Awareness and Perception of the Environmental Sustainability of Beverage Packaging Materials

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Abstract Sustainability is an important issue, and there are growing concerns on what could be done to achieve it better. Beverage packaging materials have an important task to safely hold its content and allow for convenience in consuming drinks by the consumer. However, after consumption, it becomes an environmental sustainability concern. This paper investigated university-educated young consumers' awareness, and perception of the impact different beverage packaging material choices have on environmental sustainability through a mixed methods action research approach. Prospective participants of the study were invited through the students' network and contact. The participants were requested to complete a survey with multiple choice answers and an opinion scale on various areas related to the environmental sustainability of beverage packaging. Conventional plastic-based beverage packaging materials were in the opinion of the majority of the surveyed consumers, to be most detrimental to the environment. However, that might not be the real case, as evident from the results of life cycle analysis (LCA) studies on several different beverages and packaging materials. It was noted that the students and alumni do care about environmental sustainability. However, there is some confusion among the respondents on how they could contribute effectively in their daily activities to the sustainability goal. Some still lack practical knowledge that can guide their purchasing decisions and disposal practice for consumed packaging. Some propositions for future actions and research on improving awareness and actions were provided.

Keywords Sustainability · Packaging materials · Engineering education · LCA

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1 Introduction

Sustainability is an important concept with increasing efforts seen by governments around the globe in implementing measures that will help the world grow more sustainably. Consumer personal consumption purchases directly impact a nation's GDP and, more importantly, sustainability efforts [1]. Consumer purchase behaviors and actions have direct consequences on the quest for sustainability [2]. Consumers who have become aware of the importance of sustainability may choose to select products labeled with information implying "sustainability" or, in their opinion, will be able to help with the sustainability cause. In a context of sustainability and need of a circular economy, studies on consumers purchasing behavior on common goods and services has been an important research topic because any changes to this influencing factor would have a significant impact to the success of environmental initiatives that involves supply and demand [3, 4]. One of the prevalent initiatives is promoting sustainability in packaging materials usage and their waste control, as outlined in the European Union Directive on Packaging and Packaging Waste (Directive 94/62/EC). For beverage industry, packaging not only plays an important role in preserving the quality of the liquid it contains, but it is also a marketing tool and communication instrument between the industry and consumers. Aesthetical aspect of a packaging, such as shape, graphic design and color has been used for product promotion by differentiating its appearance from its competitors [5]. Packaging also conveys important information to consumers, such as shelf life, ingredients, nutritional content and place of manufacture. Thus, the design of a packaging has a significant influence on consumer decision process.

Considerable amount of new design guidance have been introduced to packaging industry, for example, several design frameworks for sustainable packaging have been proposed, with coverage ranging from efficient use of material, energy and water to the inclusion of life cycle analysis tool for assessment of environmental impact caused by the packaging material [6, 7]. Beverage industries have realigned their strategy toward the three pillars of sustainability, i.e. economic, environment and social, because by doing that they can gain competitive advantages to meet the demand of modern "green consumers". Many beverage companies, such as PepsiCo, Coca-Cola and Nestlé, have published their goals to improve sustainability of their packaging materials. These goals are collectively listed in a database shared by the Sustainable Packaging Coalition [8]. To achieve these goals, such as "Making 100% of our packaging recyclable globally by 2025, Cola-Cola" [8], companies have to address multiple aspects of design issues simultaneously, which include sustainable sourcing, weigh reduction, increasing use of recycled and/or biodegradable materials, reusability and design for improved recovery. Inevitably, all these require substantial amounts of financial commitment and thus in return the companies expect increased market share and customer satisfaction within a reasonable timeframe.

Consumer buying decisions have been modelled by many studies [9] and can be divided into several steps, which include need recognition, information search, evaluation of alternates, purchase and post-purchase behavior [10]. It has been reported

that the design of a packaging, in particular its visual appearance, has a significant effect on such buying decisions and can influence consumer's perceptions about the product quality and its appeal. Packaging imagery has been widely known to be one of the important elements that affects packaging visual appearance. A well designed image can attract consumer's attention quickly and the information the image trying to transmit can be processed with less cognitive efforts, which is more efficient compared to textual printings [11]. Packaging color also has a strong positive correlation to consumer buying decisions [12]. Despite color psychology is complex and personal, a great deal of efforts have been directed towards understanding its contribution to brand identity and sale value [13]. Packaging material is another contributing factor to consumer buying decision, but in a quite unique way, as the perception is built mostly on haptic contact. A packaging with good visual appeal but made of flimsy material will not be pleasing to the hand and thus negatively affecting the buying decision [14].

