Estimation of consumer's willingness to pay for biodegradable food container in Kota Bharu, Kelantan

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Abstract. Rapid rising population and regional urbanisation in Malaysia has led to rising demand and a more convenient disposable way of non-biodegradable food containers. The amount of mismanaged plastic waste in Malaysia keep increasing every year. This study is conducted to identify the consumers' willingness to pay for biodegradable food containers in Kota Bharu, Kelantan. This study employed a simple random sampling method, and 270 respondents have participated in a face-to-face interview technique. The Contingent Valuation Method was used to estimate the consumers' willingness to pay for biodegradable food container products. The study has found that the three factors, age, marital status, and monthly household income, influence their willingness to pay for biodegradable food containers. The result indicates that the consumers in Kota Bharu, Kelantan, are willing to pay RM0.78 for every biodegradable food container, which is 28 cents more than the current rate. The finding can become a guide or tool for improving biodegradable food containers and reducing non-biodegradable food containers' usage to create a better living environment.

1. Introduction

Regional urbanisation worldwide has had a rising trend where people are moving from rural to the urban area. The pace of life rapidly changes, the workload becomes more bustling, and more women enter the workplace like men [1]. Such a situation tends to increase the convenience of disposing non-biodegradable food containers. People are more inclined to buy food outside and eat at the workplace, which is more convenient than bringing their lunch with their lunch box. In the way towards being a developed country, Malaysia's economy, military, and education are flourishing. In the past twenty years, Malaysia's population has been rising vigorously since 1998, with a population of 22,113,464 [2]. The population is then increased by about 43.85 per cent to 31,809,660 in 2018 [3]. By the year 2007, the share of the urban population in Malaysia's total population was 68.36 per cent, where it had increased to 75.45 per cent in the year 2017 [4]. The strong population growth, regional urbanisation and heavy workload are causing higher demand and a convenient way to dispose of non-biodegradable food containers. A biodegradable product is known as a "sustainable" or "green" product made up of renewable raw material, which can be completely broken down by microorganism or other living organisms in the ecosystem. It will then decompose into an essential element of the carbon cycle in nature at the end of its life cycle in a short time [5]. Nowadays, many biodegradable products can replace those ordinary products that are non-biodegradable and not environmentally friendly—for instance, biodegradable food container. As its name suggests, biodegradable food containers are the food containers that are used to put and keep a dish produced by the raw material that can undergo
biodegradation after disposal. The raw material used can be cardboard, corn, potato, plant fibre of sugarcane or biodegradable plastic.

In Malaysia, a few states have started to ban polypropylene, polystyrene, and expanded polystyrene food containers and replace them with biodegradable ones. Penang is the earliest state that has started to use biodegradable food container in the year 2009—followed by the Federal Territories of Putrajaya in the year 2011. Melaka has implemented the policy of prohibiting polystyrene food container at all cafés and food premises in public areas like government buildings, local authorities, and education institution since May of 2015 [6]. Next, Perak and Selangor have also banned these food containers in 2017, starting from January and June, respectively. Meanwhile, Johor state has fully implemented this policy in January 2018 [7]. In Kelantan, the local government has not banned the use of polystyrene food container yet. Thus, the usage and demand for polystyrene food containers in Kelantan are still high, as this type of food container is the first choice for consumers and food stall owners. According to the study by Jambeck et al. [8], it is estimated that the Malaysia government must manage about 0.94 million metric tons (mmt) per year of mismanaged plastic waste. Among this 0.94 mmt, includes non-biodegradable food containers made up of Styrofoam or non-biodegradable plastic. However, the data on the actual amount of non-biodegradable food container discarded is not available. The study was conducted in selected areas, indicating the usage of containers made from expanded polystyrene or other plastic, which has increased to 12.5 million tons in 2009 from 120,000 tons in 1960 [9]. The high demand and consumption for low cost and efficiently use food containers in Malaysia have led to a rise in non-biodegradable food containers being disposed of and occupying area in the landfill. The non-biodegradable food container generated is now a significant concern in Malaysia as Malaysia's landfill areas have become a significant worry in solid waste management. Hence, this study is carried out to determine the consumers' willingness to pay for biodegradable food containers in Kota Bharu, Kelantan, Malaysia.

