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Sustainability in Food Retail Industry through Reverse Logistics

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Abstract- **Global sustainability regulations and market restrictions prompted global industries to develop the backflow supply chain management system termed reverse logistics. Reverse logistics or retrogistics deals with returns and waste management of products along supply chains. The adoption of reverse logistics across the manufacturing industry has been studied in detail for its adaptability and feasibility. However, a gap could been seen in studies on reverse logistics adoption across the food retail industry. The delicate nature of food products and backward flow of packaging and food materials necessitate the establishment of a smooth reverse logistics system across the supply chain. Planning a successful reverse supply chain process for the food retail industry requires research on existing reverse practices and implementation across the different retail formats. This gap in literature on reverse logistics adoption across all retail formats in a food retail industry limits the rate of success of this aftermarket system. The situation of reverse logistics research in the Malaysian food retail industry is not different. Considering the importance given to green movement by the government of Malaysia, this gap in sustainability studies need to be further investigated. This study thereby aims to investigate the level of reverse logistics adoption by retailers in Malaysia. The results highlight the present scenario of reverse logistics processes of return and waste management, determinants to reverse logistics adoption, benefits obtained by retailers from reverse logistics, and barriers to adoption of reverse logistics.**

Keywords- reverse logistics, determinants, retail formats, sustainability, barriers, benefits

1. Introduction

The food retail industry faces a lot of problems in its supply chain, starting with the perishability of food products. Stock forecasting, continuous food supply, quality management, returns management, and waste management are some of the other problems faced by food retailers worldwide. The need for fast movement of food products along the supply chain not only necessitates forward supply chain management, but also the development of a backward product flow management system. Reverse logistics or retrogistics is the answer to this problem. Reverse logistics deals with the returns and waste management of products along its backflow supply chain. Being a sustainable and green initiative, aiding in operations planning, and product traceability favours reverse logistics adoption by industries. It is also one of the widely studies sustainability logistics practices in the manufacturing and mechanical industries. The adoption of reverse logistics not only support operations sorting but also greening of the supply chain in accordance with global government sustainability regulations. Studies on reverse logistics adoption across the food retail industry are limited. This might be due to the complexity in tracing food products across the supply networks among other factors. The situation in the Malaysian reverse logistics industry is also not different.

The Malaysian food retail industry is of split format with grocery stores (56%), convenience stores (1%), supermarkets, and hypermarkets (43%) [23]. It is also one of the fastest growing industries in Malaysia, as a result of globalization, increasing expendable income, and demands from population mix. The food retail industry is currently worth US$15 billion, with a forecast of 10% growth per annum for the next three to five years [20]. The split format of the industry might be preventing sustainability studies across the retail formats. With the Malaysian government's current

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goal to green its industries with launch of green initiatives like 3R campaign (Reduce, Reuse, Recycle) and the Solid Waste and Public Cleansing Management Act, 2007 (SWPCMA), it is imperative to close this gap in sustainability studies.

There are several unanswered queries on reverse logistics in food retail industry. What is the level of adoption of reverse logistics by the retailers? What is the customer rate of return of food products to retailers? How is waste management done? What is the role of firmographics in adoption level of reverse logistics? Which determinants influence adoption level of reverse logistics by retailers in Malaysian context? What are the benefits and barriers to reverse logistics? This study aims to understand the reverse logistics adoption across retail formats. It further focuses on studying returns management and waste management practices followed, determinants to reverse logistics adoption, benefits of acceptance of reverse logistics and barriers to total inclusion of reverse activities in a day-to-day operation planning.

2. Literature Review

One of the most commonly used definitions for reverse logistics [27] described it as "the process involving planning and management of backward product and information movement from consumer to origin, with sole purpose of value recreation or disposal". In common terms, reverse logistics deals with product movement from their typical final destination, with the intension of disposal or recapture of value [12]. The general focus is always on forward supply chain movement. However, certain factors like product expiry, damage, mistake in orders, overstocking, and recalls among others initiate the backward journey of products. This required the establishment of a backward system for the returned products [7], [16]. This makes reverse logistics dependent on supplies. Product returns can be roughly categorized into customer returns, overstock returns, marketing returns, recalled product returns, and environment hazardous product returns. Some of the most common reasons for returns are overstocking, slow business, and low quality of products [33]. Weak inventory management, frequent product upgrades, sales forecasting, and product promotions are also other reasons behind returns [2].

