

Predictive Factors of Sustainable Food Processing Practices Among Community College Students in Malaysia

Rafidah Abu Nasir¹, Suriani Mohamed^{2,*}, Anisah Andul Wafi²

¹Kolej Komuniti Pasir Salak, Jalan Lebu Paduka, 36800 Kampung Gajah, Perak,

²Faculty of Technical and Vocational, Universiti Pendidikan Sultan Idris, Tanjung Malim, Perak

*Corresponding Author: suriani.mohamed@ftv.upsi.edu.my

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Abstract: Insecurity of food need the changes towards more ethical, safe, and nutritious food processing system. Evaluation of food processing sustainability practices among community college students is important in contributing to the sustainability of processing and product in the SDGs. Hence this study aims to examine the relationship between sustainable food processing (SFP) practices and the related predictive factors (knowledge, awareness, attitude, subjective norm, perceived behavioural control and personal norm). A research framework was established based on existing literature to the relationship among these variables by employing The Theory of Planned Behaviour, Model KAP, Model of Predictors of Environmental Behaviour and Model of Pro-environmental Behaviour. As the population are 808, therefore by using stratified random sampling method, the total sample of 298 respondents were analysed after the normality test performed. The data of community college students collected using the online questionnaire (*i-KProM*) have been tested the reliability ($\alpha = 0.5 - 0.93$) and the validity. Analysis of Pearson correlation shows that all predictive factor is correlated to the SFP practices ($r = 0.24-0.44$). The multiple regression revealed that knowledge and attitude have the significant positive relationship towards the sustainable food processing practices ($R_2 = 0.28$; $F(6, 291) = 18.91$; $p < 0.01$). Therefore, the findings of this study suggest that community college especially in the field of food processing needs to give special attention to the formation of curricular and programs that contribute to the sustainability of food processing. In addition, improvements of regulations on sustainable development issues need to be given attention so that they can be better addressed in the future.

Keywords: *sustainable food processing, technical and vocational training and education, sustainable practices*

1. Introduction

Food security had been triggered due to covid-19 pandemic for the past few years and become more major discussion currently [1] The United Nations (UN) has declared 17 sustainable development goals (SDGs) that have been younger accepted over 128 countries regarding sustainability had strongly mention to achieve the food security and improved nutrition by promoting sustainable agricultural (SDG 2). SDG2 can only been achieved by ensuring the sustainable consumption and production (SDG 12) along the food chain [2]. The urgency to speed up the establishment of sustainable food processing of our current food chain issue is very important especially for younger generation as reported in High Level Panel Expert [3]. The

HLPE report mentioned that this younger generation is the most effected group due to food insecurity.

Apart from having insufficient of nutritional and affordable food for daily consumption, the youth also facing the challenges in financial, technology and knowledge for their future job undertaking [3].

There are many findings showed that the improvement in practices towards sustainable development goal might scaffolding the sustainability [4-5]. There are also finding that showed a moderate sustainable food processing practices among the community college in Malaysia, which included 3 sub-construct of practices which are processing practices at high level (4.20), pre-processing practices (2.97) and post-processing practices (3.17) at a moderate level for each sub-construct [6]. The improving method must base on the

Corresponding Author: Suriani Mohamed, Universiti Pendidikan Sultan Idris, 35900 Tanjong Malim, Perak, 019-3035580

predictive factor that contribute to the actual practices. Therefore, this study is to investigate the predictive factors of sustainable food processing (SFP) practices among the students at community colleges in Malaysia.

2. Literature Review

Theory on Sustainable Practices

The following theories and models are discussed to illustrate the relevance of the variables used in this study. The theories discussed have already been examined based on previous studies, in determining the theories and models that are appropriate for this study.

The Theory of Planned Behaviour (TPB) was introduced by Icek Ajzen [7]. This theory has argued that attitudes, subjective norms, and perceptions of behaviour control will influence an individual's intention and behaviour to perform an act. The TPB states that the individual who thinks that he has the opportunity and high environmental resources to do something, then the control of behaviour in him to do that behaviour is higher [8]. Thus, it can be stated that, intention accompanied by the perception of behavioural control can produce the desired behaviour to be manifested. Based on the pre-conditions presented by Ajzen and Fishbein [9] and Ajzen [10] that the behaviour to be assessed must be in line with the perception of behaviour control and intention of the individual. Therefore, the behaviours being assessed need to lead to specific behaviours that are accompanied by the intention to do so. In addition, attitude also plays a role in determining an individual's actual behaviour. Attitude refers to an individual's feeling to perform a desired behaviour. Lastly the element of subjective norm that places an individual referring to his environment that wants the individual to perform an intended behaviour [7, 11].

