

Study on Potential Alternatives for the Banned Polythene Bags and Lunch Sheets (PBLs) and Exploring the Nature of PBLs Prevailing in the Market in Sri Lanka

Sri Lanka Journal of
Economic Research
Volume 7 (2) June 2020
SLJER 07.02.02: pp. 25-45
Sri Lanka Forum of
University Economists
DOI: <http://doi.org/10.4038/sljer.v7i2.113>

S.P. Fernando

P.C.J. De Silva

I.V. Kuruppu

G.V.N. Aiome

D.R.P. Dembatapitiya

G.K.C. Nilusha



Abstract

The study illustrates potential alternatives for the banned polythene bags and lunch sheets (PBLs) imposed in 2017 by the Sri Lankan government and explores the nature of PBLs in the market in Sri Lanka. Results reveal that the government, at present, has no laboratory facilities to test degradability of PBLs. Further, there are very few alternatives for the banned PBLs while the high price acts as the main limitation for its popularity.

Keywords: *Degradability, High price, Lunch sheets, Polythene bags, Potential alternatives*

S.P. Fernando (Corresponding Author)

Hector Kobbekaduwa Agrarian Research and Training Institute, Sri Lanka

Tel: +94 715117766, Email: sangeeth.nature@gmail.com,

 *<https://orcid.org/0000-0003-2670-464X>*

P.C.J. De Silva

Hector Kobbekaduwa Agrarian Research and Training Institute, Sri Lanka.

Tel: +94 718462779, Email: chathural1@yahoo.com

I.V. Kuruppu

Hector Kobbekaduwa Agrarian Research and Training Institute, Sri Lanka.

Tel: +94 716393775, Email: virajithkuruppu@gmail.com

G.V.N. Aiome

Hector Kobbekaduwa Agrarian Research and Training Institute, Sri Lanka.

Tel: +94 717003323, Email: noricaaiome@gmail.com

D.R.P. Dembatapitiya

Socio Economics and Planning Centre, Department of Agriculture, Sri Lanka.

Tel: +94 717004371, Email: drpdembatapitiya@yahoo.com

G.K.C. Nilusha

Hector Kobbekaduwa Agrarian Research and Training Institute, Sri Lanka

Tel: +94 712443445, Email: gkchami@gmail.com

INTRODUCTION

In 1977, supermarkets began to offer plastic grocery bags as an alternative to paper bags. By 1996, out of every five-grocery bags four were plastic. Since 1996 over 80 percent of all bags are plastic. It is estimated that somewhere between 500 billion and one trillion plastic bags are consumed throughout the world each year. Approximately 53 percent of plastic bags are distributed from supermarket outlets, while 47 percent come from other retail outlets such as fast food shops, liquor stores and general merchandising (Gogte, 2009).

There are two types of plastic shopping bags. They are; the lighter, filmy bags taken from supermarkets and other food outlets and, the heavier bags taken from other retail outlets, like clothing stores. HDPE or High Density Polyethylene Bag is stiff, thin and not transparent or opaque. HDPE (Ethylene polymer with densities ranging from 0.941 to 0.965 grams per cubic centimetre/ ≥ 0.94) is normally used in grocery or t-shirt bags. Low Density Polyethylene-LDPE (0.916 to 0.925 grams per cubic centimetre/ < 0.94 mm) or low density polyethylene bags are thick and soft and can be transparent and glossy in appearance. LDPE is used in shopping bags usually with attached handles. Unlike HDPE, LDPE cannot be recycled.

The Danish Environmental Protection Agency found in a study that a grocery bag would have to be reused a number of times to have as low an environmental impact as a standard LDPE single-use plastic bag. For example, value of 5 indicates a bag would have to be reused five times to equal the environmental impact of a standard single-use plastic bag (Bell and Cave, 2011). The results show that certain plastic bag alternatives have high environmental impact and would require many reuses to make them worthwhile as a substitute. For example, an organic cotton bag would have to be reused 149 times to equal LDPE's greenhouse gas emissions and 20,000 when impacts such as eutrophication, water and ecosystem are included.

There is a range of alternatives to plastic bags. Supermarkets in Australia introduced biodegradable bags made from tapioca starch in 2003. According to Gogte (2009); though these bags closely resemble polythene bags they decompose within three months. According to a study in the United States by Camann (2010), canvas bags are as popular as paper bags. The study also has demonstrated that a fair amount of the consumers would be willing to pay a small fee for alternative bags if such a system was introduced. The amount of participants willing to pay for alternatives is larger than the amount of participant willing to pay for current plastic bags. According to a study in Sri Lanka by Athukorala et al., (2017), cement paper bag with corn husk as the bottom, cement paper bag with oil paper layering and cement paper bag with banana tree bark at the bottom are also feasible alternatives for polythene bags.