Product returns are linked to the competitive strength of a company. This is seemed especially in case of food industry, with its high perishability and complexity. Competitions among companies, legal restrictions, consumer requirements, along with environmental commitment of companies play decisional roles in reverse logistics practice across industries [26]. The environmental angle of reverse logistics comes from the fact that practicing reverse logistics lead to energy conservation and pollution reduction, among other environment friendly benefits. This puts reverse logistics in the position of being a part of both sustainable and green logistics processes [12]. The retail industry is known for its innovative product return solutions in face of competition. Grocery retailers have been the first to concentrate on product returns and develop reverse logistics process for their supply chain. This led to the development of reclamation centres and centralized return centres for management of returns. Retailers are more likely to use technology like computerized return tracking, computerized returns entry, electronic data interchange (EDI), and radio frequency identification (RFID) technology to enhance their reverse logistics management [13].

Over the years, researchers have tried to identify few crucial determinants to adoption of reverse logistics across industries. Environmental concerns, legislation, customer demands, competition, and ISO 14001 system are among the determinants identified to reverse logistics adoption [33], [5], [28]. The changing consumer perspective on environment conservation, increasing emphasis on product safety, development of techniques, and product innovations are some of the factors leading to corporate strategized product life-cycle management. Another study identified recycling requirement, environment consciousness, economic prospects, customer relationship management (CRM), assets recovery, and legislation as motivators to reverse logistics adoption [11]. A study on reverse logistics adoption among Malaysian manufacturers revealed that regulatory pressure, customer, and stakeholder pressure significantly influence the level of reverse logistics adoption among manufacturers [21].

One of the important determinants to reverse logistics is cost. The cost of managing reverse logistics depends on the storage time and quality of returns [34]. Other determinants to efficient reverse logistics process include good inventory management, good inter-player relations in supply chains, and good management information systems

(MIS) [7], [31]. Good relationships among supply chain players, especially in the food industry is essential. Link discontinuity could result in product quality compromises, affecting consumer health, damaging product brand among other negative effects. The establishment of liberal product return policy is a step taken towards removal of damaged or undesirable products from the supply chain.

Economic and environmental issues are the major driving forces behind development of closed-loop supply chain systems like reverse logistics [9]. Regulation is one of the most important influencers to reverse logistics adoption [6]. Several studies on corporate implementation of reverse logistics revealed that decisions to implementation of environment-friendly programs is taken to avoid the legal circle [18], [13]. An efficient reverse logistics program could be a differentiator for market gain and competitive advantage in the industry [15]. The implementation of reverse logistics not only improves supply chain relationships, but also lead to economic advantage and better inventory control [32]. A study on implementation of reverse logistics across supermarkets revealed the implementation of reverse logistics activities without prior information on reverse logistics and its implications [17]. The importance of corporate image and its impact on consumer's purchasing power is also not lost on companies. Company reputation, public image, and company goodwill are some of the non-financial considerations taken by companies for adopting reverse logistics [19]. The after-sales service through CRM is essential for customer management and loyalty guarantee [3]. Efficient after-sales services lead to increased customer satisfaction, thus ensuring customer loyalty [29].

Improved customer relations, assets recovery, cost control, increased profitability, better inventory management, green customer loyalty, and environment regulations acceptance are some of the key performance measures of reverse logistics which are equally considered as benefits from its adoption [1], [15], [11]. Waste reduction, better disposal techniques, competitive advantage, energy efficiency, improved CRM are some of the benefits from adoption of green logistics practices perceived by Malaysian food manufacturers [14].

Irrespective of the benefits and opportunities, reverse logistics application is clouded by hurdles. The uncertainty in return forecasting, complete value recovery from return products, and complexity in management of returns network are some of the major challenges identified to reverse logistics adoption [10], [22]. Lack of awareness about reverse logistics, management inattention, financial constraints, problems with product quality, inadequate information systems, absence of company policy on reverse logistics, and legal issues are some of the barriers identified in reverse logistics adoption across companies [30], [26], [25].

3. Research Methodology

3.1 Conceptual framework

The conceptual framework given below (Figure 1) has been developed from extensive literatures on reverse logistics and sustainability determinants in industries. The core economic, social, and environmental determinants from studies by [33], [34], [28], [10], [21], [4] have been summarized to form the framework of this study. A hypothesis (H_1) was developed in order to understand the role of firmographic characteristics like retail formats on the level of adoption of reverse logistics across stores.

