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Factors influencing the adoption of online group-buying in virtual community

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Abstract In the past few years, virtual communities have greatly changed and influenced the way Internet users interact and exchange ideas. It not only offers amusement and enriches social relationship, but also changes people's daily habits. In the case of online retailing, the emergence of online group-buying is regarded as one of the popular and burgeoning shopping models. This works through an initiator who issues the group-buying message to members with the same demand for a specific product. In this way, it can enhance the bargaining power with the producer through bulk-buying to achieve the goal of price-cutting. In this study, we proposed a conceptual model to discuss constructs which influence online group-buying behaviors. These constructs include perceived interactivity, initiator's trust, perceived risk, word-of-mouth, and group-buying behavior intention. In the sample part, 134 valid participants with online-purchasing experiences were collected through online survey method. The conceptual model was conducted by structural equation modeling (SEM) method through SmartPLS 2.0 software to test the hypotheses proposed in this study. The results indicated that (1) perceived interactivity positively influenced the initiator's trust, (2) initiator's trust positively influenced group-buying behavior, (3) initiator's trust influence the perceived risk negatively; (4) word-of-mouth positively impacted group-buying behavior; and (5) perceived risk negatively impact on group-buying behavior. Overall, the results showed a good fit for the proposed model and provided the fine predictive and explanatory power on group-buying behavior of a virtual community.

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1 Introduction

In recent years, there has been an emergence of online group-buying as a unique shopping behavior. The central spirit of online group-buying is to get a discount through the aggregation of purchasing power from geographically dispersed consumers who are bound by a common interest in a product [65]. In the meantime, the widespread use of the Internet as well as the proliferation of virtual communities have facilitated the rapid growth of electronic commerce (e-commerce); thus accelerating the exchange and sharing of information between buyers and sellers. According to Evans' findings [22], virtual communities are currently blooming and business should take part as people around the world are connecting to each other and discussing their products through this community. In the case of group-buying, virtual community members are able to pool together to buy a product at a lower price. The various interactions between members in a community create many unexpected innovative and original ideas. Recently, virtual communities have begun to facilitate interactions that affect emotions and experiences [51]. Wasko and Faraj [78] found that one of the motivations to get involved in the virtual community is to have an exchange of knowledge, namely, to carry out the behavior of sharing and gaining. As a result, it has been proposed that the idea of online group-buying are no longer confined to family, friends, and well-known websites. Generally speaking, the group-buying model belongs to brokerage groups in which the websites act as middle men between companies and customers; for example, Groupon and Mobshop.com.

Compared to traditional group-buying websites, it is easier to form a group-buying proposal in a virtual community because there the trust developed between virtual community members reduces perceived risk [6]. An initiator is supposed to know more information about the product and the seller than virtual community members, which enables them to spread related information to potential buyers. According to Lai and Zhuang's research findings [48], the role of the initiator in group-buying is to be either a main buyer or a seller; however, the majority of the initiators are also main buyers who invite both strangers and family members, calculates the quantities and qualities of products before negotiating the price, order, and arrival dates with sellers. Therefore, regardless of the role of the initiators, the relationship between the initiator and group-buying members and the level of trust are considered as important factors in group-buying operating process; as a result, this creates a mutually beneficial situation among suppliers, initiators, and members. Moreover, online group-buying behavior was discussed by [35, 44] which compared and analyzed transaction data between virtual and real online buying websites. Jarvenpaa, Tractinsky, and Vitale [39] empirically showed the favorable effect of trust on consumer purchase intentions. Cheng and Huang [12] also showed that the initiator's trust can affect online group-buying intention; clearly, the role of trust is a fundamental importance for adequately capturing consumer behavior in online trading. In addition, word-of-mouth (WOM) has been referred to as one of the most powerful forces in business and frequently studied in academic interest for many years [2, 9, 57]. Paridon, Carraher, and Carraher [58] stated that WOM information is a type of information sharing. In today's virtual era, the power of WOM has grown exponentially and virtual marketing is associated with WOM through electronic media.

As mentioned above, the consumer's intention and perception are the main concerns which were discussed within the domain of online group-buying website or platform; as a result, there is only limited amount of research that explores the communicative relationship between initiators and members. This study proposes five factors (i.e., perceived interactivity, initiator's trust, word-of-mouth, perceived risk, and group-buying behavior intention) which influence

online group-buying within a virtual community. Moreover, perceived interactivity, initiator's trust, word-of-mouth and perceived risk are considered key factors to group-buying behavior intention. Consequently, the purpose of this study is to better understand how effectively these factors achieve the proposed influences. To be more specific, the current research tries to answer the following questions, which center on factors contributing to the intention to purchase: First, does perceived interactivity exert any effect on initiator's trust? Second, does an initiator's trust exert any effect on perceived risk and group-buying behavior intention? Third, does perceived risk and word-of-mouth exert any effect on group-buying behavior intention? To answer these research questions, we focused on a registered Facebook group (i.e., www.facebook.com/groups/) to examine our proposed model and used the structural equation modeling (SEM) method through SmartPLS 2.0 software to test the hypotheses. The purposes of this study are as follows:

1. To investigate whether perceived interactivity, initiator's trust, perceived risk, and word-of-mouth significantly affect online group-buying behavior intention.
2. To evaluate whether the depicted research model provide a solid theoretical basis for examining the adoption of online group-buying in virtual community.