1.1. Contingent valuation method

Contingent Valuation Method (CVM) is any technique that valuates a commodity [10]. CVM acts as one of the approaches towards forecasting the economic value in environmental evaluation and measure based on the willingness to pay for environmental improvement. [11]. In this approach, a hypothetical market will be introduced to the respondents. The hypothetical markets would imitate a private product or a political market where the respondents own the chance to buy or consume the product list in the question. This method is known as CVM because the Willingness to Pay (WTP) is identified by this method as contingent and depends on the hypothetical market that delivers to the respondents to ask the maximum amount that the respondent is ready to pay [12]. In CVM, there are four formats commonly used for the elicitation of the value of WTP. There is an open-ended format, dichotomous choice format, payment card format and bidding game format [13]. The study's primary factor in utilising CVM was its simplicity, flexibility, and straightforwardness [14]. CVM can be easily understood by everyone and do not require considering resources' precise value [15]. Moreover, this technique can help to measure total economics value, whether it is non-use value or use-value. Not only that, values like bequest values, existence value and option values can also be estimated by this method.

2. Methodology

2.1. Study area

Kelantan is one of the 14 states located in Malaysia. Up to the year 2016, the area of Kelantan is 15,101 km² [16]. The heart of Kelantan state is known as Kota Bharu, with a population of about 468,438 people. Meanwhile, the area of Kota Bharu is about 115.6 km² with a population of 44,757 peoples. The Kota Bharu district is selected because of the growing catering, manufacturing, and service industry. Most residential areas have a running business such as a restaurant, small manufacturer, mini market, café, and hardware store. Other than running their own business, some residents work as civil servants [17]. Figure 1 presents a map of the study area.
2.2. Data collection
This study has utilised a simple random sampling technique for data sampling, as the population has an equal probability of inclusion in the sample [18]. The face-to-face interview has been conducted to ensure the respondents understand the nature of the questionnaire [19]. In this study, a total of 270 sets of questionnaires were distributed to the respondents. However, only 260 set questionnaires were returned, and there were 2 sets of questionnaires that the respondents did not thoroughly answer. Thus, only 258 sets were accepted and applied in the following analysis. The reason for choosing a complete answered questionnaire was to ensure that selection bias can be avoided.

2.3. Willingness to pay analysis
In this study, the contingent valuation method's dichotomous choice approach is applied to draw forth consumers' willingness in Kota Bharu to pay for biodegradable food containers. This is because CVM can determine both use and non-use economic values for all types of ecosystem service and environmental goods that do not have the market price [20]. Each respondent is required to answer either "yes" or "no" to the question, which inquires about their willingness to pay for biodegradable food container at a particular price (bidding). A classification algorithm called the logistic regression model was utilised to discover the relationship between willingness to pay and the factor that has influenced the willingness to pay. This model can estimate the probability of the incident by predicting the binary dependent outcome from a set of independent variables. The model features, such as asymptotic and comparative mathematical simplicity, could also lead to this model's utilisation [21]. The variables resolved in this study include all the socio-demographic variables asked in Part A of the questionnaire. The consumers' willingness to pay for the biodegradable food container was regressed against the respondents' socio-demographic. All of the variables were tested by using binary logit regression with the NLogit Software Limdepl 16. The sigmoid function was employed in this study based on the extended model by Van Ravenswaay and Hoehn [22].

\[
P(x) = \frac{1}{1 + e^{-x}}
\]

P stands for the respondents' probability of paying the amount, in which they have answered yes (1). While the lower case \(x\) represents the estimated equation of logit regression. \(x\) equal to the summation:

\[
\beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \cdots + \beta_nX_n
\]

in which
\(\beta_0 = \) estimated constant,
\(\beta_1, \ldots, \beta_n = \) estimated parameter of the coefficient. (That are the demographic profile of respondents such as age, gender, household income, education etc. that have influences toward the WTP of biodegradable food container) and,
\( X_1, \ldots, X_n = \text{explanatory variables' mean value.} \)