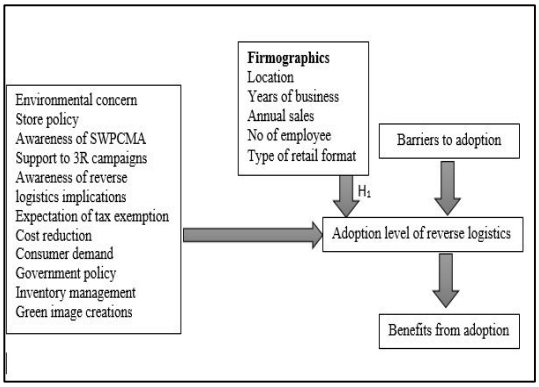

Figure 1: Conceptual framework

H_1: Adoption level of reverse logistics is influenced by firmographic characteristics of retail stores

3.2. Sampling frame and research instrument

The sample frame of this study consisted of 236 food retailers from Klang Valley, Malaysia. Food retail sector of Klang Valley was selected to represent Malaysian food retail industry because of its recognition by the Ministry of Domestic Trade, Co-operatives and Consumerism (MDTCC) as the

area with highest number of retailers in Malaysia. Klang Valley is one of the crucial areas for retail National Key Economic Area (NKEA) under their Economic Transformation Program (ETP) [24]. The limitation in time and resource availability also lead to selection of this retail hot spot for the study. The list of food retailers was obtained from Yellow Pages [35]. Stratified sampling was followed for prospective respondents' categorization. The four formats of retail namely grocery stores, convenience stores, supermarkets, and hypermarkets were covered in the sample. Primary data survey technique was selected using a structured questionnaire as a research tool. The questionnaire format was developed with open-ended and close-ended questions, and 5-point Likert scale statements. The items included in the study were taken from previous literatures on reverse logistics.

The questionnaire was divided into three sections. The first section covered questions on retailer's profile, while the questions in the second section were related to reverse logistics practices and determinants to adoption. In the final section, questions on benefits from adoption of reverse logistics and the barriers to acceptance of reverse operations were included. Benefits and barriers were measured using 5-point Likert scale statements in order to gauge the extent of its influence on reverse logistics adoption. Benefits used 5-point Likert scale statements ranged between '1-Never, '2-Rarely', '3-Occasionally', '4-A moderate amount', and '5- A great deal'. Barriers used 5-point Likert scale statements ranged between '1-Strongly disagree', '2-Disagree', '3-Neutral', '4-Agree' and '5-Strongly agree'. The questionnaire was applied through face-to-face interviews with store management. A pilot survey was conducted prior to actual data collection in order to check for validity and reliability of questionnaire across retail formats.

3.3. Methods of analysis

To fulfil the objectives of this study, descriptive analysis, mean ranking analysis, chi-square analysis, and binary logistic regression analysis were performed. Descriptive analysis was used to profile the respondents and highlight reverse logistics operations performed on a day-to-day basis by the retail stores. Mean ranking analysis was used to better understand the benefits of reverse logistics adoption and barriers to its complete acceptance by stores. The Cronbach's Alpha result for reliability was 0.612. A reliability level of more than 0.60 is acceptable in a social science, meaning these variables were valid and reliable for further analysis [8]. Chi-square test of independence was used to examine the relationship between adoption level of reverse logistics and firmographics of the retail stores.

Binary logistic regression was used to determine the extent to which selected determinants influence the adoption level of reverse logistics across stores. The coding used for the predictor variables and dependent variable is listed in Table 1. The equation of the model Eq. (1) is given below: -

$$\ln\left(\frac{\pi}{1-\pi}\right) = \beta_0 + \beta_1 x_{\text{retail format type}} + \beta_2 x_{\text{environmental concern}} + \beta_3 x_{\text{stores policy}} + \beta_4 x_{\text{SWPCMA}} + \beta_5 x_{3R} + \beta_6 x_{\text{awareness of reverse logistics}} + \beta_7 x_{\text{Tax}} + \beta_8 x_{\text{consumer demand}} + \beta_9 x_{\text{government policy}} + \beta_{10} x_{\text{cost reduction}} + \beta_{11} x_{\text{inventory management}} + \beta_{12} x_{\text{green image}} + \varepsilon i \quad (1)$$