Meanwhile, the Sri Lankan government imposed a ban on polythene bags and lunch sheets (PBLs). Accordingly, the new laws came into gazette effect on September 01st 2017 aiming at minimizing the environment issues prior to a full ban on PBLs in September 2017, which led to a huge uproar within the society. While some applauded the step, pointing at the sunny side of the ban on the environment; others protested, for the lack of alternatives and the economic blow it may have on their livelihood. The All Ceylon Polythene Manufacturers and Recyclers Association and All Ceylon Canteen Owners' Association accused the authorities for their impractical approach and not offering plausible replacements. Almost two years later, has Sri Lanka successfully overcome its reliance on polythene? Are there enough eco-friendly alternatives for PBLs available in the market in Sri Lanka? Are single use PBLs available in the market biodegradable? Still no study has been conducted in Sri Lanka to find the answers for questions arising following this major step. This study examines the prevailing and potential alternatives for the banned PBLs imposed in 2017 by the Sri Lankan government, different stakeholders' perception on them and the nature of PBLs in the market in Sri Lanka.

RESEARCH METHODOLOGY

Selection of Study Location

According to the data collected by Japan International Cooperation Agency (JICA), the per capita generation rates of solid waste in Sri Lanka roughly range between 0.46 kg and 0.52 kg (Wijedasa, 2017). As an average value, that is around 0.49 kg. When reviewing the literature regarding the plastic waste in Colombo Municipal Council (CMC) and most other places in Sri Lanka, it shows that there are around six to seven percent (Wipulasena, 2018) plastic out of total. Thus, the per capita plastic generation quantity in Sri Lanka per annum is around 10.73 kg to 12.52 kg (data generated through the above figures) and the highest rate of per capita consumption of conventional polythene is reported in the Western Province. Besides, polythene producers and vendors of the polythene shopping bags and lunch sheets are concentrated in the Western Province. That trend is more likely to spread to other parts of the country. Therefore, considering these, this study was conducted in every district in the Western Province, covering all the rural, semi-urban and urban areas.

Methods of Data Collection

Key informant interviews, focus group discussions and questionnaire surveys were used to obtain primary data and the sources of Central Environmental Authority (CEA) and JICA, details of research reports, journals and newspaper articles were employed as

secondary data. Accordingly, primary data was collected from 1291 respondents (including key informant interviews, focus group discussions and questionnaire surveys) by covering government institutions, civil associations, material researchers, major foodstuff producers, polythene manufacturers, supermarket chains, grocery shops, food vendors, entrepreneurs, plastic collectors and recyclers as well as the general public. The data collection took place from March 2018 to February 2019 largely focused on the Western Province.

Key Informants Interviews

Key informant interviews were conducted with 75 key persons including government institutions, non-governmental organizations, material researchers, polythene manufacturers, supermarket chains, major foodstuff producers and entrepreneurs in order to learn the situation following the polythene ban.

Focus Group Discussion

There was a main focus group discussion on May 30, 2018 with the participation of different parties (around 30 parties) including government institutions, non-governmental organizations, material researchers, major foodstuff producers, polythene manufacturers, supermarket chains, grocery shops, food vendors, entrepreneurs, plastic collectors and recyclers as well as the general public to gather the current situation on PBLs in Sri Lanka and evaluate the possible path forward.

Questionnaire Surveys

Mixed reactions of both probability and non-probability sampling techniques were used for each questionnaire survey to attain the research objectives. Cluster sampling techniques were applied to select the respondents in each district. The gender of the respondents was considered to obtain good results. Therefore, purposive sampling techniques were also applied with mixed reactions of both cluster sampling with two stages and purposive sampling techniques.

There are 40 divisional secretariats (DSs) in the Western Province (Colombo: 13, Gampaha: 13 and Kalutara: 14). Since the number of DSs are similar in each district, interviews were planned with 250 consumers, 64 households, 25 retailers/sellers, 50 food court owners/restaurateurs (bake houses, pastry shops, bread shops etc...), 25 supermarket owners/responsible persons and 25 alternative producers/entrepreneurs in each district. Altogether 1317 respondents including 750 consumers, 192 households, 75 retailers/sellers, 150 food court owners/restaurateurs (bake houses, pastry shops, bread shops etc...), 75 supermarket owners/responsible persons and 75 alternative

producers/entrepreneurs were selected in western province. For this, five DSs were selected from each district and the aforementioned sampling techniques were applied to fulfil the above requirement. However, due to the lack of support of some stakeholders and limited time, we were unable to cover the total sample size (1317) within the study period and only 1186 questionnaires were usable to the survey.

DATA ANALYSIS

Categorical data analysis (cross tabulation) was mainly employed to analyse the data with SPSS. For achieving the factors affecting for the objectives, main variables of consumers, households, retailers/sellers, food court owners/restaurateurs, supermarket owners and alternative producers/entrepreneurs were analyzed and they consisted of 35, 46, 32, 26, 29 and 33 variables respectively. Moreover, choice experiment (CE) method was used to estimate the willingness to pay (WTP) for an eco-friendly alternative by the households.

Choice Experiment (CE) Techniques

Choice experiment techniques are widely used to value environmental resources. However, CE techniques can also be used to derive value for other aspects as well. Various forms of non-market valuations related to wide sectors ranging from health, transport and infrastructure have been conducted using CE techniques to estimate willingness to pay and accept of general public (Alpizar et al., 2001). CE techniques enable estimation not only of the value of the asset as a whole but also of the implicit values of its attribute (Hanley et al., 1998; Kuruppu et al., 2018). In this study since there are limited or no alternatives for polythene in the Sri Lankan market, CE technique was deployed to elicit willingness towards such alternatives.