Next, Holdsworth et al. [12] stated that the Theory of Planned Behaviour (Theory of Planned Behaviour) is effective to assess the ability of sustainability practices among students in the workplace. Their study has looked at the relationship between attitudes, subjective norms, and perceptions of behavioural control towards sustainability. There are many other studies that use this theory that give confidence to the researcher to use for the purpose of constructing the conceptual framework of this study [13-15]

A Knowledge Attitude Practice (KAP) model by Ramsey and Rickson [16] also being used to evaluate human behaviour. They stated that knowledge is directly proportional to attitudes and practices. Having knowledge of environmental issues can foster a positive attitude towards those issues. Several studies have been conducted using the Behavioural Change System Model (KAP Model) clearly showing the impact of knowledge and attitudes on practice [17, 18]. A study to determine the effectiveness of short courses of food handling in Ukraine found that the variables of knowledge, attitudes, and practices in the Behavioural Change System Model (KAP Model) have shown an interaction relationship between the three variables

mentioned in the above model [19]. The importance of knowledge on food waste management practices has also been demonstrated by Naim and Rahman [20] who suggested that the application of waste management knowledge is essential to promote such practices.

The Model of Responsible Environmental Behaviour (REB) was developed by Hungerford and Volk [21] who stated that an individual needs to go through or feel the existence of an environmental sustainability issue, before they react to the issue. Therefore, individuals including the students need to have knowledge and awareness (knowingness) to the related behaviour before they could respond or improve an environmental sustainability issue [22-24]. Apart from the above theory and model, The Pro-Environmental Behaviour Model proposed by Kollmuss and Agyemen [25] also being used in this research to investigate the relationship between awareness, knowledge, and attitudes towards proenvironmental behaviour, which they also included that there are also external factors (costs) and internal factors (proenvironmental awareness) for everyone to execute the sustainable practices [25]. Furthermore, finding by Ernst et al. [26] also emphasised that environmental attitude and sense of personal responsibility are the predictive factor toward the future involvement in environmental action.

Sustainable food processing in Community Colleges

The field of food processing is the most important aspects in the food security system, which needs to be strengthened [27- 29] by all parties. In general, the field of food processing is the process of producing and improving food resilience that involves the required resources and end products obtained for the product including commercial products, domestic usage, and wastage [28, 30]). There are various literatures that list the fields related to food processing either for the aspects of processing ([28], life cycle of food processing [31] and management of processing products such as food waste and solid waste [32, 33].

There are various study programs offered at the certificate level at community colleges that involve food processing either directly or indirectly. Apart from the Food Processing and Quality Control Certificate program, other programs offered are such as culinary, food and beverage services, agrotechnology and pastries also seen to focus on food processing related activities [34]. Through the courses designed in the Food Processing and Quality Control Certificate program is seen to be able to produce knowledgeable and skilled semi-skilled human capital [35].

As the field of entrepreneurship is the first leap in Malaysia Education Blueprint, PPPM (Higher Education) 2015-2025, the Food Processing and Quality Control Certificate program has set the main objective is to produce human capital and entrepreneurs who are knowledgeable and skilled with industry needs and current national needs. Graduates of the Certificate in Food Processing and Quality

Control program are also trained to have team -based problem -solving skills that involve innovation and creativity that need to be exposed through lifelong learning experiences embedded in their learning curriculum. Even the importance of communicating information effectively is also a major objective of community colleges based on teamwork and social responsibility.

Overall, the field of food processing in community colleges is a broad field with the involvement of all community colleges in Malaysia. Community colleges that offer Certificate in Food Processing and Quality Control programs, as well as colleges that offer short courses of lifelong learning in the field of food processing have a role in the success of courses related to food processing. Community colleges are also responsible for implementing a short course in a sustainable manner in support of the role of TVET institutions as institutions that have sustainability characteristics in the management of their programs and activities. The urgency to achieve the sustainable food processing practices among the community college is another concept to educate our new generation especially in technical and vocational education and training (TVET) [36].