Table 1 : Coding of variables for binary logistic regression

Variables	Coding system
Dependent variable: Level of reverse logistics adoption	0: Low adoption 1: High adoption
Categorical predictor variable: Retail format type (RF_1, RF_2, RF_3)	1-0-0: Convenience 0-1-0: Supermarket 0-0-1: Hypermarket 0-0-0: Grocery store
Dichotomous predictor variables: Environmental concern	0-Not concerned 1-Concerned
Policy on environment conservation	0-Not executed 1-Executed
Awareness of SWPCMA	0-Not aware 1-Aware
Support to 3R campaign	0-Not support 1-Support
Awareness of reverse logistics implications	0-Unaware 1-Aware
Tax reduction	0-Not influence 1-Influence
Consumer demand	0-Not influence 1-Influence
Government policy	0-Not influence 1-Influence
Cost reduction	0-Not influence 1-Influence
Inventory management	0-Not influence 1-Influence
Green image creation	0-Not influence 1-Influence

4. Results and Discussion

4.1. Firmographics of retail stores

The results in Table 2 show the firmographics of the 236 retail stores that participated in this study. The survey covered areas such as Subang Jaya (10.6%), Shah Alam (15.7%), Serdang (14.8%), Putrajaya (6.4%), Puchong (11.9%), Kuala Lumpur (18.2%), Kajang (18.6%), Cyberjaya (0.8%), and Cheras (3.0%). Table 2 also shows the job profile of respondents to include Store Managers (59.3%) and Store Supervisors (40.7%). The sample constituted grocery stores (44.5%), convenience stores (21.2%), supermarkets (29.7%), and hypermarkets (4.7%). Majority of the stores (45.8%) were established less than five years ago. Stores with more than 20 years of experience (10.6%) had also participated in this study. The annual turnover of the stores ranged from less than RM0.5 million annually (36.9%), to more than RM3.5 million a year (8.9%). Most of the retail stores (52.5%) had between 1 to 3 employees, while 5.5% of stores had more than 15 employees.

Table 2: Firmographics of retail stores

Profiles	Percentage (%)
Store Location	
Cheras	3.0
Cyberjaya	0.8
Kajang	18.6
Kuala Lumpur	18.2
Puchong	11.9
Putrajaya	6.4
Serdang	14.8
Shah Alam	15.7
Subang Jaya	10.6
Type of Retail Format	
Convenience Stores	21.2
Grocery Stores	44.5
Hypermarkets	4.7
Supermarkets	29.7
Years of Operations	
< 5 years	45.8
5 - 10 years	24.2
11 - 15 years	16.1
16 - 20 years	3.4
> 20 years	10.6
Annual Turnover (RM million)	
< 0.5	36.9
0.5 - 1.0	25.4
1.1 - 1.5	12.3
1.6 - 2.0	5.9
2.1 - 2.5	4.2
2.6 - 3.0	4.2
3.1 - 3.5	2.1
> 3.5	8.9
Number of Employees	
1 - 3	52.5
4 - 6	37.6
7- 9	6.0
10 - 12	2.5
13 - 15	0.8
>15	5.5
Job Designation	
Store Manager	59.3
Store Supervisor	40.7

Note: n = 236

4.2. Reverse logistics awareness and practices

In order to study the practice of reverse logistics, it is necessary to understand the extent to which retailers are familiar with the terminology and its practices. The enquiry of familiarity of the term reverse logistics showed that only 30.9% of the respondents were actually aware of it. The remaining 69.1% of the respondents were unfamiliar with the term reverse logistics. An extended discussion identified the subconscious application of reverse logistics practices without expert guidance. Figure 2 shows the sources of information for retail stores on reverse logistics. The source of information for this was mainly linked back to newspapers (72.5%), television and radio (60.6%), and trainings/workshops (39.8%). Competitors (3%) and Supply Chain Management (SCM) experts (4.2%) were the least informative sources of reverse logistics to food retailers.

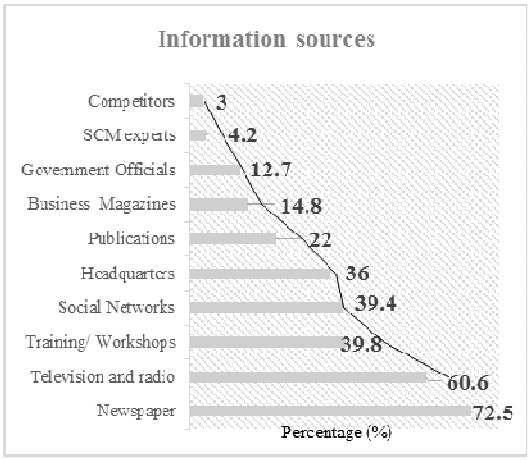

Figure 2: Sources of information on reverse logistics

Figure 3 shows the reverse logistics practices followed by retail stores. Inventory management (100%), product return (92.4%), landfill (90.7%), and gatekeeping (88.6%) were the majorly practiced reverse logistics activities in stores. Some of the minor practices followed include recycling of the return goods (13.1%), reselling of return goods (3.8%), and e-waste management (39.4%).