Despite the beverage industry has devoted considerable efforts in promoting sustainable packaging, and substantial number of existing literatures on relationship between packaging design and consumer buying decisions are available, there have been few studies investigate which features of sustainable packaging have the most influential effects on consumer buying decisions. In recent years, many environmental labels have been proposed and used on beverage packaging, aiming to communicate the importance and benefit of sustainable practices. However, it was reported that some consumers still confused with the various environmental labels used and difficult to link their buying decision to sustainable packaging [15, 16]. In this study, we focused on university-educated young consumers' awareness and perception of the design of sustainable beverage packaging.

Universities attract and nurture talents that will have a profound impact on the world. Universities and institutions of higher learning have an important role in promoting the sustainable development cause, and more universities are embracing sustainability [17]. The institutions are teaching students about the importance of sustainability through their programs offerings and embed the principle of sustainability in their operations, mission, and strategy [18, 19]. By including sustainability topics into its programs and demonstrating sustainability values in all that it does, the universities seek to influence their students and graduates to become aware and champion sustainability measures.

University students are well educated and will have substantial purchasing power in the marketplace upon graduation. These young adults are a key market for beverage producers, and the consumption of all types of beverages is growing steadily. However, there is an important issue with the growth trend: the increased usage of packaging for the beverages and the disposal or treatment needed to handle the growing amount of waste. From the authors' own experience, consumed drink bottles are among the most common disposals on campus litter bins.

This study will assess the students' perception of the environmental sustainability of different beverage packaging options commonly found in China. The study had also explored the participants' choice of beverage packaging options and willingness to adjust their options in the interest of environmental sustainability through an online

survey. A further in-depth interview was conducted with the participants to explore how they have learned about the importance of sustainability and how it has guided or influenced their purchasing decision of everyday goods like beverages.

2 Methodology

This study adopts the action research approach to study environmental sustainability concerns. Action research is a participatory method that is context-specific and problem-focused based on a partnership between action researchers and participants directly involved in the change process [20]. Action research is one of the three key research paradigms for insider research on own organization settings [21]. The authors (academics and students) are all part of the higher education community highly passionate about sustainability. The focus of the study on beverage packaging materials was initiated due to the authors' observations on the growing consumption and disposal of takeaway beverage cups and bottles in higher education institutions. For data collection, the study had adopted mixed method research approach. Mixed method approach involves the collection of both quantitative and qualitative data in a single inquiry or study which is suited for answering a wide range of research questions [22]. Additionally it has been noted that the mixed method approach is aligned closely with that of action research [23, 24]. Quantitative research was carried out in the form of an online questionnaire survey, and qualitative research was carried out in the form of a face-to-face interview with participants. The advantages of using an online questionnaire include geographical reach, relatively low cost, and the ability to reach a considerable amount of respondents [25]. Although face-to-face interviews are time-consuming and laborious, the answers obtained were more detailed based on the open-ended questions [26]. Therefore up to 15 respondents were invited and participated in the follow-up interview sessions.

The participants in this study were invited from the personal contact and networking of the students based on a convenience sampling approach. All of the participants were current or recent graduates of an institution of higher learning in China. The survey question was adapted from [27, 28] and supplemented with details that suit the locality of the study. The online questionnaire consisted of four sections. In the first section, five questions mainly investigate the participants' awareness and perception of environmental sustainability. The second part investigates how strongly the participants feel about environmental protection when they purchase packed beverages. The third section of the online questionnaire explores the respondents' awareness and knowledge of some common labeling information found on beverage packaging, particularly those related to its disposal instruction and environmental impact. The participants were required to choose the correct answer according to the meaning of the eleven different labels. The answer choices available to the respondents were in two primary forms. When the questions relate to their perception or opinion on sustainability, they will choose the alternatives on a 1–7 scale, where 1 = completely disagree (very environmentally unsustainable) and 7 = completely agree

(very environmentally sustainable). The other questions are in the multiple-choice format, where the respondent will need to select the best answer/s that represents their view. The questionnaire was hosted and distributed using the China popular online survey platform wjx (www.wjx.cn). A total of 243 valid and complete questionnaires were received in this study.