Predictive Factors

To achieve the sustainability, it is very important to address on improving the knowledge in sustainable development [37]. Sustainable processing is the main driver of sustainable practices in the food chain [38]. Knowledge of the sustainability of food processing is often referred to technology in food processing [39]. The importance of knowledge in a study and assessment of practice clearly shows that, without accurate knowledge, a good practice is difficult to implement [40]. Therefore, the determination of knowledge variables in this study is an important for the assessment of an individual's practice as well as the sustainability practice of food processing.

The importance of fostering awareness through sustainability education is widely discussed in previous studies. [41]. According to Lindgren et al. (2018), awareness of food sustainability through waste reduction can be achieved by creating new initiatives and markets for vegetables and fruits that are less preferred by consumers. Adaptation according to local community norms is also able to increase the level of sustainability awareness [41]. Thus, the awareness of sustainable food processing practices clearly contributes to sustainability in the processing of the entire marketed product [43].

Cultivating attitudes towards reducing food waste is important in efforts to reduce the cost of food raw materials, labour costs and increase company profits [45]. However, the industrial sector is seen to be lacking in prioritizing attitudes in the management of their processing waste, especially the disposal of water waste and solid waste because they pay less attention to the importance of sustainability in food processing [46]. Therefore, this study looks at the importance of attitude in contributing to the practice of food processing

sustainability, because individual attitudes are expressed through their personal response to a situation that they like or dislike [47].

Subjective norms need to be used as a guide to food producers to achieve sustainable products as it has significance contribution towards consumer purchase intention [48-49] in their study asserted that creating positive personal norms towards sustainability practices related to food, can mobilize, and succeed in the development of sustainability as a whole. The importance of subjective norms towards sustainable food chain practices is seen in the aspect of increased use of digitalization once shared by the farmers that implemented the technology [50-51].

A study by Aitken, Watkins, Williams, and Kean [52] found that the perception of behavioural control can be increased through the provision of information effectively. In addition, communication, satisfaction, and trust that are perceived positively and significantly also reduce the gap between the perception of behavioural control and actual pro-environmental behaviour ([53].

Personal norms towards sustainable products among consumers still face constraints from the aspect of personal norms and consumer attitudes towards other products [54]. However, this individual's personal norms can only be evaluated through his actual practice of food-related practices ([55]. Therefore, this personal norm also needs to be inspected into this study to get wider view towards the sustainability practices in food processing.

Based on the literature mentioned above, the determination of the predictive factor analysis, which is knowledge, awareness, attitude, subjective norms, perception of behavioural control and personal norms towards the sustainability of food processing in this study refers to knowledge, awareness, attitude, subjective norms, perception of behavioural control behaviour and personal norms of individuals towards something. Looking at the objectives of this study, by using the theory and model presented it can be predicted that, for each knowledge, awareness, attitude, subjective norms, perception of behavioural control and personal norms that lead to the sustainability of food processing, will have an impact on a person's practice.

3. Methodology

This study uses quantitative approach with a descriptive method by using questionnaire that have been approved the validity and reliability [56]. The instrument of sustainable food processing practices (i-KProM) consists of five variables (awareness, attitude, subjective norm, perceived behavioural control and personal norm) that have been validated using Exploratory Factor Analysis method, and included knowledge as sixth variables [57]. Therefore, this study uses the full cross sectional questionnaire survey method. Descriptive analysis was used to identify the predictor factors that drive food processing sustainability practices among students of the Food Processing and Quality

Control Certificate (SPK) program in community college in Malaysia. Such predictor factors are knowledge, awareness, attitudes, subjective norms, perceived behavioural control and personal norms. While inferential analysis was used to answer the research question of either; there is a significant relationship between predictor factors namely knowledge, awareness, attitudes, subjective norms, perceptions of behavioural control and personal norms towards the sustainable food processing practices among students.

This study selected students of the Certificate in Food Processing and Quality Control to specifically examine the predictive factors towards sustainable food processing practices among the students at community colleges in Malaysia. Based on calculations by Krejcie and Morgan [58] and the total value of Sample Size Determination Through Error Level 5 percent, then the minimum sample of students of the Certificate in Food Processing and Quality Control program for this study is 265 people. However, as this research being administered thru online, the result was 298 respondents after the data screening and data standardization. The researcher has run a stratified sampling method for sampling as required to run the inferential analysis.

