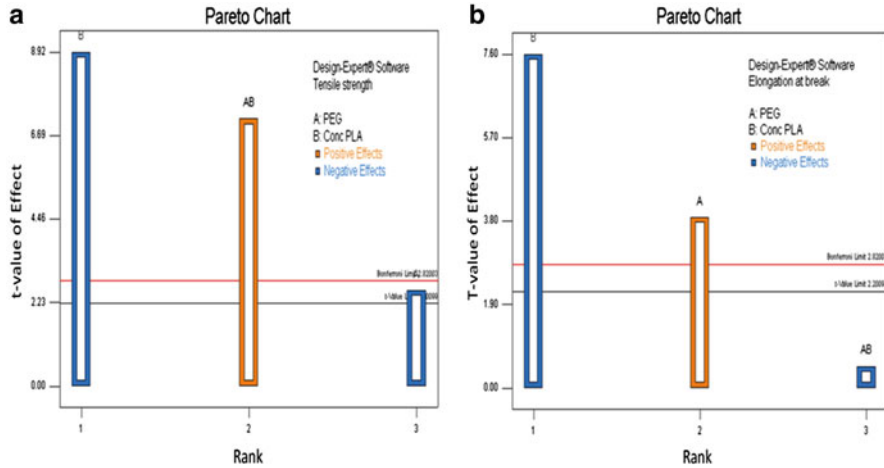
Fig. 90.1 The Pareto diagram for a 2^2 full factorial design with four central points when using (**a**) tensile strength (MPa) and (**b**) elongation at break (%)

had been included in the models [9]. In this experiment, for tensile strength response, R-squared = 0.9257 and Adj R-squared = 0.9054, while for elongation at break response, R-squared = 0.8692 and Adj R-squared = 0.833.

Main and Interaction Effects

The Pareto chart (see Fig. 90.1) displayed the absolute standardized effect at a 95 % confidence interval for both the tensile strength and elongation at break responses. From Fig. 90.1a, the factor sequence of the rank was B, AB, and A in the experiment which expressed an absolute value higher than the t-value limit (2.23) and had a significant effect on tensile strength response. For picture (b) of Fig. 90.1, the factor sequence of the rank was B, A, and AB in the experiment. Only the factors A and interaction AB expressed an absolute value higher than the t-value limit (1.19) and had a significant effect on elongation at break response. This Pareto chart showed the positive and negative effect clearly which the factor interaction AB for tensile strength responses and factor A for elongation at break response indicated the only positive effect, respectively.