The last part of the questionnaire covers the respondents' demographics and background information and asks if they are willing to participate in a follow-up in-depth interview related to the topic. Further in-depth interview with a total of fifteen participants was completed. The interview consisted of thirteen semi-structured questions related to the topic and was arranged to gain insights from the respondents.

3   Results and Discussion

The information collected from the online survey is analyzed, presented, and reflected along the four key components mentioned in the methodology. Further related inputs collected from the face-to-face interview sessions will also be included and linked to the survey findings. The key notable findings are presented as follows.

3.1   Background Information of the Respondents

The 243 respondents participated in this study age between 18 and 28 years old, where 50.62% are male, and 49.38% are female. The respondents are currently students or have recently graduated from their undergraduate or post-graduate university education. The following are some of the selected key responses to the questions covered in the questionnaire.

3.2   Awareness and Views on Environmental Sustainability

Figure 1 shows that about 68% of the respondent feels that the ecological environment around them was getting better. On the other hand, about 12% of the respondents did not have an opinion or is unclear about the condition. This clearly shows that the majority of the respondents believe that the ecological environment is getting better. It is not surprising as in the authors' own experience, the environment and pollution in the local vicinity has improved over the years. There are continuous efforts by the local authorities and city government in improving cleanliness, reducing pollution activities, and minimizing littering in the streets. As mentioned by a number of the interviewees, they had participated and supported waste separation activities driven by their university and local government. However, as highlighted by the interview participants as well, the news and social media posting of environmental issues and
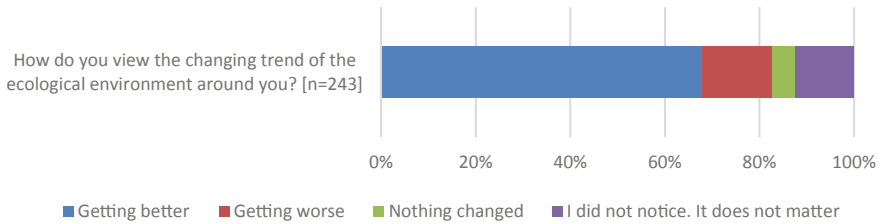
Fig. 1 Opinion on the ecological environment

disasters happening around the world is less pleasing and is of a concern to them. They periodically watch and read about the increasing impact of climate change, pollution, and disasters happening in different places around the globe. This has made them becoming more concerned about the environment.

Figure 2 illustrates the participant's awareness towards environmental protection, where the respondents are asked to rate their agreement on a scale of 1–7 on several environmental-related issues. The data shows that about 94% of the respondents agree that "Sustainable development is the most important factor in environmental protection." Up to 78% of the respondents disagree with the notion of "The packaging design is more important than its environmental friendliness." A further 63% of the respondent finds it challenging to classify and separate wastes.

Interestingly about 72% of the participants had felt that packaging pollution imposes more severe problems than food waste. From the responses, it is evident that the respondents feel strongly about sustainability and the concept of sustainable development. However, they may find it difficult to sustain the activities needed to ensure sustainable living voluntarily. As mentioned in the interview sessions, the
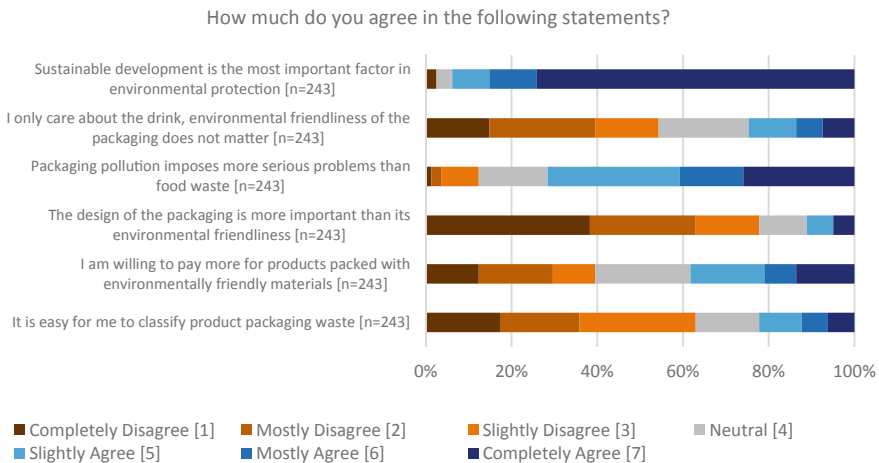
Fig. 2 Agreement with environmental sustainability related statements

students had participated, and some had volunteered to support the government initiative of municipal waste separation at the source. Others have indicated that they are aware of the waste separation initiative and think it is good for the environment. However, they only comply and follow it as it is a strictly enforced requirement in their dorm or residential community. They might not have acted to separate their litter if not for the requirement set.