CE method was used to estimate the willingness to pay (WTP) for an eco-friendly alternative by the households instead of polythene in Sri Lanka. CE can deliver the opportunity to elicit a deeper understanding of the trade-offs between different attributes. Also, CE provides more information since it allows estimating not only the mean WTP, but also the implicit price or marginal WTP for the different attributes. Identifying and understanding attributes are important in this study in order to derive an ideal alternative for the ultimate product. This is why study adopted CE method. For this, a theoretical consistency in line with the Lancaster's model of consumer choice was employed. According to Lancaster (1966), choice of consumer is derived not from the actual content of the system but from the characteristics or attributes of the elements within it. Simply, each and every part may contribute to derive the ultimate value of that system. Preference

for the system is derived through its usability or utility. If a set of attribute bundle caters more, utility consumer chooses that bundle.

However, if a consumer is directed for a repeated choice then the consumer chooses something else due to some random factors. Therefore, even the consumer indirectly derives his preference from a set of attributes as a result of random factors repeated choices may vary. In this technique, a utility function (U_{ij}) as derived from alternative is specified and behaviour is integrated into this function by Random Utility Approach, where utility of a choice is comprised of a deterministic component (V) and an error component (e), which is independent of the deterministic part and follows a predetermined distribution.

Thus, the utility can be specified as;

$$U_{ij} = V(Z_j, S_i) + e(Z_j, S_i)$$

For any given household i , a given level of utility will be associated with any alternative system j . Therefore, utility derived from any of the alternatives depends on the attributes (Z) of the system and the social and economic characteristics (S) of households. This error component implies that the predictions cannot be made with certainty. Choices made between alternatives will be a function of the probability that the utility associated with a particular option (j) is higher than that the utility associated with other alternatives.

Finally, descriptive statistics of the data collected through the primary data sources (such as Key Informant Interviews, Focus Group Discussions and Observations) and secondary data sources (research reports, journals and newspaper articles) were used to justify the research objectives.

Choice Sets

Choice cards were prepared using the crucial attributes and the attribute levels. An example choice set is presented in Table 3.1. Orthogonalization procedure was used to recover only the main effects, consisting 32 alternative profiles and the profiles were randomly blocked into eight different versions, each with four different alternatives for polythene products. After the questionnaire, households were presented with the choice card and each respondent was asked to select the best preferred alternative for polythene from the four alternatives.

Table 1: Sample Choice Set Used for the Study

Main Block 1				
Alternative Characteristics	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Material/s	Crop leaves & residue	Degradable plastics	Papers	Cloths
Frequency of usage	Only once	Multiple times	Multiple times	Only once
Degradable percentage	100%	100%	75%	75%
Availability	Any retail outlet	Any retail outlet	Any supermarket	Any supermarket
Unit price	Rs. 6.00/=	Rs. 9.00/=	Rs. 3.50/=	Rs. 1.50/=

Source: HARTI Field Survey, 2018

Each choice card is consisted of four alternative choices and each alternative has five attributes and the sixth attribute is a proxy for blocking purposes. It is not feasible to select one alternative from a large number of alternatives; hence the main purpose of blocking was to reduce the number of alternatives for a respondent. From all five attributes two consisted of four levels and the rest of two levels. Attribute is a feature of the particular alternative and the level refers to possible stages of that attribute.

Besides, Conditional logit model was deployed in both scenarios for data analysis. In direct utility from each system takes the form as follows:

$$V_{ij} = \beta_1 \ln(Z_1) + \beta_2 \ln(Z_2) + \beta_3 \ln(Z_3) + \beta_4 \ln(Z_4) + \beta_5 \ln(Z_5)$$

Where β_1 refers to the coefficient, which is specified to account for the proportion of choice of participation in household level. The term β_2 refers to the vector of coefficients associated with the vector of attributes describing system characteristics and the fifth represents the monetary attribute.

RESULTS AND DISCUSSION

Overview of the Stakeholders

Composition of the Customer Sample

Perception, difficulties faced and practices by various stakeholders on PBLs ban may vary based on the gender. Therefore, it is a vital component of the study. When considering the gender of the selected respondents, it could be observed that three fourth were female while the males were only one fourth.

In another instance, respondents' perception and behaviour may differ according to the place of shopping. Therefore, respondents of 723 were interviewed in different places in each district from the Western Province and table 1 shows it in a descriptive manner.