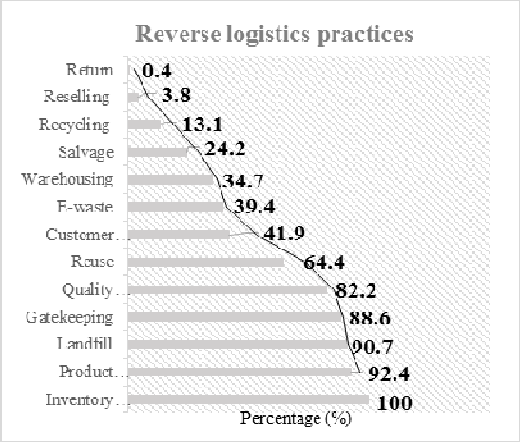

Figure 3: Reverse logistics practices followed by retailers

4.3. Returns management in store

Table 3 shows the returns management by food retailers. The results showed that 7.6% of the retailers did not have product take-back policy while 43.6% of the respondents have an annual consumer food returns rate between 6-10%. The highest return rate between 26-30% was seen in case of 3.4% of the respondents. Retailers explained expiration of food products (80.5%) and damage to product (53.0%) as major reasons behind food product return by consumers. Beverages (79.7%), dairy products (73.3%) followed by packed foods (50.0%) were among the most returned food products by consumers. Most of the returned items were either returned to suppliers (79.2%) or dumped in landfills (61.0%).

Table 3 : Returns management in store

	Percentage (%)
Rate of customer returns	
0	7.6
1 - 5	35.6
6 - 10	43.6
11 - 15	16.2
16 - 20	10.8
21 - 25	0.8
26 - 30	3.4
Reasons	
Poor quality	4.2
Unable to follow directions	11.4
Liberal return policy	12.3
Expired products	80.5
Non-halal products	0.8
Damaged products	53.0
Food returned	
Fresh fruits	5.5
Fresh vegetables	4.2
Dairy products	73.3
Beverages	79.7
Meat products	4.2
Poultry products	20.8
Fresh fish	3.0
Ready-to-eat foods	36.2
Packed foods	50.0
Processed foods	23.7
Frozen foods	7.2
Action taken	
Return to suppliers	79.2
Recycle	3.0
Landfill	61.0
Reuse	2.1
Resell	2.1

Note: n = 236

4.4. Waste management in store

In order to understand reverse logistics initiation at the retailer end, it is also necessary to acknowledge the management of packaging materials and left-over food materials by retailers. As per the results of Table 4, food left-overs mainly constitute of packaged foods (46.2%) and dairy products (39.8%). Landfilling of the products (62.7%) and returning to vendor/supplier (62.3%) were two most common actions taken up by the retailers. Reselling of the left-over perishables (17.4%) was also carried out by the retailers. Cardboard boxes (89.8%) and plastic sheets (74.2%) were the major packaging materials left over in stores. They were usually reused (54.2%), resold (58.5%) or underwent landfill (64.8%), among other alternatives.

Table 4 : Waste management in store

	Percentage (%)
Left-over food items	
Vegetables	26.7
Fruits	25.0

Packed foods	46.2
Canned foods	13.6
Dairy products	39.8
Meat and meat products	5.9
Fish and fish products	4.7
Poultry products	18.2
Action taken	
Return to vendor/supplier	62.3
Resell	17.4
Landfill	62.7
Left-over packaging materials	
Cardboard boxes	89.8
Plastic sheets	74.2
Bubble wrap	27.5
Sleeve packaging	8.9
Corrugated boxes	24.2
Wooden crates	24.2
Shrink and stretch wrap	70.8
Action taken	
Return to suppliers	22.0
Reuse	54.2
Recycle	38.1
Resell	58.5
Landfill	64.8
Incinerate	15.7

Note: n = 236

4.5. Chi-square analysis

Chi-square analysis was carried out to test the hypothesis on relationship between adoption level of reverse logistics and firmographic characteristics of retail stores.