3.3   Beverage Packaging and Environmental Problems

For the next research question, each respondent can select more than one option; hence a total of 993 responses was received from 243 respondents. As shown in Fig. 3, only 3.7% of respondents did not think that beverage packaging can cause environmental problems. 72.8% of the respondents chose water pollution. This shows that the respondents believe that the consumption of beverage packaging can cause various kinds of environmental problems. Many respondents had associated the use of plastic beverage packaging with the pile-up of plastic litter in the ocean and the micro plastic pollution of the seas. Likely this is due to the continuous media and environmental organizations coverage of plastics threat on the marine ecosystems [29]. Other forms of environmental issues such as climate change, ozone layer destruction, and biodiversity reduction were also in the opinion of many respondents due to the increasing usage of beverage packages that are not properly managed. While some of these issues may be directly linked to the overuse and poor disposal of beverage packages, factors like ozone depletion may not be so. The respondent may have a general impression that the packaging is responsible for environmental issues but may not be so clear on the exact cause and mechanism of how damage
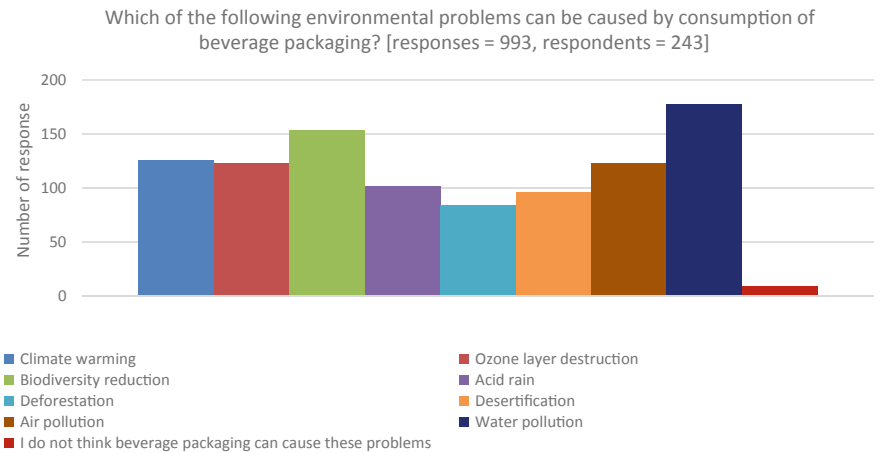

Fig. 3 Environmental issues related with the increase of beverage packaging use

to the environment occurs, as seen in the in-depth interview responses. A notable comment shared by the interviewees relates to the fact that the increased usage of beverage packaging materials (and all materials) will burden the available resources in the world. There are only finite materials and resources available.