Table 2: Distribution of Customers/Consumers Participated in the Study

District	Sathosa	Keells Super	Cargills	Laugf Super	Arpico	Fair/ Central Market	Total
Colombo	51	24	27	21	21	76	220
Gampaha	45	30	-	14	66	100	255
Kalutara	150	-	-	-	-	98	248
	246	54	27	35	87	274	723

Source: HARTI Field Survey, 2018

Table 3: Composition of the Remained Samples of the Study

Sample	District	No. of Respondents
Households	Colombo	64
	Gampaha	64
	Kalutara	64
	Total	192
Retailers/Sellers	Colombo	26
	Gampaha	29
	Kalutara	11
	Total	66
Food Vendors/Restaurateurs	Colombo	53
	Gampaha	53
	Kalutara	22
	Total	128
Different Types of Supermarkets	Colombo	10
	Gampaha	9
	Kalutara	8
	Total	27
Alternative Producers	Colombo	25
	Gampaha	25
	Total	50

Source: HARTI Field Survey, 2018

The majority (82 percent) of the alternative producers in the sample is small-scale. This is true to both the districts projected here. However, entrepreneurs who have introduced and attempted to promote material and products as substitutes have expressed their disappointment with authorities who have done little in terms of providing support. This was clear with what was observed in the study, where very few alternative products were found to be available and in use.

Prevailing and Potential Alternatives for PBLs

During the study, Professor Jagath Premachandra, the University of Moratuwa was interviewed on the ban on polythene. According to him, agricultural waste and waste products in the garment industry can be used for producing alternative bags. In addition, traditional ingredients such as cans and straws can be used for producing the alternatives. The University of Moratuwa is conducting a research to produce alternative bags with agricultural waste and waste products in the garment industry. There are several issues with regard to the production of biodegradable polythene. The process is heavily time consuming. Another issue in Sri Lanka is the absence of technical facilities to test the time taken by biodegradable polythene complete degradation and decompose into carbon dioxide, water and humus. In addition, it is possible to make lunch sheets by using the polylactic acid is imported for producing bio-degradable lunch sheets, mixed with starch (sugarcane, corn, rice) instead of HDPE and lunch sheets. These products are already being manufactured in countries such as India and England. Even it is possible to use oxo biodegradable; it must be mixed with heavy metals to direct decompose in the first stage. In this process, after it decomposes up to 90 percent, the remaining 10 percent is decomposed by soil microbes. In certain countries, this method is banned, but is a common practice in Saudi Arabia. According to the Premachandra, Sri Lanka can produce polythene by using oxo biodegradable as a raw material, if approved by the Sri Lanka Standards Institution. Nevertheless, it was not environmental friendly and he pointed out those heavy metals added at the initial stage of the process may be added to the environment.

According to the study, the most prominent alternatives for lunch sheets in the Western Province were banana leaves, areca nut leaves (“Kolapath”) and lotus leaves used by food vendors. Yet, the study revealed that 97% of food vendors still relied on the use of lunch sheets (both biodegradable and not) in their business. The most common alternatives identified for polythene grocery bags at super markets and grocery stores were fabric bags, paper bags and bags made of starch based biodegradable plastics.

Although consumers use banana leaves, lotus leaves and other types of leaves instead of lunch sheets, there is no sufficient supply for the current demand. In the meanwhile, Dr. Sujatha Weerasinghe; a lecturer of the University of Colombo conducted a study applying bio technology to produce banana leaves in a large area to wrap food while gaining a bumper harvest (Source: HARTI Survey data of this Study, 2018). Therefore, amenable officers should promote such programmes. Moreover, the research team visited the National Craft Council, Pelawatta twice at the initial stage of the study (May, 2018) as well as at the latter stage of the study (January, 2019) to observe that a few projects producing eco-friendly alternatives for polythene products were afoot in the latter visit.

Kolapath Plates/Plates Made of Arecanut Leaves and Lunch Boxes

Mr. Ananda of the National Craft Council revealed that there are kolapath plates and lunch box suppliers registered with the National Craft Council. Besides, they have the ability to supply these products in mass quantity and the kolapath plate price starts from Rs. 10.00. At that time, they have been put in supermarkets for trial. According to him, the products can be reused for a month.

Stakeholders' Perception on Alternatives

Households' Perception on Alternatives

Based on the key informant interviews and discussion conducted with the experts in the field, five important attributes related to alternatives for polythene products were derived. Key attributes are: basic material used to produce the product, usability of the product, relative recyclability of the product, availability of the product and price of the product. Accordingly, four basic materials were also identified as material derived through plant and biomass, recyclable plastics, paper base and cloth base. Usability was defined as frequency of using the product: one-time usage and several times usage. For recyclability again two levels: 75 percent recyclability and 100 percent recyclability were derived. Availability of the product was defined as relative accessibility to the product at two levels: only from retail shops and only from supermarkets was derived.

