Driving Forces for Reverse Logistics Post-Consumption Packaging in the Beverage Industry in Thailand: Pilot Case Study

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Abstract— In Thailand, Municipal Solid Waste (MSW) problems exist, and 15% of these problems are due to post-consumption beverage packaging that is left behind after the point of consumption.. This study aimed to analyze the driving forces in the reverse logistics of post-consumption packaging in the beverage industry in Thailand in order to mitigate the waste issue. Initially, 13 variables were extracted from a review of 20 key reverse logistics studies in multiple industries. Item-Objective Congruence (IOC) was performed by experts from the academic and business sectors, and 5 further variables were added from the Thai context. Thus, a total of 18 variables were employed in the pilot study. Purposive random sampling was used to select the pilot group for 57 samples from major market share beverage manufacturers. The research instrument applied an 11-point rating scale questionnaire. The results revealed that the 3 most influential driving forces are "green marketing", "pollution", and "quality stakeholder standards". Exploratory factor analysis was conducted to extract all the variables in order to identify the internal and external factors. Further study needs to be conducted using Structure Equation Modelling to examine the causal relationships between the abovementioned factors and to identify the impacts of reverse logistics from the sustainability perspective.

Keywords: post-consumption packaging; beverage industry; reverse logistics

I. INTRODUCTION *(HEADING 1)*

Municipal Solid Waste (MSW) is a high priority issue, which has impacts at both the global and local levels. In a study by the World Bank, it was pointed out that the MSW lev-el is currently at 1.3 billion tons per year and is likely to increase by 2.2 billion tons per year until 2025 [1]. Most of this waste is post-consumption waste, which increasingly grows with the rising population. It is undeniable that the garbage problem has been managed unproperly due to a lack of funds and education /knowledge—even subconscious knowledge—relating to environmental and social responsibilities.

Government and private sectors are now putting their efforts toward the realization of a sustainable solution for managing the garbage problem by encouraging the 3Rs concept, which consists in the reduction, reuse, and recycling of waste in the whole supply chain process, including planning, sourcing, making, delivering, and return.

The European Commission has provided guidelines on the sustainability concept to influence the business world in the past decade. It is concerned with the realization of a holistic view that includes economic, environmental, and social aspects, providing a practical framework for doing business with integrity and responsibility to the public [2]. It is not only a way of doing business internally, but also a standard or requirement for sourcing suppliers/ vendors. If a company does not comply with the sustainability code of conduct, they may not be registered in the approved vendor list at all. It can be said that the sustainability concept has sometimes been used as a trade barrier to block out trade competitors, especially in international

trade, where some countries have set environ-mental protection policies, such as the eco-friendly production process, the disposable packaging, and even the post-consumption management policies, in order to reduce the garbage problem to a minimal level or close to zero.

Moreover, the European Commission has announced a Zero Waste policy and envisages that 100% of plastic packaging will be recyclable within 2030. This also forces manufacturers to be seriously concerned with the environment[3].

In Thailand, the garbage problem has become increasingly dire due to the growth and expansion in economics and society, which drives more production of various types of goods to satisfy consumer demand for both the product itself and attractive packaging. Moreover, the promotion of tourism and the expanding of the urban community also im-pact consumption.

The Pollution Control Department, Ministry of Natural Resources and Environment (2019) has reported the MSW level in Thailand, which is approximately 27.82 million tons per year or 76,220 tons per day nationwide. Only 9.58 million tons or 35% can be recycled, and another 65% or 18.24 million tons needs to be disposed of. Unfortunately, waste is properly disposed of only 39% of the time (or approximately 10.88 million tons), and an-other 26% (or approximately 7.36 million tons) is disposed of either improperly or in a sub-standard manner, as illustrated in this Figure 1[4].

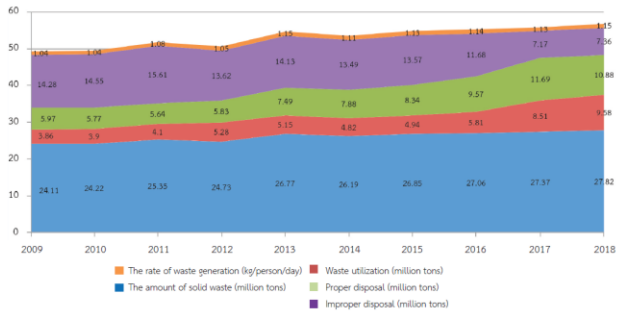

Figure 1. Thailand solid waste in 2009–2018.

Moreover, data on the ten waste collection activities that contribute the most MSW in 48 areas, covering 24 provinces in Thailand, showed that the waste from beverage pack-aging contributes approximately 15.2% of total wastes.

In the beverage industry in Thailand, the post-consumption management of packaging, such as glass bottles, plastic bottles, aluminum cans, paper cartons, etc., is critical and difficult to sustainably manage. Most packaging is left behind at the point of consumption in popular places, such as touristic areas.

The government, public sector, and citizen are also asking for greater responsibility from the manufacturers to clean up or collect their sold items in order to reduce the intensity of the MSW issue sustainably. Many companies have also initiated and seen the im-portance of the reverse logistics of post-consumption packaging, putting it back into use or recycling it. The activity is either conducted within the organization or through a collabo-ration with stakeholders in the supply chain, but there are some that are still not implementing such procedures.