2 Literature review

Many factors are key determiners of online group-buying behaviors. In recent years, some studies have discussed key factors that influence consumer participation of online group-buying, including: initiator's trust, perceived risk, and WOM [41]. Several researchers have indicated that the level of perceived interactivity is significantly related to trust [15]. Thus, the literature section is organized as follows to describe and explore perceived interactivity, initiator's trust, word-of-mouth, perceived risk, and group-buying behavior intention under online group-buying model of virtual community.

2.1 Perceived interactivity

Due to the maturity of network technology, it is able to provide a number of interactive communication services with personalized, interactivity, real-time, boundary-less characteristics. Through the interactivity of network services, it can attract network users significantly, improve users' participation, and operation performance based on previous researches. Furthermore, interactivity can enhance the comparative advantage for website [4]. According to Ghose and Dou's findings [28], there is a positive correlation between website interactivity and evaluation. Hence, interactivity is regarded as one of the most important quality of information services within the network domain. Furthermore, it is now paid more attention in academic research and industry applications than it was before.

Because of a virtual community's interactivity, members can share their opinions, experiences, and discuss the information about group-buying with multitude of other members [51, 61]. Due to advanced online shopping, an initiator will interact with buyers that they know in real life: relatives, friends, colleagues, classmates, etc., or people that they only know through a virtual community. Berndt and Perry [3] identified that friendship is associated with intimate self-disclosure, and that it is based on voluntary social interaction [34, 69]. Furthermore, close friends have more social interaction with consumers and enjoy sharing lots of information,

which could promote business interaction [16]. This is because true friends are expected to be unmotivated by benefits that can be used beyond the relationship (e.g. money, status), whereas business partners are, by definition, at least partly motivated by these more "instrumental" concerns [56, 64]. Based on group-buying behavior, true friends are more concerned about mutual interests than business relationship because friendship could cause less perceived risk. Bove and Johnson [7] also showed that buyers enjoy making transaction with close partners because they depend on more frequent interaction to enhance trust and decrease transaction cost and risk. Although previous studies have found that consumers' perceived interactivity influences their online trust [11, 15, 79], these studies lack focus on the relationship between perceived interactivity and trust on initiator, which can be improved by having a better understanding of social media based interaction. Meanwhile, interactivity can create a sense of mutual trust for each other, reduce the group-buying risk, and promote the group-buying intention [40]. Therefore, this study proposes that it is easier to build social media when the members feel the level of virtual community's interactivity is improved.

2.2 Trust

Trust is an expectation that others one chooses to trust will not behave opportunistically by taking advantage of situation and is a central aspect in many economic transactions because of a deep-seated human need to understand the social surroundings, that is, to identify what, when, why, and how others behave [33]. By trusting, people reduce their perceived social complexity through a belief that may, at times, be irrational, and that rules out the risk of undesirable but possible future behaviors on the part of the trusted party [52]. Trust also refers to individuals can rely on another person's words and behavior and have good intentions on the other side [19]. Kini and Choobineh [46] defined trust as the belief for reliability, security and ability of system in case of high-risk situation. Hawes, Mast, and Swan [33] confirmed that the relationship between trust and perceived risk is very close. Shemwell, Cronin, and Bullard [68] proposed that the negative relationship exists between trust and perceived risk. Teo and Liu [73] proposed that the perceived risk will be reduced when consumers have a higher level of trust for website. Kim and Benbasat [45] found that trust can reduce complexity and vulnerability in the process of transaction for consumers. It makes consumers to believe counterparty that is reliable and integrity in the exchange process and have good intentions on the other side.

In the context of social media such as Facebook, there are several reasons why the initiator's trust is an important factor in a successful group-buying [50]. First, users must provide personal information when they register to social media. For this reason, users may have concerns about the misuse of their personal information. Second, users must trust the social media's vendors not to violate their privacy and security because there are still unclear security settings (such as https, SSL, or third party certificate) in the said social media. Third, anybody can open a shop in social media as long as they are a registered member. Therefore, group members may have concerns about whether the initiator is reliable. According to the aforementioned reasons, this study considers an initiator's trust as negatively related to a group members' perceived risk and positively related to their purchasing intentions.