This study administered using i-KProM that is being developed to analyse the predictive factors of sustainable food processing among the TVET students [57] thru Google Forms and being extracted to the Excel file for data screening. The data was analysed using a Statistical Package for Social Science (SPSS 26.0). The descriptive analysis used to compare the mean and standard deviation of each item. The item being used in this research are, knowledge (28 items), awareness (9 items), attitude (13 items), subjective norm (4 items) perceived behavioural control (6 items), personal norm (3 items). Each self-report item was measured on a 5 - point Likert scale with one (1) as 'Extremely disagree' and five (5) as 'Very agree' to show the degree of agree of the

respondent's perception for the five predictive factors (awareness, attitude, subjective norm, perceived behavioural control and personal norm), For the knowledge variables the scale used are one (True) and 2 (False) regarding the item listed. Data standardizations are needed for scale measurements that are sensitive to variables with different magnitudes or scales [59]. The z-score formula is used to obtain a standardized score using the number of standard deviations from the mean of the data provided the data is normally distributed. This standardized score allows comparative analysis to be conducted between units in the study population that have different subject sizes. This z-score analysis is carried out to achieve the second objective which requires inference analysis to be done, then all variable total scores are standardized to an equivalent value using z-score. This is to enable the variable "Knowledge" which uses two scales namely "True" and "False" to be equated with other variables.

4. Results and Discussion

The result for this study will show the mean score and standard deviation of predictive factor for the sustainable food processing practices among the community college in Malaysia. Based on suggestion by Pallant [60], the mean score of each predictive factor are high for knowledge (M=0.83,SD=0.10), awareness (M=4.46, SD=0.43), attitude (M=4.37, SD=0.47), subjective norm (M=4.60,SD=0.47) perceived behavioural control (M=4.42.SD=0.48), personal norm (M=4.54,SD=0.48). The summary of the result is shown as Table 1

Table 1 Distribution of Predictor Factor Levels (N=298)

| Predictive Factor | Mean Score | Standard Deviation | Interpretation |
|-------------------------------------|------------|--------------------|----------------|
| Knowledge | 0.83 | 0.10 | High |
| Awareness | 4.46 | 0.43 | High |
| Attitude | 4.37 | 0.47 | High |
| Subjective Norm (SN) | 4.60 | 0.47 | High |
| Perceived Behavioural Control (PBC) | 4.42 | 0.48 | High |
| Personal Norm (PN) | 4.54 | 0.48 | High |

Sources: Pallant [60]

Specifically, Pearson's correlation is used to measure the linear relationship between two variables of a study to show the significant value, the positive or negative direction of the

relationship as well as the strength of the relationship obtained [61]. The findings of the study found that Pearson's correlation analysis showed that all the above independent

variables were correlated or had a significant relationship with the dependent variable, which is food processing sustainability practices at a 95 percent confidence level as shown in the Table 2 below.

Table 2 Summary of Correlation Test Results Between Variables

| | SFP Practices | Knowledge | Awareness | Attitude | Subjective Norm | Perceived Behavioural Control | Personal Norm |
|-------------------------------|---------------|-----------|-----------|----------|-----------------|-------------------------------|---------------|
| SFP Practices | 1.00 | | | | | | |
| Knowledge | 0.42* | 1.00 | | | | | |
| Awareness | 0.34* | 0.25 | 1.00 | | | | |
| Attitude | 0.43* | 0.29 | 0.77* | 1.00 | | | |
| Subjective Norm | 0.25* | 0.16 | 0.62* | 0.68* | 1.00 | | |
| Perceived Behavioural Control | 0.32* | 0.20 | 0.66* | 0.75* | 0.67* | 1.00 | |
| Personal Norm | 0.24* | 0.06 | 0.57* | 0.58* | 0.58* | 0.54* | 1.00 |

*Correlation is significant at the 0.05 probability level (2-tailed).

To achieve the objective of this research, question on what are the predictor factors that are knowledge, awareness, attitude, subjective norms, perceived behavioural control and personal norms that are significant towards sustainable food processing practices among the student from program of Food Processing and Quality Control Certificate in community college in Malaysia, a standard multiple regression analysis has been done. The results of the standard multiple regression

analysis test showed that attitude and knowledge accounted for 28 percent of the variance in sustainable food processing practices ($R^2 = 0.28$; $F(6, 291) = 18.91$; $p < 0.01$). There are two variables that have successfully contributed as significant predictors of food processing sustainability practices, namely attitude ($\beta = 0.35$, $t = 3.61$, $p < 0.01$) and knowledge ($\beta = 0.32$, $t = 6.05$, $p < 0.01$). The Table 3 below show the summary of the analysis.