Table 4: Conditional Logit Estimates for Alternatives

Variables	Coefficient	P-Value
Use of recyclable plastic	-0.177	0.568
Paper base	0.081	0.797
Cloth base	0.740**	0.023
Usability	-0.061	0.568
Recyclability	-0.029	0.929
Availability	-0.229	0.483
Price of the product	1.06e-12***	0.010

***Significant at 1% level, **Significant at 5% level, *Significant at 10% level

Source: Authors' Estimations based on Field Survey, 2018

According to the conditional logit estimates, respondents' willingness was placed only for the material which the alternative was made and the price is at 95 percent confidence level. All other attributes: usability, recyclability and availability were not significant at 95 percent confidence level. Interestingly, respondents are willing to use an alternative product made of fabric. Also, respondents have placed a relatively low price for the alternative. Hence, it is envisaged that, new alternative products should be manufactured using cloths and when pricing, it is suitable to place a relatively low or penetration price for that alternative product. Penetration pricing is a pricing strategy where the price of a product is initially set low to rapidly reach a wide fraction of the market and initiate word of mouth. Through penetration price more customers may switch to that product promptly. This would be the best strategy to promote as well as attract households to use these types of products. Anyhow, descriptive statistics shows that 11 percent of customers still were not following any practices to promote eco-friendly alternatives.

Alternative Producers View on Customers' Purchasing Behaviour on Alternatives and Promotion of Eco-friendly Alternatives

Various responses were received when asked about the buying behaviour of the customers of eco-friendly alternatives by producers. According to the producers, every person wishes to use alternatives. But, half of the producers stated that although customers wish to buy the alternatives, the high price keeps them away from buying.

When questioning the producers' view on promotion of the eco-friendly alternatives, 12 percent stated that polythene shopping bags must be banned totally while another 22 percent held the view that the government should encourage people to use eco-friendly alternatives. Furthermore, 30 percent expressed that people should be educated on the quality of the eco-friendly alternatives while 14 percent stated that stalls for selling alternatives for polythene products should be established. Moreover, the rest 22 percent said a subsidiary is essential for machinery used to produce alternatives.

Government Officials View on Alternatives

An official in CEA informed that the government has taken steps to promote production of lunch sheets, which are biodegradable as alternatives to the banned polythene. According to him, the Central Environmental Authority has requested the government to grant tax concessions to import raw materials to produce biodegradable polythene shopping bags and lunch sheets. Further, he mentioned that if traditional polythene manufacturing factories are converted to ones that make biodegradable polythene, they are to be provided 50 percent concession for machinery repairs. Accordingly, polythene manufacturers should be paid for the machines they possessed. According to the

manufacturers, cost per machine is around Rs. 400,000.00. However, when inquired about the situation about the concession from polythene manufacturers by February 2019, they informed they were paid only Rs. 200,000.00 (Irrespective of the number of machines) instead of the above concession for repairs. Therefore, they were disappointed over the relevant government officials especially in the CEA. In addition, he informed that the government is planning to impose more taxes on imported raw materials for polythene production.

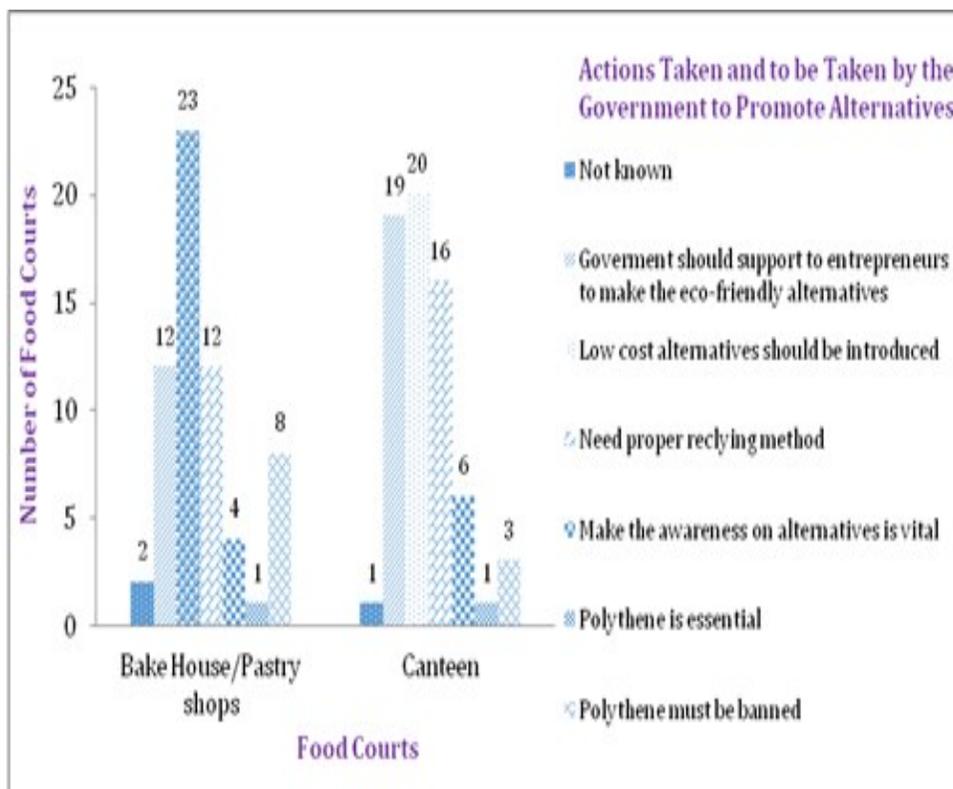
Similarly, according to a senior officer in the Sri Lanka Standards Institution, standards have been outlined to produce biodegradable and composting polythene by now. Therefore, the Institution provides the CEA with an opportunity to check the quality of imported raw materials and the quality of production. However, according to him, although the government is offering such relief the industrialists are not interested in producing biodegradable polythene. The Institute had granted approval to 16 individuals to import biodegradable polythene materials by end of May 2018. In addition, only six to seven industrialists have handed over applications to obtain the standards of biodegradable polythene manufacturing.