Figure 4 shows the perception of the respondent on some of the aspects that makes the beverage packaging material more sustainable. It was seen the majority of the respondents agree that all the listed features or characteristics will make beverage packaging more environmental friendly. The top choices of the respondent are; beverage packaging that is compostable or biodegradable, material that can be recycled, and beverage packages that can be reused for other purposes. On the other hand, the option with minor support relates to beverage packaging that can be returned and refilled. The interview responses support the findings presented in this figure. Interviewees had shared that they least prefer the use of reusable bottles or cups as they feel the convenience of getting a drink on the go is important for
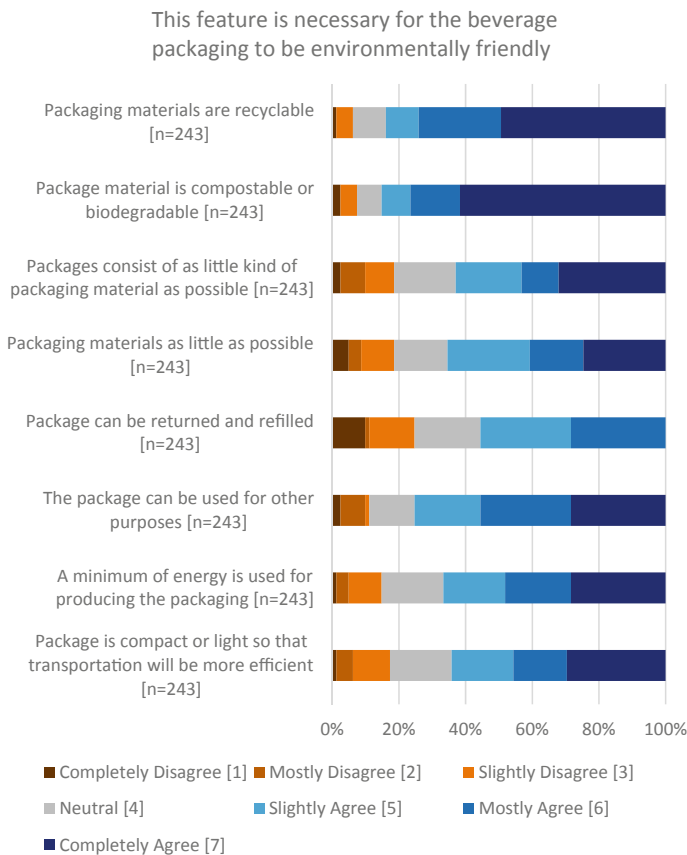

Fig. 4 Characteristics of more environmental sustainable beverage packaging

them. They have shared that the use of their own containers usually is for drinking water, and many outlets that prepare drinks like milk tea do not offer the options to customers to bring their own cup or container. Although recyclability after use is listed as one of the top choices, some interview respondents had a cautious view of the practice. "It (recycling) is not as simple as many people think" was a quote from one of the respondents. Recycling is a complicated process, and many factors affect its viability and success [30]. It is even more complicated when recycling food and beverage-related packaging materials as there are stringent safety and health requirements. The recycling process also consumes energy, and this, as mention earlier, leads to the depletion of natural resources.

On which type of packaging material the respondents think is more environmentally friendly, bio based plastic was listed as the clear choice as seen in Fig. 5. On the other far end, conventional petroleum-based plastic was rated as the least environmental friendly beverage packaging material. Glass, metal and Tetra Pak beverage packaging materials are in between the two extremes. The interview response provides further insights into the views of the students and graduates that participated in this study. Although they are not clear on the technical specification and process for biodegradable plastics, the interviewees had shared that they had the impression that bio based plastic is easily degradable and will return as nourishment to the earth. Therefore they feel it would be beneficial for the environment. Apart from the bio based plastic, the findings here actually diverge from an LCA study
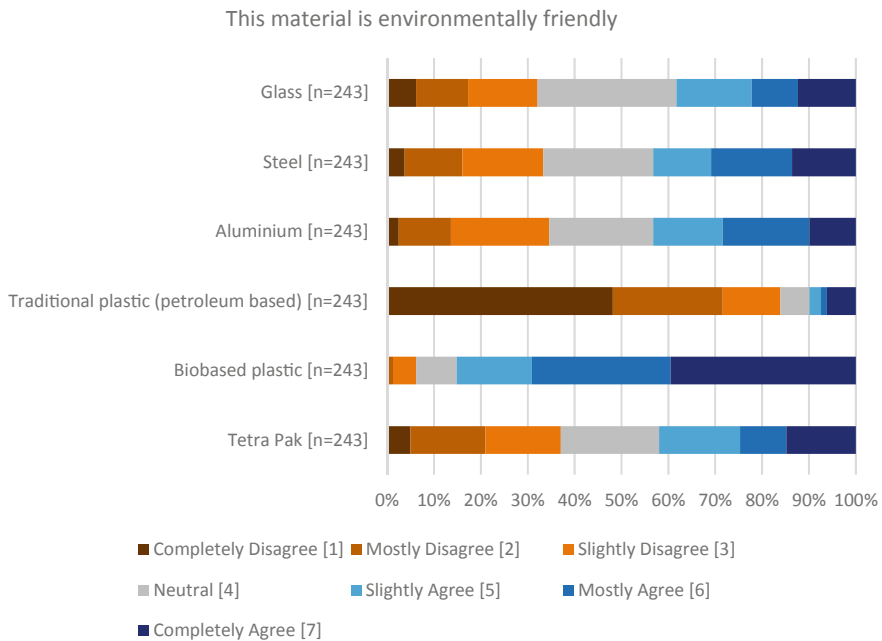
Fig. 5 Beverage packaging materials that is environmental friendly