H_1: Adoption level of reverse logistics is influenced by firmographic characteristics of retail stores

The firmographic characteristics of location, years of experience, annual sales, retail format, and no. of employee were crosstab with adoption level of reverse logistics across retailers. The results of Table 5 display this analysis. Company location, annual sales, retail format, and no. of employees were found significant at $p<0.01$ level of significance. The multi-racial population of Malaysia, with their varied product requirements and influx of green consumerism heavily influenced the operational decisions of food retailers in Malaysia. Increasing consumer expectations necessitate sales forecasting and stock management practices across locations and retail formats. This result in the implementation of supply chain streamlining processes like reverse logistics by stores, thereby making company location and sales intend factors of consideration. The workforce strength also influenced the extent of reverse logistics implementation in stores, with increase in employee numbers supporting better implementation of all reverse logistics activities.

The years of experience in retail business was found insignificant to adoption level of reverse logistics. This could be a result of general aversion towards changing store policies, especially by older retail formats.

Table 5: Relation between level of reverse logistics adoption and retail store firmographics

Firmographics	**Chi-square**	**Sig.**
Company location	35.266	0.000***
Years of experience	3.999	0.406
Annual sales (RM million)	44.550	0.000***
Type of retail format	49.116	0.000***
No. of employee	40.431	0.000***

*Note: ***Significant at 1% level ($p \leq 0.01$)*

In order to get a better understanding of reverse logistics across retail formats, it was necessary to crosstab the level of reverse logistics adoption across the four format types. Figure 4 summarizes the results of the crosstab. As can be observed from the figure, hypermarkets have a better inclination to high adoption of reverse logistics, followed by supermarkets, and convenience stores, while grocery stores displayed low level of reverse logistics adoption. The results highlighted the changing *modus operandi* of retailers, with modern formats catering to needs of environment conscious consumers with their push-pull strategy, wherein traditional formats slowly shift from their push strategy towards push-pull strategy of business.

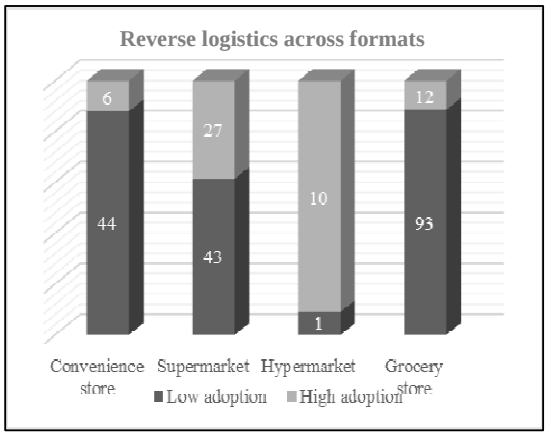

Figure 4: Level of adoption of reverse logistics across retail formats

4.6. Binary logistic regression analysis

Binary logistic model was used to find the extent to which retail format type, store concern for environment, store policy on environmental conservation, awareness of SWPCMA, awareness of reverse logistics implications, support to 3R campaign, expectation of tax reduction, consumer demand, government policy on green, intend for cost reduction, better inventory management, and green image creation influenced level of reverse logistics adoption across retail formats. Table 6 shows the estimate logit model for determinants towards level of reverse logistics adoption.

All 236 cases in this analysis were used, with zero cases missing, and zero unselected. The dichotomously scored dependent variable 'level of adoption of reverse logistics' had two categories which are 'high adoption' of reverse logistics coded as one, and 'low adoption' of reverse logistics coded as zero. The two step iteration of Block 0 gave a -2 Log likelihood value of 488.203 which was reduced to 158.156 in the final model, which is desirable. The overall model classification also increased from initial 54.2% to 84.3%, denoting better classification of cases by the final model. The pseudo R square statistics or multiple R square analogs of Cox & Snell R square and Nagelkerke R square values have similar functions to R square of linear regression model. The Cox & Snell R square value of 0.340 and Nagelkerke R square value of 0.513, from Table 6 indicated an average model fit for this study. The Hosmer and Lemeshow test is a measurement of fit which evaluates the goodness of fit between predicted and observed probabilities in classifying the dependent variable. In this case, the low chi-square value of 3.855 and its insignificance at p=0.870 indicated a matchup of predicted and observed probabilities.