2.3 Word-of-mouth

Word-of-Mouth (WOM) is an effective routine to provide product information to potential consumers from a user perspective [69]. Arndt [2] was one of the earliest researchers into the

influence of WOM, he defined WOM as "oral, person-to-person communication between a receiver and communicator, whom the receiver perceives as non-commercial, regards a brand, product or service". Kotler and Keller [47] pointed out that the family is the most influential reference group in traditional WOM communication. However, unlike in traditional WOM communication, in the e-commerce context, consumers prefer to get information from virtual communities or website discussion groups such as blogs, Internet forums [13] and even Facebook. Park and Kim [59] noted that existing users write reviews on products or services via the Internet; this is called electronic WOM (e-WOM), which consists of messages written by existing users and posted in virtual communities or website discussion groups.

WOM can also be defined as the favorability of indirect information about online purchasing from the customer's social media relationships, either offline or online [66]. In this situation, WOM is in the form of experiences with sellers that were posted by prior users in their online social media. The WOM refers to the influences of both positive and negative referrals and has a strong persuasive effect on other people [70]. Brown and Reingen [8] concluded that WOM plays a significant influence factor on the purchasing process for customers in the information communication channel. If consumers receive positive WOM messages from existing user reviews, they will follow the opinions expressed and develop an intention to purchase certain products on group-buying websites [12]. Therefore, this study attempts to explore if the uncertainty among group members decreases if the WOM of a product can be offered from the member's social media. In other words, it studies the influence of WOM on group-buying behaviors.

2.4 Perceived risk

Since the 1960s, the theory of perceived risk has been used to explain consumers' behavior. Peter and Ryan [62] defined perceived risk as a kind of subjective expected loss. Featherman and Pavlou [24] defined perceived risk as the possible loss when pursuing a longed for result. Cunningham [17] pointed that perceived risk consisted of the amount that would be lost if the consequences of the act were not favorable and the individual's subjective feeling of certainty that the consequences will be adverse. Moreover, due to the distant and impersonal nature of the online environment, the uncertainty of using an open infrastructure for transactions usually bring about two specific types of risk: security/privacy risk and financial risk.

Security/privacy risk refers to a potential loss due to Internet fraud or hacker intrusion. Mayer, Davis, and Schoorman [53] stated that phishing is a new online crime by which phishers attempt to fraudulently acquire sensitive information, such as usernames, passwords and credit card details, by masquerading as a trustworthy entity in an electronic communication. A phishing attack takes places when a user receives a fraudulent email (often referred to as a spoof email) representing a trusted source that leads them to an equally fraudulent website that is used to collect personal information [24]. Financial risk refers to the potential for monetary loss due to transaction error or stock account misuse. Tsvetovat, Sycara, Chen, and Ying [75] showed that many customers are afraid of losing money while performing transactions or transferring money over the Internet.

Jarvenpaa and Todd [38] examined the general tendency of consumers to shop on the Web and the factors that affect their decisions and used an experimental survey of 220 Internet shoppers to validate a model of attitudes and shopping behaviors. The model included several perceptual indicators that belonged to four major categories: the value of the product sought by the consumer, the shopping experience, the quality of service offered by the Web site, and risk

perceptions of Internet retail shopping. Their findings showed that perceived consumer risk was cited as a barrier to shopping on the World Wide Web, but was not as salient to the sample as product perceptions, shopping experience, and customer service. After further analysis, a variety of goods perception, shopping convenience, and information retrieval of consumer services are the key approaches to online shopping over the Internet. If members of group-buying perceive the level of risk associated with purchasing a product as too high, they will not join group-buying and complete the transaction. As a result, purchasing products through social media is considered as more risky compared with traditional shopping. This study adopts perceived risk as a negative factor to explain the intention toward online group-buying.

2.5 Group-buying behavior intention

In theory of reasoned action (TRA), Fishbein and Ajzen [25] pointed out that intention related to "a person's location on a subjective probability dimension involving a relation between himself and some action" and therefore it refers to "a person's subjective probability that he will perform some behavior". As a result, intention is deemed as a critical predictor of consumer behavior. Online group-buying purchase intention refers to "the degree to which an individual believes they will adopt online group-buying to make a purchase" [13, 25]. Dodds, Monroe, and Grewal [20] defined purchasing intention as the possibility of buying behavior for the goods. Pi, Liao, Liu, and Lee [63] defined group-buying intention as the consumer's intention to engage in an online community information exchange activity and Jung [43] concluded that consumers in the decision-making process of purchasing and using products consist of narrow and broad senses. In a narrow sense, consumers directly decide to obtain and use economical products and services. In a broad sense, consumers have strategic and behavioral analyses except for consumer behavior. Furthermore, Pavlou and Gefen [60], and Pi et al. [63] have found that online group-buying purchase intention really influences consumers' actual buying behavior, and the behavior intention may influence transaction activities in the future.