The mean value of WTP was estimated as the area is under the probability function. In order to estimate the area under the curve of the probability function, the integration technique was applied with an equation (3):

\[
E(WTP) = \int_{L}^{U} (1 + e^{a+b\text{PRICE}})^{-1}d\text{PRICE},
\]

where the bracket element stands for the probability of answering (1), capital U is the upper limit while capital L is the lower limit of the integration. This framework's usage for estimation of mean WTP depended on several assumptions related to the upper limit and lower limit of the integration. For instance, the amount of price where the probability of answering (0) is zero, and the probability of answering (1) is one. By applying this to the price behaviour and assuming individuals will not pay if they receive disutility, negative WTP can then be ruled out, and zero can be used as the lower limit. The value of WTP that are negative can be excluded, and zero can be employed as the lower limit of the integration when this assumption is applied to the price behaviour [14]. If \( P \) is the probability of answering yes, then the difference between 1 and \( p \) is \( Q \), representing the probability of answering no (0). \( Q \) can be calculated by

\[
Q(x) = 1 - \frac{1}{1 + e^{-x}}
\]

3. Results and Discussion

3.1. Respondents socio-economic profile

Table 1 presents the results of 258 respondents' socio-economic profile who participated in this study. The data have found that female respondents (60.8%) are the majority of respondents participating in this study than males. This is due to the fact that female are more comfortable to approach during the survey. The age of the respondents has been classified into seven groups. The finding reveals that the respondents' age of 18 to 25 has the highest numbers of participants in the study (27.13%). On the contrary, less than 18 years old respondents are the least number of participants in this survey with 1.94%. 63.2% of the respondents are married, and the rest are single (36.8%). Hence, most of the respondents (45.3%) who participated in this study have received a moderate education level, either diploma or college. About a quarter of the respondents have a lower education at the secondary school level (25.6%). Next, the respondents who had finished at undergraduate and postgraduate level are 20.9% and 8.2%, respectively. Respondents who serve as civil servants made up the majority of the total respondents (46.1%). There were 22.9% which is equivalent to 59 respondents who are working in the private sector. Out of 258 respondents, the study has found that 14.3% are self-employed, and 12.8% are students. However, the number of respondents who work in others' occupation is 1.9%, such as retired, unemployed, babysitter and farmer. The results also show that the majority of the respondents (46.5%) have a monthly household income in the range of RM1000 to RM3000. About a quarter of the total respondents (25.2%) has a monthly household income in the range of RM3001 to RM5000. In contrast, there is only 13.2% of respondents having monthly household income less than RM1000.

3.2. Willingness to pay

There was 3 set of prices designated while conducting the survey. The bidding price is for Set A (RM0.80, RM 1.00, RM0.60), (RM1.00, RM1.20, RM0.80) for Set B and (RM1.20, RM1.40, RM1.00) for Set C, respectively. Table 2 shows that a total of 117 respondents (45.35) were willing to pay for the given additional price. In contrast, the remaining 141 respondents (54.65%) did not have the willingness to pay for the suggested additional price. This is because they have a lack of awareness regarding the convenience of the product. Some of them also stated that they are unwilling to pay for a
higher amount because they cannot afford it and believe that protecting environments are government responsibilities similar to Fatimah et al. [14]. Table 2 also shows that when the bidding price increases, the number of respondents willing to pay for biodegradable food containers has reduced. Nevertheless, since the original finding from the study conducted had asked for the first bidding price of RM0.80, about 17.83% of the respondents were willing to pay. As the bidding price increased to RM1.20, fewer respondents were willing to pay, indicating that the relationship between WTP and the biodegradable food container price is inversely proportional. This result shows consistency with the theoretical expectation, whereby, as the given bid is decreased, the number of respondents willing to pay increases, and vice versa [11].