Table 3 Results of Multiple Regression Analysis Between Predictor Factor Variables Against Sustainable Food Processing Practices

| Predictive factors | β | SE | t | Sig. | Hypothesis result |
|-------------------------------|---------|------|-------|------|-------------------|
| Knowledge | 0.32 | 0.05 | 6.05 | .01* | Rejected |
| Awareness | 0.01 | 0.08 | 0.04 | .10 | Accepted |
| Attitude | 0.35 | 0.10 | 3.61 | .01* | Rejected |
| Subjective Norm | -0.08 | 0.08 | -1.11 | .27 | Accepted |
| Perceived Behavioural Control | 0.02 | 0.09 | 0.29 | .77 | Accepted |
| Personal Norm | 0.05 | 0.07 | 0.75 | .45 | Accepted |

Sig. * $p < 0.01$

Based on the results of the standard multiple regression analysis above, it was found that knowledge and attitude are significant contributing factors to food

processing sustainability practices among students of the Food Processing and Quality Control Certificate at the community college. Here is the standard multiple regression equation for sustainable food processing practices: $Y = b_1x_1 + b_2x_2$

Based on the results of Pearson's correlation analysis, all the predictor factors above have a moderate positive relationship

with sustainable food processing practices except for the subjective norm variable which has a low positive significant

relationship. Moderate positive relationships for knowledge, awareness, attitudes, perceived behavioural control and personal norms are seen as proportional to food processing sustainability practices. The importance of knowledge, awareness, attitude, perceived behavioural control and personal norms on the sustainability of food processing has been widely debated based on previous studies [62 - 64]. Therefore, the findings of the study, which are equivalent to previous studies, allow the evaluation of the curriculum of the Food Processing and Quality Control Certificate program to be carried out based on the predictive factors studied. Therefore, the results of this study which found positive correlation results between predictor factors namely

knowledge, awareness, attitude, subjective norms, perceived behavioural control and personal norms towards food sustainability practices show the development of a conceptual framework built using the Theory of Planned Behaviour and the Behaviour Change System Model (KAP Model), the Model of Predictors of Environmental Behaviour (PEB) and the ProEnvironmental Behaviour Model have achieved their objectives in determining the relationship that has been set. Standard multiple regression results found that knowledge and attitude variables contributed significantly to food processing sustainability practices among community college students. Although this result is different from the findings by Masyita and Nur Amalina [65], who found no correlation between knowledge and attitude among food handlers, this finding shows that community college students need to be knowledgeable and have attitudes that include trust and feelings towards good sustainability practices. food processing in improving food processing sustainability practices. This study is in line with findings by Betzler [66] using the Theory of Planned Behaviour, that is, knowledge and belief values are positively correlated to a person's sustainable practices according to relevant experts in the study. In fact, this finding also supports the model by Kollmus and Agyeman [25] which states that attitudes towards sustainability will lead to actions to practice sustainable actions. The findings of studies that use the model also show the need to have a specific attitude towards sustainability to obtain individuals who practice environmental sustainability [67 - 69].

The discussion of the findings of this study in an empirical aspect explains that a new model of evaluation of sustainable food processing practices among community college students has been successfully produced. The following Figure 1 shows the relationship between food processing sustainability practices and the importance of attitudes and knowledge obtained in this study:

Based on the relationship of the model above, to measure food processing sustainability practices among community college students, there are two variables that have successfully contributed as significant predictors of food processing sustainability practices, namely attitude ($\beta=0.35$. $t=3.61$, $p<0.01$) and knowledge ($\beta=0.32$. $t=6.05$, $p<0.01$).

Apart from that, the findings of this study also confirm that the importance of knowledge and attitude towards

individual practices and behaviour supports the Theory of Planned Behaviour by Ajzen [7] which says that the predictor factor for an action to be taken, most clearly is in the performer, his norms, and beliefs. Knowledge also plays a role as a core to the determination of attitudes, intentions, and behaviour ([70]. According to Chen et al. [71] , by adapting the Theory of Planned Behaviour, the decision to implement sustainability practices on campus needs to be viewed by administrators and students. The opinions of administrators and students can be used as benchmarks to adapt subjective norms, attitudes, and personal norms among campus residents to practice sustainability [71]. Recently, Betzler et al. [66] also confirmed in his study that knowledge has a positive effect on sustainability practices which explains the importance of knowledge about sustainability.