Figure 90.2 showed normal probability plot of residuals for (a) tensile strength response and (b) elongation at break response. By plotting a normal probability plot of the residuals, the normality of the data can be inspected. The data were normally distributed when the points of the plot lie close to the straight line [10]. From Fig. 90.2, it could be seen that both responses from the experiment came from normally distributed population because the data point was fairly close to the straight line.
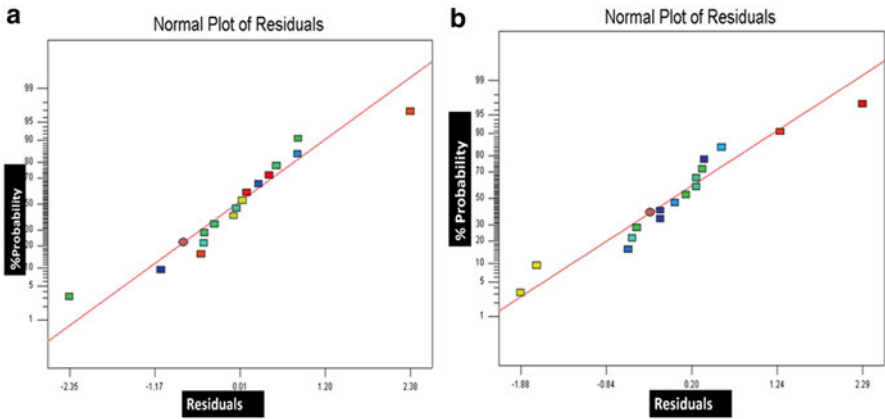
Fig. 90.2 Normal probability plot of the residuals for a 2^2 full factorial design when using (**a**) tensile strength (MPa) and (**b**) elongation at break (%)
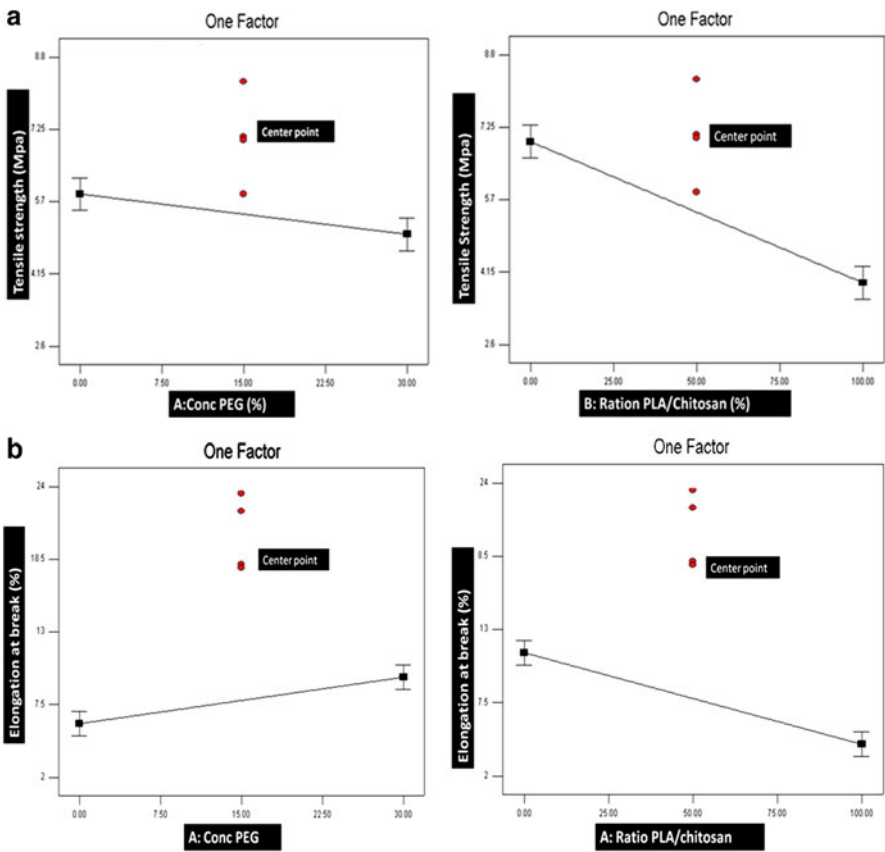

Fig. 90.3 Main effect plot with its response for the (**a**) tensile strength and (**b**) elongation at break

In order to validate the curvature, main effect plot indicates the mean response changing the level of the factor. Accordingly, the strength of the effect of responses across factors could be recognized. As stated in Fig. 90.3, factors A and B for tensile strength response (a) decreased when they moved from high level to the low level. Larger difference of the levels of factors A and B in the vertical position of the plotted points, steep slopes, gave the different meaning which factor B showed to have a greater effect on the response tensile strength than factor A.

For elongation at break response (b), factor A increased when moved from low level to the high level, but factor B decreased when they moved from high level to the low level. However, factor A for both (a) and (b) responses seems no visible main effect were present since the lines are almost parallel to the x-axis. However, these factors are still significant according to P-value in Table 90.2.

Conclusions

From the results of statistical analysis, it can be concluded that both the concentration of polyethylene glycol (PEG) 400 and the ratio of polylactic acid (PLA)/chitosan had significant effect on tensile strength and elongation at break responses. Therefore, the concentration of polyethylene glycol (PEG) 400 and the ratio of polylactic acid (PLA)/chitosan content in the blend films were employed for a surface analysis design in order to achieve an optimal quality of film based on tensile strength and elongation at break responses. From Table 90.1, the standard order 15 showed the best results in tensile strength and elongation at break which are 8.27376 Mpa and 23.4974 %, respectively. The results from FFD could be studied further expanded to a central composite design, in order to fit the measured data to a quadratic model and to calculate response surfaces.

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