The results from Table 6 show that retail format type, awareness of SWPCMA, awareness of reverse logistics implications, government policy, and inventory management were significant determinants to adoption level of reverse logistics. Retailers influenced by government policy had 6.350 times more intension towards high adoption of reverse logistics when compared to retailers unaffected by government policies on 3R campaign and reverse logistics. This indicates the importance of government as a stakeholder to decisions on reverse logistics and green practices. The results indicated that retailers with awareness of SWPCMA were 3.214 times more inclined to high adoption of reverse logistics than those with no awareness of SWPCMA. The findings also showed that respondents aware of reverse logistics and its implications had 0.154 times more inclination to high adoption of reverse logistics when compared to respondents unaware of reverse logistics.

Furthermore, retailers with inventory management as a decision criteria were 2.164 times more intend towards high adoption of reverse logistics. The values from retail format categories, namely RF_1, RF_2, and RF_3 could be used in the final binary model Eq. (2) for future estimations. The final binary logistics model equation Eq. (2) is given below:-

$$\begin{aligned} &\ln(\textit{Adoption level}) \\ &\quad = -2.880 - 1.422\,(RF1) + 1.346\,(RF2) + 4.330\,(RF3) \\ &\quad + 1.167\,(\textit{SWPCMA}) - 1.872\,(\textit{Awareness of reverse logistics}) \\ &\quad + 1.848\,(\textit{Government policy}) \\ &\quad + 0.772\,(\textit{Inventory management}) \qquad (2) \end{aligned}$$

Table 6: Estimates logit model for level of reverse logistics adoption

Variables	β	Sig.	Exp(B)
Retail format type	-1.422	0.027**	0.241
RF1	1.346	0.006***	3.842
RF2	4.330	0.000***	75.946
RF3			
Environmental concern	-18.863	0.998	0.000

Store policy	-0.897	0.180	0.408
Awareness of SWPCMA	1.167	0.036**	3.214
Support to 3R campaign	-0.368	0.568	0.692
Awareness of reverse logistics	-1.872	0.002***	0.154
Tax reduction	0.743	0.165	2.102
Consumer demand	0.535	0.308	1.707
Government policy	1.848	0.001***	6.350
Cost reduction	-0.496	0.316	0.609
Inventory management	0.772	0.099*	2.164
Green image	0.433	0.415	1.542
Constant	-2.880	0.002	0.056
-2 Log Likelihood	158.156		
Cox and Snell R Square	0.340		
Nagelkerke R Square	0.513		
Hosmer and Lemeshow Test	0.870		

4.7. Benefits from reverse logistics adoption

A series of 5-point Likert scale items were used in order to gauge the benefits reaped by retailers through adoption of reverse logistics practices. Figure 5 shows the responses to benefits attained from reverse logistics adoption. Out of the 12 benefit statements seen in Figure 5, five benefits were identified with mean scores of 3.00 and above. A mean score of 3.00 and above indicated that these five benefits were mainly gained through adoption of reverse logistics by retailers. Based on mean ranking of benefits, reduction in returned goods has the highest mean with mean score of 3.61. This means that food retailers were able to reduce the return of goods by consumers through adoption of reverse logistics practices. Improved quality management (mean score of 3.50), better waste management (mean score of 3.49), increase in customer satisfaction (mean score of 3.47), and better inventory management (mean score of 3.41) were the other statements with high means.

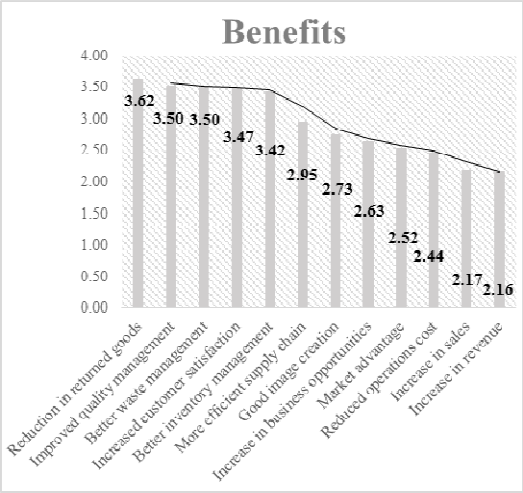

Figure 5: Benefits from adoption of reverse logistics

The top five benefits indicated towards better internal operation management of stores through adoption of reverse logistics practices. The statement of increasing sales and revenue received lowest means with mean scores of 2.16 and 2.15 respectively, indicating the least obtained benefits of reverse logistics.