Food Vendors' Perception on Alternatives

The suitability of bio-degradable polythene for food wrapping in food courts has been questioned. Accordingly, around 74 percent of food vendors (canteen owners and bakery owners) said it is difficult to use bio-degradable polythene in food wrapping.

As shown in Figure 1, 34 percent of food court owners called for low cost alternatives while 24 percent of food court owners from total expressed that the government should support entrepreneurs to make eco-friendly alternatives.

Figure 1: Views of Food Vendors on Promoting Eco-friendly Alternatives



Source: Field Survey, 2018

Obstacles for not using the Eco-friendly Alternatives by Stakeholders

There are few eco-friendly alternatives in our country, but due to various issues stakeholders refrain from using them. The main constraint in not using the alternatives as per the food court owners was the high cost (68 percent). Thirteen percent of food court owners pointed out the free availability as an issue. In addition, 32 percent of customers said that the price of every alternative is high. In another way, the majority of households (59 percent) said the free availability of LDPE bags in the market discouraged them to switch to alternatives. Besides, 24 percent expressed that ‘polythene bags are easy to use’ and five percent of households claimed the less availability of alternatives as reason not to use the alternatives.

Moreover, the polythene manufacturers asserted that although large-scale factories comply with the polythene law, it is difficult to control the production of unregistered domestic industrialists. In addition, lunch sheets, produced by LDPE polythene released to the market in the name ‘biodegradable’ tag is another problem that is yet to address.

On the other hand, bio-degradable additives are costly. Therefore, producers tend to use fewer amounts of additives, which would lead to less effectiveness of degradable material. Besides, when interviewed the polythene manufacturers they held that the government should have discussed the matter (ban) with them before enforcing.

Nevertheless, according to former Chairperson, Anura Wijethunga of All Ceylon Polythene Manufacturers and Recyclers Association, demand for biodegradable polythene products is minimum as the market is flooded with bogus HDPE. Also, the scent of these biodegradable lunch sheets stocks has attracted mice, cockroaches and animals. Moreover, he stressed the need for a proper waste management system for polythene in Sri Lanka in place of polythene ban.

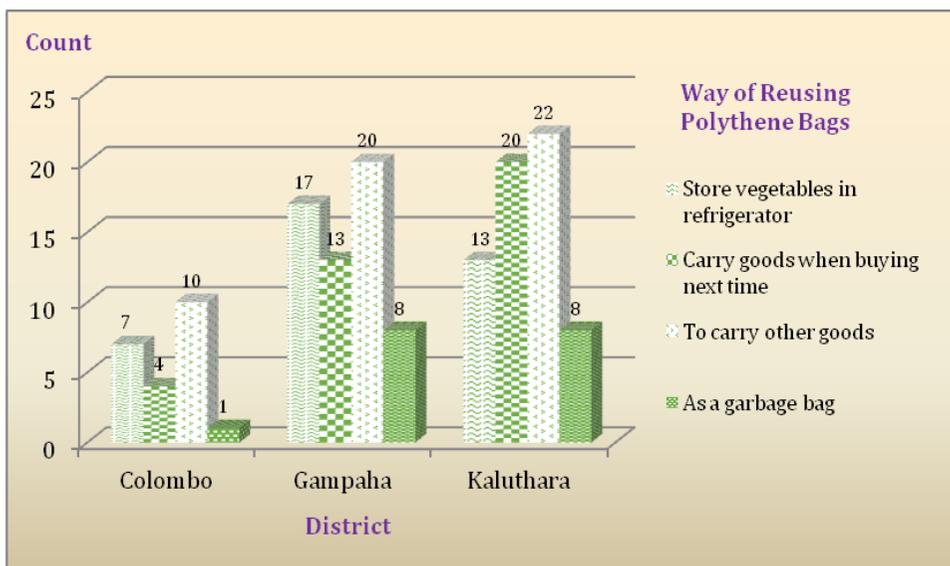
Mr. Asela Sampath, President of the Sri Lanka Canteen Owners Association charged that following the ban a bio-degradable lunch sheet was introduced but with poor discrimination. Consequently, most traders were tempted to sell LDPE lunch sheets in the guise of biodegradable lunch sheets at a high price in the market. So he stressed the need for a mechanism to identify the genuine biodegradable lunch sheets.

Positive and Negative Qualities of PBLs Prevailing in the Market

Stakeholders' Behaviour on PBLs Usage

According to descriptive statistics, 97 percent of food vendors (bake houses/pastry shops and canteens) use polythene to serve foods. Here, a quarter of food vendors still use LDPE lunch sheets to wrap foods. It was confirmed by checking the number of lunch sheets that were in store at that moment. In addition, 51 percent of households have got used to reuse the plastic bags while 49 percent have not. Out of the households who reuse the plastic bags, 36 percent reuse them to carry other goods while 26 percent reuse them to store vegetables in the refrigerator. Moreover, another 26 percent of households use them to carry goods when buy things the next time while 12 percent of households use them as a garbage bag. See Figure 2.