In fact, the findings of this study are in line with the Behaviour Change System Model (KAP Model) which confirms that knowledge and attitude influence an individual's practice. This finding is also supported by the study of Salas-Zapata et al. [17] and Besar et al. [18]. A study by Besar et al. [18] have adapted the Behavioural Change System Model (KAP Model) which found that a high level of knowledge about recycling practices gives a moderate level of attitude in practicing recycling practices among civil servants. The accuracy of knowledge and attitude towards individual practices was also found in a study by Bakar and Abdullah [72] who said that individuals practice hygiene and safety practices due to their knowledge and positive attitude towards these practices. This study also confirms the Behaviour Change System Model (KAP Model) by Ramsey and Rickson [16].

A study by Jubayer et al. [73] have suggested that further research using the Knowledge Attitude and Practices Model (KAP Model) in the field of food processing be carried out. Therefore, this study has further strengthened the Behaviour Change System Model (KAP Model) that is used and supports the findings of the study that directly links knowledge, attitude and practice [73, 74]. Their study clearly says that employees who are trained on sustainable food processing practices are more likely to practice sustainability while carrying out their responsibilities. The findings clearly show that, providing continuous training for a skill can make community college students proficient in that field. Therefore,

training in food processing sustainability practices needs to be held to face the challenges of the job field.

The importance of knowledge on sustainability is also stated in previous studies on sustainability in educational institutions. [75 -78]. In addition, a case study aimed at the food processing industry by Jubayer et al. [73] conducted in Dhaka found that individuals with different backgrounds have different levels of knowledge and attitudes towards the sustainability of food processing. They found that respondents who work in the food quality department, have a higher level of knowledge and attitude towards sustainability practices, compared to employees in other departments for the entire case study studied. More interestingly, the case study above refers to the food processing industry which has been recognized with Hazard Analysis and Critical Control Point System (HACCP), HALAL, and ISO 22000:2005 certification which has now been updated to ISO 22000:2018.

Even so, to improve the sustainable food processing practices among community college students, it is not only knowledge and training that needs to be provided. Actual experience in the field of food processing is essential for these students to relate to the knowledge and training they have undergone. According to France, Artwel, Morleen, Goden & Tendayi [79], exposure to things that should not be done when processing food is necessary to provide a real example to the individuals involved. Coughing and sneezing etiquette, equipment, clothing and environment as well as methods of defrosting and freezing products also need to be demonstrated as training and experience ([79]).

The importance of knowledge and attitude among community college students is seen very clearly in support of the National Education Philosophy which wants to produce balanced and harmonious students from physical, emotional, spiritual, and intellectual aspects. A focus on strengthening knowledge of food processing sustainability in education as well as fostering a pro-environmental attitude can produce community college graduates who are able to compete globally [80]. In fact, the importance of sustainability education has also been clearly stated by Nuttman, Patrick and Townsend [81] who found that weaknesses in sustainability education in institutions of higher learning will have an impact on food security issues. In detail, the findings of this study have explained that knowledge of the Good Manufacturing Practices [GMP] [82] as well as fostering attitudes towards the beliefs and feelings of community college students regarding sustainable food processing practices can increase the level of those practices.

5. Conclusion

This study explains the importance of predictor factors namely knowledge, awareness, attitude, subjective norms, perceived behavioural control and personal norms to determine the sustainability practices of food processing among technical and vocational education training (TVET) students at community colleges. The evaluation instrument for predictor factors of food processing sustainability practices (i-KProM) that was built can measure the level of predictor factors determined for food processing sustainability practices among community college students in Malaysia. This study found that the predictor variables of knowledge, awareness, attitude, subjective norms, perceived behavioural control and personal norms have a significantly positive relationship on food processing sustainability practices. While the factors that contribute to the practice of food processing sustainability among community college students are knowledge and attitude.

Next, based on the discussion of this chapter, it can be concluded that this study has contributed to a new form of knowledge in the field of science and practice, namely the sustainability of food processing. The suggestions for future research presented are expected to further strengthen the field of food processing sustainability studies among technical and vocational education training (TVET) students in Malaysia.

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