3 Research method

3.1 Research model and hypotheses development

According to prior academic research, there are five constructs and five hypotheses relationships discussed in the conceptual model of the study that explore the uniqueness of online group-buying behaviors: perceived interactivity, initiator's trust, perceived risk, and word-of-mouth. First of all, in the context of online social media, social interaction is a dynamic interdependent process of information diffusion between two individuals, an individual and a group, or two groups. Bigley and Pearce [5] said that trust was developed from interactivity. Godes et al. [29] defined social interaction as the actions taken by individuals who are not actively engaged in selling a product or service that impact others' expected utility for the product or service. Yadav and Pavlou [80] also stated that consumers tend to be influenced by social interactions with others when they make purchase decisions offline and online. In the online group-buying context, group members with similar preferences will spontaneously form virtual social groups that are unconstrained by time and space. Thus, their trust will improve in response to informational and normative influences of this social interaction. Fan, Liu, Lin, and Wu [23] studied that trust within a relationship exerts a critical issue among the social interaction of group members in the

community. If an initiator is able to quickly respond to the group members' needs then they are more likely to trust the initiator. Based on the trust model proposed by [39], we present that perceived interactivity can be considered as the antecedent for an initiator's trust.

Trust in the Internet has an important and far-reaching effect on online commercial activities. Kim and Benbasat [45] claimed that trust helps the complexity and vulnerability a consumer feels while engaging in ecommerce by allowing the consumer to subjectively rule out any undesirable yet possible behaviors of the online vendor. Van der Heidjen, Verhagen, and Creemers [77] stated that trust helps consumers reduce their risk perceptions when dealing with online vendors. Leeraphong and Mardjo [50] found that a consumer's trust negatively affects the consumer's perceived risk of a transaction through Facebook. Hence, trust exerts a negative relationship on a confirmed perceived risk [33, 39, 73, 74]. Meanwhile, Van der Heidjen et al. [77] examined that consumer trust in a company's website has been shown to directly and positively affect the attitude and purchase intention towards that company. Chang and Fang [10] revealed that trust can significantly influence a consumer's willingness to make online purchases. Thus, we believe that compared to trust in traditional purchasing contexts, an initiator's trust is an even more essential antecedent of group-buying behaviors in a virtual community.

In traditional e-commerce transactions, consumers may face risks in carrying out online transactions, especially when using a medium without any kind of physical contact. Johnson, Meyer, Woodsworth, Ethington, and Stengle [42] stated that reliability or riskiness can be implied as the degree of uncertainty surrounding the outcome of an innovation and that a consumers' perception of risk has an influence on adopting this Internet technology. In fact, Van der Heidjen et al. [77] and Leeraphong and Mardjo [50] found that perceived risk has a significant negative impact toward this platform's adoption. Thus, a greater perception of risk leads to less willingness to purchase [74], which means perceived risk has a negative effect on a member's intention to participate in online group-buying.

At the same time, consumers' intentions of a product/brand are influenced by WOM before they even use the product/brand [36]. In this case, a consumer's initial trust and feeling about a product will solely rely on WOM. Ultimately, this will affect a consumer's intention to buy the product. As a result, a consumer will develop positive intentions toward the product with a reliable WOM. Based on previous statements, the study proposed five hypotheses and the conceptual model was shown in Fig. 1.

H1:   Perceived interactivity has a positive influence on initiator's trust.
H2:   Initiators' trust has a positive influence on group-buying behavior intention.
H3:   Initiators' trust has a negative influence on perceived risk.
H4:   Perceived risk has a negative influence on group-buying behavior intention.
H5:   Word-of-Mouth has a positive influence on group-buying behavior intention.

3.2 Samples and descriptive analysis

The sampling structure consisted of two parts. In the first part, this study adopted five constructs (perceived interactivity, word-of-mouth, initiator's trust, perceived risk, and group-buying behavior intention) and all items of the questionnaire were measured on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The five constructs from the previous studies were modified to measured items in this study. All items of
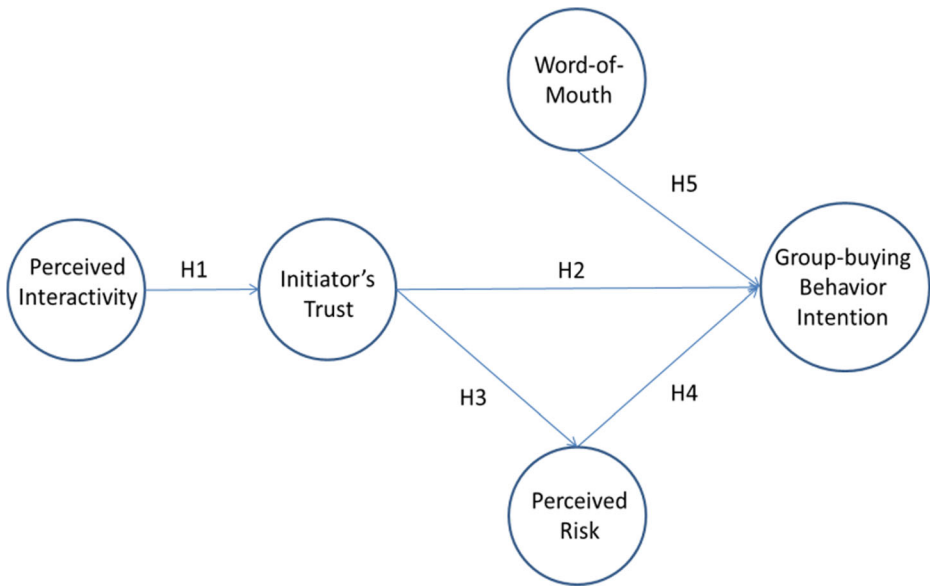
Fig. 1 The research model and hypotheses