Figure 2: Households' Behaviour on Reusing Polythene Bags



Source: HARTI Field Survey, 2018

According to descriptive statistics, after the ban, 42 percent of total households said they use lunch boxes while 32 percent of total households said they use lunch sheets available in the market. Moreover, 15 percent of the total households have opted for banana leaves. Only one percent said they use lunch sheets made from HDPE. Despite their claim, it is hard to distinguish the HDPE lunch sheet from that is made of bio-degradable material.

Material Cost of PBLs

When considering the material cost per unit item of different food carriers before and after the ban, we can clearly identify that the price has increased in every category. For an example, earlier the price of a lunch sheet was less than a rupee whereas presently it has increased to five rupees.

Stakeholders' Perception on Prevailing PBLs

According to the results, 31 percent of customers stated that new plastic bags are decomposable while 41 percent expressed doubt about their degradability. Altogether 72 percent do not have adequate knowledge on the degradability of new bags. Additionally, 60 percent of customers said the new bag's strength is poor. Accordingly, half the customers interviewed said that the use of bags has increased due to the poor strength of the bags. Moreover, 67 percent of households' perception on the new bag is its strength is poor and 27 percent claim that the strength is moderate. Further, 74 percent of

supermarket-authorized persons said strength of the polythene bag which came after the ban, is low. Similarly, 17 percent supermarket authorized persons said that they received complaints from their customers on the bags. For an example, a Senior Trade and Marketing Manager of Lanka Sathosa stated that more expenses are incurred now than before the ban to buy LDPE shopping bags. Hence, he mentioned that due to the inferior quality of LDPE shopping bags the customers ask for more bags now as the bags cannot hold much weight and tends to tear off easily. This was clear with what was observed in the study, where six percent of customers were embarrassed sometimes as the polythene bags easily broke down with the goods. Besides, one fourth of the food vendors state that the strength of the prevailing alternatives is poor. At the same time 14 percent vendors complain that the heat resistant quality of the prevailing PBLs is poor. Accordingly, these reasons have caused to rise the PBLs usage of the public.

According to the literature and the polythene manufacturers, HDPE bags' strength and recyclability rate is higher than the LDPE. Also, its production cost is low. When the study was conducted, the reason for replacing HDPE by LDPE was inquired from few government officials. According to them, the main objective of this was distancing the consumers from using polythene owing to the poor quality of the LDPE bag. On the contrary the study reveals that stakeholders' demand has not changed much.

Further, according to former Chairperson, Anura Wijethunga of All Ceylon Polythene Manufacturers and Recyclers Association, shopping bags and lunch sheets have become an essential commodity in today's busy life. Therefore, with the laws imposed on polythene shopping bags and lunch sheets, customers as well as the polythene manufacturers are in an embarrassing situation. However, abiding by the law they have now converted the machinery in their factories to make LDPE. However, according to him unlicensed HDPE polythene products are rampant in the market a reason that hinders consumers from buying LDPE at a higher cost.

Raids by CEA Officials on Supermarket Chains for Polythene Investigation

Raiding helps trace illegal polythene products and it is vital to discourage the producers and sellers involved in these activities. Accordingly, the questionnaire survey conducted up to end of August 2018 revealed that 67 percent of supermarkets were investigated by the CEA officials. Around 63 percent of supermarkets out of the total supermarkets raided were checked only one time. Punitive measures were taken against offenders last year for violating polythene laws. Those first time offenders were fined Rs. 10,000.00 while it was five times for repeating the offence. According to the key person interviews, observations and focus group discussions, CEA is in good stead in terms of the polythene raiding compared to year of 2018. The fine should be revised for raiding to be more

effective. Consequently, CEA has to increase the frequency of raiding to limit the illegal producers, sellers and etc. For this, more staff is needed, which is a constraint.

Yet, the researchers found quite a few limitations in the processes used in the detection of illegal products. The government has to rely on the importation certificates confirming legitimacy of the raw materials used in the manufacturing process, while having only limited resources and methods to check for banned substances in the finished products. It was also identified that the government sector, at present, has no laboratory facilities to test degradability of material, so as to confirm whether the required standards are met by the manufacturer.

CONCLUSIONS

The public had been largely misinformed regarding the PBLS ban, as the study found 31 percent of the surveyed public assuming the newer grocery bags to be biodegradable, while 41 percent being uncertain about its make.

According to manufacturers of grocery bags, compared to the previously used HDPE, LDPE based bags used at present were not only of poor strength, but also incurred a higher production cost while being more difficult to recycle after use. A similar issue was raised with regard to the new lunch sheets by 74 percent of the food vendors surveyed, that these lunch sheets were easily damaged, leading to leaking of wrapped food while making the wrapping process more difficult compared to the polythene sheets used before.