on several different packaging options for some of the common beverages available. According to the LCA study by Brock and Williams [31] PET and HDPE plastics were found to be listed in the middle in terms of harm caused to the environment for the use in a variety of common liquid beverages. The findings are in line with the earlier findings by Gujba and Azapagic [32] on a variety of packaging materials for beverages. Plastic has been branded to be evil, but that may not necessarily be the truth as it offers more benefits and is better for the environment than some of its alternatives [33]. A more recent LCA study compared the more sustainable material option for outdoor drinking bottles. It was determined that the single-use PET plastic bottles were a better choice than a refillable aluminum bottle with the appropriate cleaning and washing needs factored [34].

The next question presented the respondents with a selection of common beverages. They were required to rate if the packaging is environmentally friendly and their willingness to purchase that beverage with the particular packaging using the scale of 1–7. The average scores of each beverage are presented in Fig. 6. It is evident from the response that the respondent's motivation to purchase a beverage or drink is not predominantly affected by the type of packaging materials. The trend observes here is supported by further insights from the interview sessions. The interviewees mentioned that their drink preference, the convenience of purchase, and cost influence their regular beverage consumption when outside. The environmental impact of the type of packaging materials is not a critical consideration. According to the feedback,
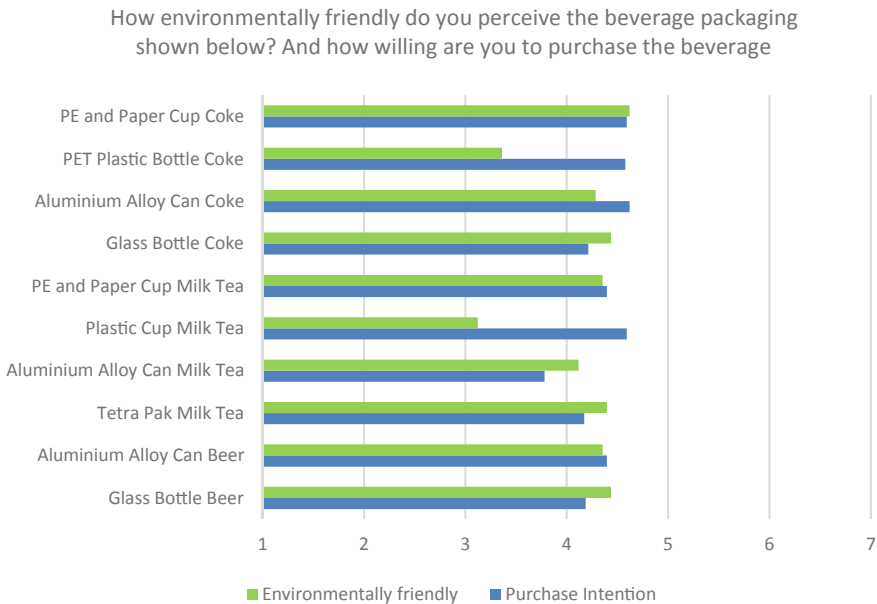
Fig. 6 Perceived environmental friendly qualities of the beverage packaging material and willingness to purchase the beverage

they would help to dispose of the bottles and package in the correct litter bin as part of their effort to protect the environment. However, most of the interviewees admitted that they do not know well about the technical details about the recycling process and how much the sorting of waste for recycling will impact sustainability. They have been encouraged to do it, so it must be good another student had mentioned.