questionnaire were developed by referring to past online-based literatures and character with a nice reliability and validity. The measurement of perceived interactivity from [54, 71], the measurement of word-of-mouth from [35] was modified, the measurement of initiator's trust from [21, 27], the measurement of perceived risk from [24], and the measurement of group-buying behavior intention from [1, 30] were all modified. Operational definitions for the five constructs and the measured items are shown in Table 1. In the second part, we described demographic variables for frequencies of subjects. Before this study performed quantitative research to test the hypotheses, active friends and relatives who had engaged in common Facebook group site (http://www.facebook.com/groups/) were chosen as our research subjects. In order to show the instruments had satisfactory reliability and validity, our quantitative research consisted of two steps to emphasize quantification in the collection of data. For the first step, we recruited 140 subjects to voluntarily visit new posts added to the Facebook group page's wall expressing our group-buying need initiated by active user (i.e., an initiator). After participating in an online group-buying simulation in which they evaluated an offer for a famous snack in Taiwan, subjects filled in the questionnaire which assessed the constructs we developed in our research in the second step. Empirical data were administered and collected through online questionnaire during April 2014. After excluding incomplete or abnormal data, our final sample included data from 134 respondents in this analysis. Of all respondents, 63.4 % were female, 78.4% were in the 30–39 age group, 64.9% were government employees, 26.1 % purchased food in group-buying, 38.8% cost 501–1000 NT Dollars per month in group-buying, and 43.3% consumed one time per month in group-buying.

3.3 Analysis method

Sørebø, Halvari, Gulli, and Kristiansen [72] pointed out that Partial Least Squares (PLS) is a second version of the regression method that combines confirmatory factor analysis and linear

Table 1 Operational definitions for constructs and measured items

Constructs	Operational Definitions	Measured Items	
Perceived Interactivity (PI)	Perceived Interactivity is defined as a level of the online interactive behavior between initiator and members.	PI1	Members are willing to share experiences of online group-buying with initiator.
		PI2	Initiator pays attentions to realize requirements of members.
		PI3	Initiator announces definitely affairs of online group-buying.
		PI4	Initiator provides immediately answers to questions for members.
		PI5	Initiator kindly and correctly answers questions for members.
Word-of-Mouth (WOM)	Word-of-mouth refers to the spread of members' positive experiences and opinions about the products throughout the virtual community.	WOM1	I think credit rating information provided by virtual community is reliable.
		WOM2	I think credit rating information provided by virtual community is objective.
		WOM3	I think credit rating information provided by virtual community is understandable.
Perceived Risk (PR)	Perceived risk is defined as the member's subjective expectation of suffering a loss in pursuit of a desired outcome.	PR1	I feel the risk associated with online group-buying in virtual community is high.
		PR2	I am worried that product quality may not meet my expectations.
Initiator's Trust (IT)	Initiator's trust is a belief in an initiator that leads to members' behavioral intentions.	IT1	I think initiator is familiar with product markets.
		IT2	I think initiator can provide good services.
		IT3	I have a confidence in the initiator.
		IT4	I think I can trust initiator.
		IT5	I can trust initiator except for special reasons.
		IT6	The initiator is famous for his/her care about the requirements of members.
Group-buying Behavior Intention (GBBI)	Group-buying behavior intention refers to the degree to which a member believes they will adopt online group-buying in a virtual community.	GBBI1	I am strongly willing to purchase products through online group-buying.
		GBBI2	In the future, I will purchase products through online group-buying.
		GBBI3	I will recommend relatives and friends to purchase products through online group-buying.
		GBBI4	I strongly recommend other persons to purchase products through online group-buying.