| Table 1. Demographic of respondents. |
|--------------------------------------|
| Variable                           | Frequency | Per cent |
| Gender                             |            |          |
| Male                               | 103        | 39.92    |
| Female                             | 155        | 60.08    |
| Age                                |            |          |
| < 18 years old                     | 5          | 1.94     |
| 18 – 25 years old                  | 70         | 27.13    |
| 26 – 30 years old                  | 41         | 15.89    |
| 31 – 40 years old                  | 59         | 22.87    |
| 41 – 50 years old                  | 42         | 16.28    |
| 51 – 60 years old                  | 32         | 12.40    |
| Above 60 years old                 | 9          | 3.49     |
| Marital Status                     |            |          |
| Single                             | 95         | 36.8     |
| Married                            | 163        | 63.2     |
| Education Level                    |            |          |
| Secondary School                   | 66         | 25.6     |
| College/Diploma                    | 117        | 45.3     |
| Degree                             | 54         | 20.9     |
| Master/PhD                         | 21         | 8.2      |
| Occupation                         |            |          |
| Government                         | 119        | 46.1     |
| Private employee                   | 59         | 22.9     |
| Self-employee                      | 37         | 14.3     |
| Student                            | 33         | 12.8     |
| Others                             | 10         | 3.9      |
| Monthly Gross Household Income level|            |          |
| < RM 1000                          |            |          |
| RM 1000 – RM 3000                  | 34         | 13.2     |
| RM 3001 – RM 5000                  | 120        | 46.5     |
| RM 5001 – RM 7000                  | 65         | 25.2     |
| Above RM 7001                      | 21         | 8.14     |
|                                  | 18         | 6.96     |

| Table 2. Consumers' willingness to pay. |
|----------------------------------------|
| Price (RM)                | Yes Frequency (%) | No Frequency (%) | Total Frequency (%) |
| RM0.80                    | 46 (17.83)        | 54 (20.93)       | 100 (38.76)        |
| RM1.00                    | 45 (17.44)        | 40 (15.50)       | 85 (32.95)         |
| RM1.20                    | 26 (10.08)        | 47 (18.22)       | 73 (28.29)         |
| Total                     | 117 (45.35)       | 141 (54.65)      | 258 (100)          |

3.2.1. Binary logit regression
The result of the logit regression model is tabulated in Table 3. The willingness to pay for the biodegradable food container has been analysed using binary logit regression. This method allows the
significant difference between the independent's variables of socio-economic to be identified. Most studies in the literature have found that the economic characteristics, socio-demographic characteristics, and the right characteristics are the components that contribute to the willingness to pay [11]. Most of the variables analysed are significant at 1%, except for the monthly household income, which is significant at 10%, indicating an association between the variables and the respondents' willingness to pay. Pseudo R2 indicates the goodness of fit test with a value of 0.128 and the right prediction, which indicates 62.3%. The coefficient for the age variable is negative. This suggested that older respondents have a lower probability of paying for the biodegradable food container. When the age increases, the probability of suffering from a disease is also increased. Hence, older healthcare expenses will go as compared to the younger ones [21]. Next, the coefficient between marital status and willingness to pay is 0.815, and the p-value is 0.032. The married respondents have exhibited a higher WTP amount than those single, which showed a similar finding with Le and Aramaki [24]. Chris and Andrew [25] stated that marriage could allow two persons to live as cheaply as one person and thus gives higher real income per partner. A study conducted by Ross [26] also concluded that a married couple's household income is higher than a single income and have the lowest economic hardship event. They tend to engage more in activities favourable to the environment for the sake of a partner or child. Hence, the household monthly income coefficient is also positive (0.227) and significant at 90% of the confidence interval. This indicates that people with higher household monthly income have a higher willingness to pay for a higher amount of biodegradable food container and vice versa.