With entrepreneurs that have introduced and attempted to promote material and products as substitutes have expressed their disappointment with authorities for their meagre commitment in providing support. As a result, very few alternative products were found to be available. Of those alternatives for lunch sheets in the Western Province, the most common were banana leaves, Areca-nut leaves (“Kolapath”) and Lotus leaves used by food vendors. Yet, the researchers found that 97 percent of food vendors still relied on lunch sheets despite the ban. The most common alternatives identified for polythene grocery bags at supermarkets and grocery stores were fabric bags, paper bags and bags made of starch based biodegradable plastics. These alternatives for lunch sheets and polythene bags had failed to become popular for the disadvantages they have in terms of price, availability and convenience.

The most preferred alternative for polythene shopping bags was cloth bags due to its physical attributes, while the high price was a main limitation for it to become popular.

Sixty-seven percent of the households and 74 percent of the supermarkets interviewed in the research had pointed that their polythene bag usage is higher than prior to the ban due to inferior quality of the current one (LDPE).

Another aspect revealed in the study was the prevalence of “black market” polythene lunch sheets which sometimes were passed off as biodegradable. This was a major concern raised by manufacturers of biodegradable lunch sheets, as they have to compete with lower priced fake products that undermine the environmental benefits of the imposed regulations.

Enforcement of the law by the government would play a major role in making the “polythene ban” effective. According to the Central Environmental Authority, an increasing number of inspections and raids had been carried out at retail shops, supermarkets and manufacturing facilities to detect illegal polythene products. Yet, the researchers found quite a few limitations in the processes used in the detection of illegal products. The government has to rely on the importation certificates confirming legitimacy of the raw materials used in the manufacturing process, while having only limited resources and methods to check for banned substances in the finished products. It was also identified that the government sector, at present, has no laboratory facilities to test degradability of material, so as to confirm whether the required standards are met by the manufacturer.

RECOMMENDATIONS

If the consumers of Sri Lanka are to move away from polythene related products, those that introduce and manufacture eco-friendly alternatives should be encouraged. Therefore, attention and support should be provided to entrepreneurs and producers of eco-friendly alternatives for plastics and polythene by the state and a systematic campaign should be implemented to promote their use among the general public.

Establishment of a systematic approach in monitoring of violations with increased allocation of officers to the environmental units of police stations is needed. The task of these police officers should include raising awareness of the public as well as conducting inspections and raids to unmark the offenders. It was also apparent that the existing fines to punish the offenders fall short of any effect. Therefore, it is recommended to increase the fines to create more impact in the society.

ACKNOWLEDGEMENTS

Authors wish to express their profound gratitude to all stakeholders in both public and private entities for the support given.

REFERENCES

Alpizar, F., Carlsson, F. & Martinsson, P. (2001). Using Choice Experiments for Non-Market Valuation. Sweden: Gothenburg University.

Athukorala, U.K., Gamagedara, D., Gayangani, E.M., Chrishanthan, J.E. and Bandara, W.A.R.T.W. (2017). Case study on usage of polythene bags in super markets of Colombo metropolitan and finding an alternative. In Proceedings of the Second Undergraduate Research Symposium on Environmental Conservation and Management, Department of Zoology and Environmental Management, University of Kelaniya, Sri Lanka. pp. 33.

Bell, K. and Cave, S. (2011). Comparison of Environmental Impact of Plastic. Paper and Cloth Bags, Northern Ireland Assembly, 319.

Camann, A., Dragsbaek, K., Krol, S., Sandgren, J., Song, D. (2010). Properties, Recycling and Alternatives to PE Bags. MA. Worcester Polytechnic Institute, Worcester, pp.18-20.

Gogte, M. (2009). Are Plastic Grocery Bags sacking the environment? *International Journal of Quality Research*, 3, 363-375.

Hanley, N., Wright, N. & Adamowicz, W. (1998). Using Choice Experiments to Value the Environment, *Environmental & Resource Economics*, 11, 413-428.

Kuruppu, I., Edirisinghe, J., Herath, H. & Jayasinghe-Mudalige, U. (2018). Potential Policy Insights on Willingness to Accept/Pay Estimates for Agro Biodiversity in Domestic Household Level. *Sri Lankan Journal of Agricultural Economics*, 19, 47-58.

Lackey, N.R. and Wingate, A.L. (1998). The pilot study: One key to research success. *Advanced design in nursing research*, 2, 375-387.

Lancaster, K. (1966). Change and innovation in the technology of consumption. *The American Economic Review*, 56, 14-23.

Wijedasa, N 2017, 'Plastic polluter: Sri Lanka victim of wrong data by World Bank', Sunday Times, 9 July. Available at: <http://www.sundaytimes.lk/170709/news/plastic-polluter-sri-lanka-victim-of-misinformation-by-world-bank-249195.html> [12 November 2017]

Wipulasena, A 2018, 'Country generates 7,500MT waste daily: Strategic solutions key to fixing garbage crisis', Sunday Observer, 14 October. Available at: <https://www.sundayobserver.lk/2018/10/14/news-features/country-generates-7500mt-waste-daily-strategic-solutions-key-fixing-garbage> [16 October 2018].