regression and can run measurement model and structural model analysis simultaneously. PLS is especially chosen as statistical means for testing structural equation model due to the following reasons: (1) PLS makes fewer demands regarding sample size than other methods, (2) PLS does not require normal-distributed input data, (3) PLS can be applied to complex structural equation models with a large number of constructs, (4) PLS is able to handle both reflective and formative constructs, (5) PLS is better suited for theory development than for

theory testing, and (6) PLS is especially useful for prediction [14, 18, 76]. Although PLS examines parameters among constructs and relationships between measured variables and latent variables simultaneously, the model analysis and explanation of PLS must engage in both measurement model and structural model analyses. PLS models are typically evaluated based on (1) the reliability and validity of measures, (2) the size and significance of path coefficients, and (3) the ability of the model to predict the outcome variables [37]. The features of PLS help one analyze relationships among constructs and predictability of the model more precisely [31, 37].

Due to the characteristics of PLS for sample size, testing theory, and the prediction orientation, we employed and performed the analysis using SmartPLS 2.0 to test the hypothesized relationships [67]. SmartPLS 2.0 performed the measurement model analysis for evaluating reliability and validity of constructs, and then evaluated significance of path coefficient tests by conducting bootstrapping sampling in order to provide *t*-test values for examining the research hypotheses and the explanatory power of the model. The cases of bootstrapping were set to be 200 and the samples of bootstrapping were set to be 5000 in this study. In the next section, we examined the measurement model and the structural model.

4 Measures and results

Two models of a PLS path model are described: (1) a measurement model relating the measured variables to their own latent construct and (2) a structural model showing the relationships (paths) between the latent constructs. In the following, we described the evaluation of the measurement model and the structural model.

4.1 Measurement model analysis

Measurement model analysis is used to examine whether all the measured variables measure the correct item in the research model or have loadings in the other constructs. In this study, we examined the measurement model from three perspectives suggested by [37]: a) individual item reliability; b) convergent validity; and c) discriminant validity. Reliability and validity analyses based on these three perspectives are described below. Individual item reliability is used to evaluate the factor loadings of the measured variables on constructs. Hulland [37] argued that a low factor loading represents a low explanatory power of the model, and suggested that factor loadings of measured variables should be greater than 0.7. After deleting a measured variable (i.e., PI5) which is factor loading under 0.7, Table 2 presented an overall good reliability of the measured variables in this study because all the factor loadings in the constructs ranging from 0.749 to 0.959. Meanwhile, Table 2 revealed that all constructs have Cronbach's alpha values above 0.7, which means that all constructs have good internal consistency [32].

Composite reliability (CR) and average variance extracted (AVE) are the two main indicators used to evaluate convergent validity [49]. A composite reliability of a construct is formed by the reliabilities of all the measured variables, which represents an internal consistency (or consistency between measured variables in a construct). The higher the composite reliability, the higher the internal consistency of a construct. Fornell and Larcker [26] suggested that composite reliability should be greater than 0.7. Table 2 showed a good internal consistency for each construct ranging from 0.846 to 0.915. The average variance extracted

Table 2 Reliability and validity analysis of constructs

Constructs	Measured variable	Factor loading	Cronbach's alpha	CR	AVE
Perceived Interactivity	PI1	0.777	0.811	0.876	0.638
	PI2	0.852			
	PI3	0.755			
	PI4	0.808			
Word-of-Mouth	WOM1	0.944	0.890	0.932	0.821
	WOM2	0.847			
	WOM3	0.924			
Perceived Risk	PR1	0.909	0.859	0.932	0.872
	PR2	0.959			
Initiator's Trust	IT1	0.905	0.913	0.933	0.699
	IT2	0.876			
	IT3	0.780			
	IT4	0.795			
	IT5	0.778			
	IT6	0.870			
Group-buying Behavior Intention	GBBI1	0.749	0.826	0.907	0.711
	GBBI2	0.794			
	GBBI3	0.893			
	GBBI4	0.924			

from a construct is employed to calculate the average variance power of the measured variables. The higher the average variance extracted, the higher is the convergent validity. Fornell and Larcker [26] suggested that an average variance extracted should be greater than 0.5. Table 2 showed that the average variance extracted for each construct ranging from 0.626 to 0.750. Based on the analysis, constructs in this study possessed a good convergent validity.

Fornell and Larcker [26] suggested that discriminant validity can be calculated by the square root of average variance extracted (AVE) of each construct and the correlation coefficient among constructs. Discriminant validity exists when the square root of average variance extracted of a construct is greater than the correlation coefficients between the construct and the other constructs. Table 3 showed that the square roots of average variance extracted were greater than the correlation coefficients between the construct and the other constructs, meaning that discriminant validity existed among constructs in this study.

Based on the analyses from the three indicators, the constructs in the research model possessed good reliability and validity, which was qualified to perform the hypothesis test about the correlations among the constructs and predictability of the model's explanatory power.