Table 3. Results of the logit regression model

| Variable          | Coefficient | Significant  | Standard Error |
|-------------------|-------------|--------------|---------------|
| Constant          | -6.534      | 0.000***     | 1.820         |
| Age               | -0.356      | 0.006***     | 0.129         |
| Marital Status    | 0.815       | 0.032***     | 0.380         |
| Household Monthly Income | 0.227   | 0.098*       | 0.137         |

Nagelkerke R² 0.128
Log Likelihood 328.279
Percentage of Right Prediction 62.3%

Note: *** are significant at 99% of confidence interval or 1% level
* are significant at 90% of confidence interval or 10% level.

3.3. Mean of willingness to pay
The mean value of respondents' willingness to pay based on age and household income is shown in Table 4. The WTP of respondent age below 18 is RM0.60. The mean value has risen to RM0.81 when the age of respondents ranges between 18 and 25. The mean value of willingness to pay further had also risen to RM0.82 when respondents' age increased to the range of 26-30. The respondents with age between 31 and 40 have the highest mean of willingness to pay which is RM0.96. Previous studies by Foster [27] has pointed out that the income and annual expenditures of the reference people shown are a "hump" that shapes over the lifespan. As the respondents' age reached the range of 41-50, the mean value that they are willing to pay has declined to RM 0.67, and the respondents' age between 51 and 60 are only willing to pay RM0.54, and those aged above 60 are willing to pay RM0.57 for a biodegradable food container.

As expected, the respondents with monthly household income less than RM1000 have less willingness to pay than those with higher monthly household income. The highest mean value of willingness to pay is RM0.82 for the respondents with a middle-income range from RM1000 to 3000 and the same value of mean for the respondents with monthly household income of RM3001-5000 and RM5001-7000 (RM0.80). However, the respondents with a monthly household income of more than RM7001 are only willing to pay for the lower amount, which is RM0.74. This may be due to their
mindset, such as the convenience of using reusable food containers that can be reused after washing made of stainless steel or Tupperware, rather than using disposables to reduce the waste disposal from the dumping site. Meanwhile, the mean value of WTP for marital status has indicated that the married respondents have a similar value of WTP with an overall mean WTP, which is RM 0.78. It is slightly higher than the single respondents, which is RM0.76. Overall, the study has revealed that the estimated mean of willingness to pay for an additional cost of every biodegradable food container consumption is RM 0.78, as the current cost stands at 50 cents for biodegradable food containers.

| Table 4. Mean value of WTP based on age, household income and marital status. |
|-----------------------------------------|---------|---------|---------|---------|---------|---------|---------|
| Age          | Below 18 | 18-25  | 26-30  | 31-40  | 41-50  | 51-60  | Above 60 |
| N            | 5        | 70     | 41     | 59     | 42     | 32     | 9        |
| Mean (RM)    | 0.60     | 0.81   | 0.82   | 0.96   | 0.67   | 0.54   | 0.57     |
| Household Income | Less than RM1000 | RM1000 - RM3000 | RM3001 - RM5000 | RM5001 - RM7000 | More than RM7001 |
| N            | 34       | 120    | 65     | 21     | 18     |        | 258      |
| Mean (RM)    | 0.58     | 0.82   | 0.80   | 0.80   | 0.74   |        | 0.78     |
| Marital Status | Single | Married |       |        |        |        | 258      |
| N            | 93       | 165    |        |        |        |        | 0.78     |
| Mean (RM)    | 0.76     | 0.78   |        |        |        |        |          |

4. Conclusion
This study's objectives, which estimate an additional cost for consumers' willingness to pay a biodegradable food container, have been achieved. The result has proven that consumers in Kota Bharu districts are willing to pay 28 cents more than the current cost at 50 cents for biodegradable food containers. In a nutshell, the finding in this study shows that socio-demographic factors influence consumers' willingness to pay. There are also age, marital status, and monthly household income factors included. The additional charge on biodegradable food container can be implemented by turning it into the fund to preserve and conserve the environment. The findings can guide policy improvement to consume biodegradable food containers and reduce the usage of non-biodegradable food containers in creating a better living environment in the future.

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