3.4　Awareness on Beverage Packaging Label Logo Information

Figure 7 shows that most respondents are familiar with the PITCH-IN (do not litter) symbol, followed by the Food Quality and Safety Sign and the Universal Recycling Symbol, where 70.37%, 58.02%, and 54.32% of the respondents got it correct, respectively. Other than those three logos, the percentage of correct answers of other labels falls below 50%. This hints that most respondents still lack knowledge and understanding of environmental-related information presented on beverage packaging. In comparison to an earlier study of the European general public [27], the number of correct identification for ecolabels and logo on beverage packaging is higher in this study. In China, it is not all beverages sold have logos or ecolabels in their products. Ecolabels are also not covered extensively in the educational system. This explains why most respondents do not know the meaning behind most of them. It is worth noting that some beverage producers with sustainability concepts in mind
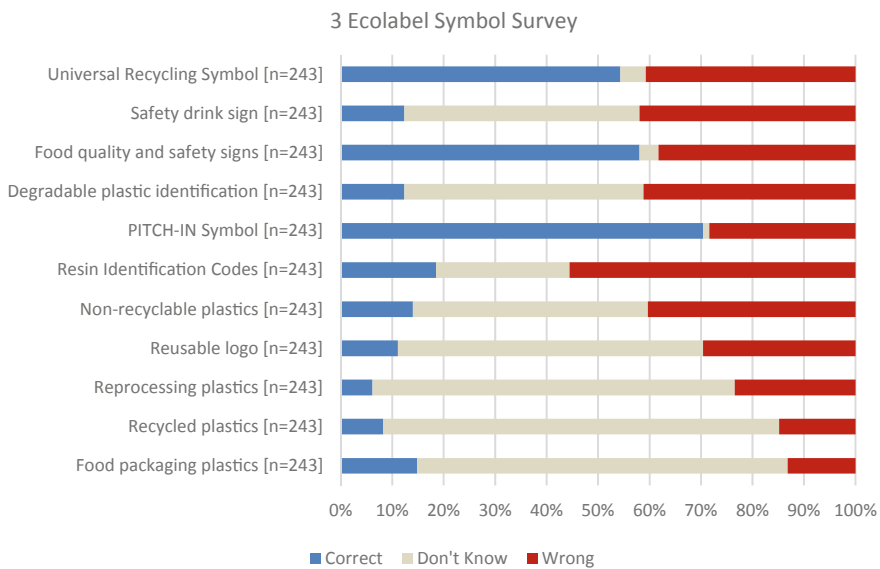

Fig. 7 Beverage packaging label logo information

do include ecolabels on their products. This might help in making their product to stand out and ideally to attract consumers with a strong sustainable living principal. The interviewees had mentioned that they have seen some of the logo on some of the drinks they have purchased before and have learned about it from various sources. However, they are sometimes confused by the logo as they are rather "small" on print, and some of the information provided is not directly beneficial for them.

Participants to this study were also probed on their willingness to pay more for beverage products which are deemed more sustainable. These beverages can be packed using more environmental friendly packaging material and have the information clearly labelled on them on the possible environmental impact. Majority of the interviewees have indicated that they are willing to spend a little more if it will help environmental sustainability through their purchases. However, it was emphasized that the amount must be small relative to their purchase amount and it must not be a noticeable burden to their finances. Not everyone will want to pay more for their products and how much more will depend on the segment of customer or background [35].

4   Conclusion and Reflections

Sustainability is an important issue to be addressed, and higher learning institutions can influence their community to contribute better and support its success. This mixed-methods action research had explored the university students' and graduates' awareness and perception of the common beverages packaging materials on environmental sustainability. As sustainability is emphasized as an important part of university education today, it was anticipated that the young consumers participating in this study would have a high level of awareness and knowledge regarding environmental sustainability. The finding shows that the majority of the respondents do feel strongly and are aware of the concept of environmental sustainability. However, their perceptions of what is environmentally sustainable may not always be based on scientific facts and evidence, as seen in some of the survey responses and interview feedback. The media and environmental organizations' campaigns have deeply impacted their views on sustainability. There have been lots of talks about the negative impact of plastic without further clarification on the even worst impact of non-plastic alternatives. As seen in the literature, a number of LCA studies had indicated that there are far worst packaging material choices for the beverages when considering the impact on the environment. Even single-use plastic bottles could still be used sustainably if proper disposal and recycling are considered. The respondents could correctly identify the more common and obvious labels and logos on beverage packages related to environmental sustainability. The correct rate was also higher relative to a similar study for the general population in a European setting. It is seen that although young adults understand and embrace the concept of sustainability, more is needed to equip them with practical knowledge on how to act and contribute to the

sustainability agenda. This is evident in this study when discussing beverage packaging, which is a common everyday product. The authors seek to reflect and explore different approaches and opportunities to enhance higher education sustainability education. Further practical and actionable information on sustainability should be encouraged in higher education settings. As seen in this study, students can participate in sustainability research and initiate projects with academics to deliver positive change to the broader community.

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