Table 3 The square root of AVE of each construct and the correlation coefficient between the construct and the other constructs

| Constructs	(1)	(2)	(3)	(4)	(5)
Group-buying Behavior Intention(1)	**0.843**				
Initiator's Trust(2)	0.770	**0.836**			
Perceived Interactivity(3)	0.688	0.793	**0.799**		
Perceived Risk(4)	-0.204	-0.288	-0.067	**0.934**	
Word-of-Mouth(5)	0.800	0.775	0.737	-0.101	**0.906**

Bold numbers in diagonal lines are square root of AVE of each construct; numbers in non-diagonal lines are correlation coefficient between the construct and the other construct

4.2 Structural model analysis

Structural model analysis is mainly to examine path coefficients and R^2 among constructs in the research model. Path coefficients measure the relative strength and sign of causal relationships among constructs, whereas R^2 is the percentage of total variance explained of exogenous variable (or independent variables) on endogenous variables (or dependent variables) and represents the predictability of the research model. Path coefficients and R^2 represent the matching level between structural model and experimental data. Fig. 2 was the summary of the structural model analysis in this study. The path coefficient is shown for each path, with the significance as asterisked, and the R^2 is shown under each endogenous variable. Table 4 showed the path coefficients, t values and p values among constructs, and the results of the hypothesis test.

According to Table 4, the test results for hypotheses 1,2,3,4, and 5 were significant. The significant results included: a) perceived interactivity positively affected initiator's trust; b) initiator's trust positively affected group-buying behavior intention; c) initiator's trust negatively affected perceived risk; d) perceived risk negatively affected group-buying behavior intention; and e) word-of-mouth positively affected group-buying behavior intention. The path coefficients of the five hypotheses were 0.793, 0.351, −0.228, −0.071, and 0.520, respectively.

Hulland [37] pointed out that LISREL and other covariance structure analyses examine the structure model based on the overall model fit, whereas PLS examines the model goodness-of-fit based on R^2 of endogenous variables, because PLS focuses mainly on minimisation of error or maximisation of variance explained in all endogenous variables. As shown in Fig. 2, R^2 for the four endogenous variables in the present model, including group-buying behavior intention, perceived risk, and initiator's trust, were 0.701, 0.052, and 0.629, respectively. In other words, initiator's trust, perceived risk and word-of-mouth explained about 70% of the total variance in group-buying behavior intention; Initiator's trust explained about 5% of the total variance in perceive risk; and Perceived interactivity explained about 63% of the total variance in initiator's trust. Since the research model explained more than 50% of the total variance in group-buying behavior intention, the research model held a good predictability and explanatory power for the acceptance of the online group-buying based on virtual community.
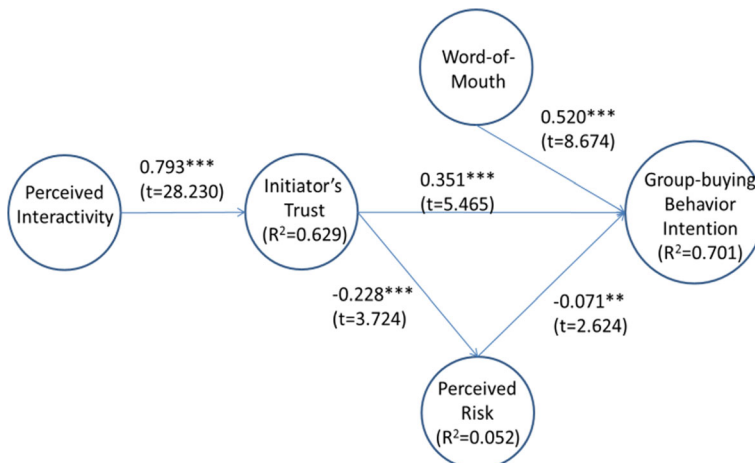
Fig. 2 Structural model and analyzing results

Table 4 Path coefficients and results of the hypothesis test

Hypothesis	Path	Path coefficient	t value	p value	Supported
1	Perceived Interactivity → Initiator's Trust	0.793***	28.230	<.001	Accept
2	Initiator's Trust → Group-buying Behavior Intention	0.351***	5.465	<.001	Accept
3	Initiator's Trust → Perceived Risk	-0.228***	3.724	<.001	Accept
4	Perceived Risk → Group-buying Behavior Intention	-0.071**	2.624	<.01	Accept
5	Word-of-Mouth → Group-buying Behavior Intention	0.520***	8.674	<.001	Accept