4.8. Barriers to revere logistics adoption

Figure 6 shows the barriers to complete acceptance of reverse logistics activities in day-to-day operations of food retail stores. A 5-point Likert scale has been used to grade the barriers. Out of the 15 statements, five statements have been identified as valid (mean scores more than 3). A mean score of 3.00 and above indicated that these five barriers severely prevent the adoption of reverse logistics by retailers. Consumer indifference to green retail store operations limit the interest of retailers to reverse their operations. This is seen as the biggest barrier to adoption, with a mean score of 3.80. The absence of experts in this field to guide the retailers through the complex operations of reverse logistics was the next hurdle to adoption (mean score of 3.25). The absence of government policies on reverse logistics (mean score of 3.17), zero tax exemption for its adoption (mean score of 3.11), and non-mandatory adoption of reverse logistics by stores (mean score of 3.03) also pose problems to acceptance of reverse logistics into daily operation planning. The mean ranking of barriers highlighted consumer indifference and thereby store

indifference to reverse logistics as highest barrier to reverse logistics. Store policy with statements with mean scores of 1.59 and 2.29 posed least problems to reverse logistics adoption.

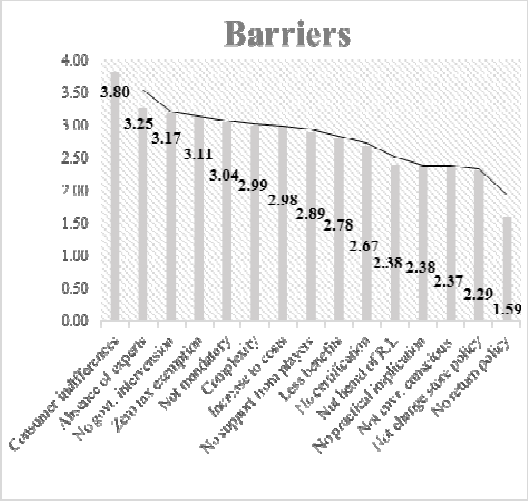

Figure 6: Barriers to adoption of reverse logistics

5. Conclusion

This study was conducted to understand the level of adoption of reverse logistics practices across food retailers in Malaysia. The results showed that retailers mainly practice reverse logistics practices without familiarization with the term 'reverse logistics'. A partial application of reverse practices have been revealed in the study. Inventory management, product take-back, and waste management are some of the major practices followed by the retailers under reverse logistics. Print and visual/audio media has been found to be the major sources of information on reverse logistics activities for the retailers. Return management results showed an average 6-10% rate of consumer return, majorly beverages and dairy products which are either returned to supplier or undergo landfilling. Waste management results showed landfill operations as a main method for disposal. The firmographic characteristics of location, annual sales, retail format, and no of employees were found significant to level of reverse logistics adoption. While hypermarkets and supermarkets displayed high level of reverse logistics adoption, grocery stores showed a relatively low level of adoption. This result could be an effect of size of operations on applicability of reverse logistics in a supply chain.

The binary logistic regression analysis isolated retail format, awareness of SWPCMA and reverse logistics implications, inventory management, and government policy as significant influencers towards increased adoption of reverse logistics by retailers. Retailer's sensitiveness to government policies on green was revealed to be the most influential factor towards high adoption of reverse logistics by food retailers in Malaysia. This study also revealed that quality management, reduction in rate of returned goods, and better waste management are the benefits majorly enjoyed by retailers through adoption of reverse logistics activities. Lack of consumer interests, non-availability of expert advice on reverse logistics, and absence of government policy on compulsory adoption of reverse logistics are major barriers identified by retailers to complete adoption of reverse logistics activities.

The role of the Malaysian government in implementation of reverse logistics practices is clear from the above results. A strong governmental stand towards compulsory adoption of reverse logistics practices is however missing. In order to fulfil the goal of green Malaysia, the Malaysian government needs to make a strong standpoint on implementation of sustainability practices like reverse logistics by retailers. This will not only green their supply chain, but also aid in improved firm performance. Along with regulations, industrial education on sustainability operations like reverse logistics would be beneficial for small format businesses.

A feasibility study on the adaptability of sustainable activities like reverse logistics to small formats could be conducted. Such studies would also help Malaysian government in their 'Small Retailer Transformation Program' under ETP. The split nature of industry and its wide spread limited a full impact study of this industry. This initial study on food retail might help future researchers in further exploration of dynamics of reverse logistics in food supply chain in Malaysia.

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