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

5 Discussion and limitations

5.1 Key findings

The purpose of this study was to provide a better picture of factors influencing online group-buying behavior intention in virtual community. Two key findings are described as follows. First, the findings strongly supported that the appropriateness of potential driving factors (initiator's trust, perceived risk, and WOM) to understand online group-buying behavior intention. According to Table 4, the result supported hypotheses of both relations between perceived interactivity and initiator's trust, between initiator's trust and perceived risk, and between initiator's trust and group-buying behavior intention. The process of perceived interactivity was investigated with initiator's trust. The group member-initiator relationship influences trust on initiator. On the basis of trust on prediction [21], group members are able to observe the initiator's behavior, which increases the degree of trust on initiator. There is a significant and positive correlation between group member-initiator interaction and trust on initiator in hypothesis 1, that is to say, this finding was consistent with the research result [21, 39]. Unlike normal online purchase behavior intention, there are more risks and trust involved in the online group-buying while group members purchasing products. Clearly, an initiator plays a critical role and initiator's trust becomes a major concern while joining online group-buying through social media. Hypothesis 3 revealed that initiator's trust generally reduces group members' perceived risk. The more trust on initiator, the less perceived risk. This result was consistent with previous research [39, 73]. From Ajzen and Fishbein [1] point of view, trust can be considered as a belief, whereas purchasing intention can be regarded as behavior intention. That is to say, behavior intention is affected by trust. Hypothesis 2 supported that initiator's trust is a key factor as regards intention to be involved in group-buying. This result was consistent with previous research [39]. Consequently, the three significant relationships with initiator's trust are in line with the previous literature reviews.

Second, the result supported hypotheses of both relations between perceived risk and group-buying behavior intention and between WOM and group-buying behavior intention. If group members believed that the online group-buying environment is secure and products have a good reputation, the group members are more likely to join group-buying through social media. Consistent with prior research [13, 74], hypothesis 4 provided empirical support for the relationship between perceived risk and online group-buying behavior intention. Although Mudambi and Schuff [55] found that many consumers would like to make a choice according to their personal feelings, hypothesis 5 showed that WOM is positively related to group-buying behavior intention, which indicated that group members may be influenced by

some discussion forums posted in Facebook page before they decide to join group-buying. Thus, WOM significantly affected group-buying behavior intention through social media. The result was consistent with previous research [12, 36].

5.2 Limitations

Unlike one of the most well-known online group-buying sites in Asia, "ihergo" (found at http://www.ihergo.com/), which was founded in March 2007, the data collection in this study was constrained to data pertaining to members engaged in designated Facebook group, not a group-buying site which already enjoys a reputation as an established site. A potential limitation of this study is that it only examines members of a Facebook group in Taiwan. Thus, replicating this research in other countries would result in differences with the outcome of this study because of cultures. Hence, there is much room for future research to replicate this study across a wider variety of Facebook groups/fans to verify the generalizability of our findings.

6 Conclusions and suggestions for future research

6.1 Conclusions

Online social media (i.e., virtual community) allows members to share information to their friends, families or relatives which could be browsed by many people and lead to many to many spread of information. Recently, the power of the social media has pushed the business to use social media as a platform to conduct online commerce. On the basis of the characteristics of virtual community, we focused on the two antecedents, perceived interactivity and initiator's trust, and involved three constructs (i.e., WOM, perceived risk, group-buying behavior intention) to propose the conceptual model discussed in the study. According to our empirical analysis with PLS, the proposed model validation included validation of measurement model and validation of structural model. In validation of measurement model, assessment of composite reliability and divergent validity revealed that this study possessed good reliability (i.e., internal consistency) and convergent and discriminant validity. In validation of structural model, evaluation of path coefficients and calculation of R^2 leaded to two findings as follows:

First, all of hypotheses were supported. The significant results showed that perceived interactivity had a positive influence on initiator's trust, initiator's trust and WOM affected group-buying behavior intention positively, initiator's trust had a negative influence on perceive risk, and perceived risk had a negative influence on group-buying behavior intention. Second, the result finding showed a good fit for the proposed model with a fine predictability and explanatory power in relationship among constructs as follows: (1) Initiator's trust was accounted for 62.9% by perceived interactivity, (2) approximately 70.1% of group-buying behavior intention was accounted by initiator's trust, and (3) perceived risk and WOM; and perceived risk was accounted for 5.2% by initiator's trust.

6.2 Suggestions for future research

Our results made a valuable contribution to understanding the group-buying behavior intention in virtual communities. Furthermore, this study pointed towards several areas of potential

future research. First, the empirical data for this current study was only collected using quantitative research and the questionnaire method. In future studies, this research may wish to bring in qualitative research to get more detailed information from members of the group-buying in virtual community. It is helpful to strength the results of empirical data. Second, from the structural model findings, the proposed model constructs didn't explain 30% of the variance in group-buying behavior intention. There exist great opportunities for future researchers to include other possible factors affecting group-buying behavior intention to purchase, in addition to those discussed in this study. Factors like perceived value, social influence, conformity, and the development of technology are all considered to be critical when discussing group-buying behavior in virtual community in the future.

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