The key issue in the beverage industry is the very low percentage of reverse logistics, putting packaging back into use. A lot of packaging is treated as garbage, causing the ex-traction of new virgin resources to produce new packaging.

The reverse logistics flows of post-consumption packaging in Thailand, in general, is illustrated in Figure 2.

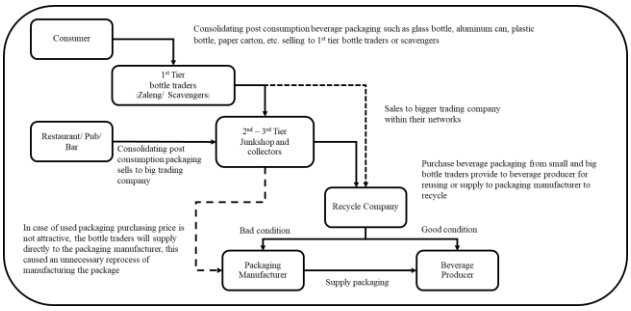

Figure 2. Reverse logistics for beverage packaging in Thailand.

Thus, this study aimed to analyze the driving forces through the implementation of the reverse logistics of post-consumption packaging in order to understand and prioritize for further actions associated with the implementation of reverse logistics.

II. LITERATURE REVIEW

The "Reverse Logistics" term, defined by the Council of Logistics Management (CLM) as "the role of logistics in recycling, waste disposal, and management of hazardous mate-rials; however, a broader perspective includes everything relating to logistics activities carried out in source reduction, recycling, substitution, the reuse of materials, and disposal". many studies elaborated this definition using the typical flow of the supply chain with reverse logistics, which can include the return of a product after consumption and rejected parts during manufacturing or transportation. These activities are also the most important part of reverse logistics. Reverse logistics can be in any form, such as returned products, recalled products, expired products, products that have reached the end of their shelf life, etc.[5]

There are approaches which proposed a framework of reverse logistics, considering 3 main aspects, which are:

- Economics: by reducing the amount of new raw material by recovering and recapturing value, materials can be reused, and disposal costs can be reduced.

- Legislation: by complying with laws and regulations relating to trading and the environment, which can be in the form of policies from the government sector, a company can be qualified to proceed with their business.
- Corporate citizenship: the values and ethics relating to the goodwill of a company, including those of stakeholders and communities[6].

Meanwhile, there are studies showed the drivers of reverse logistics for the home sup-ply industry in Turkey and found that the companies themselves are now facing pressure from external stakeholders, rather internal ones in the firm, which constitutes a drastic change from the situation in the past [7].

However, there are many reverse logistics studies in multiple industries that cover up the driving forces. The driving forces that can be selected for the model of the beverage industry are as follows:

Table I. variables from the literature review.

Variables	Definition	Literatures
Policy and Involvement from top management:	Values and principles of the organization, which are passed down from the top management	[8], [9], [10], [11] [12], [13]
Joint internal operation	Collaboration among units in the organization	[7],[9], [10], [11], [12], [13]; [14], [15]
Information system support	Information system, which supports visibility in reverse logistics activities	[7], [9], [10], [11], [13], [14], [15]; [16], [17]
Cost-efficiency	Cost benefits from the reuse and recycling of packaging; trade-off with using new packaging	[7],[9],[10], [11], [12], [13], [16], [17], [18], [19]
Laws and regulations compliance	Business proceeding to align with the enforcement of environmental laws	[7], [8], [9], [10], [11], [12], [13], [14], [16], [17], [18], [19], [20]
Green marketing	Doing business with an image of environmental consciousness, which can increase opportunities in business	[8], [10], [11], [16], [17], [18], [19], [20],
Consumer awareness	Consumer concerns regarding the environment and setting consumer purchasing priority to eco-friendly companies	[7], [9], [10], [14], [15], [17], [19], [20]
Corporate citizenship	Code of conduct and doing business with ethics by considering the impacts on other parties and stakeholders	[8],[9], [10], [12], [15], [17], [18], [19], [20]
Virgin natural resources usage	The ratio between using recycled raw material and new material for gaining benefits	[7],[9], [10], [12], [14], [17], [18]
Pollution	Decreasing waste management and environmental pollution	[8], [10], [12], [17]
Future laws and regulation compliance	To become prepared for future legalization, which may either create opportunities or threaten the business	[7], [8], [9], [10], [11], [12], [13], [14], [16], [17], [18], [19], [20]
Decline of resources	To be prepared with new strategies for coping with declines or the extinction of key raw materials	[7], [8], [10], [14], [17]
Pressure from customers/suppliers	Customers and suppliers expect more responsibility from firms in preserving the environment and society	[7], [8],[9], [10],[11],[12], [13], [14], [15], [16], [17], [18], [19], [20]

III. PILOT STUDY

The abovementioned 13 variables were subjected to Item-Objective Congruence (IOC) by experts from the academic and business sectors to validate them for use in a study of the beverage industry in Thailand. The experts are detailed in the following table II.

Table II. Experts from the academic and business sectors for IOC.

Name	Role	Organization
Expert1	Academia	Professor from leading university in Thailand
Expert2	Business expert	Representative from Thai Beverage Association
Expert 3	Business expert	Management from beverage recycle company

The IOC result shows that all 13 variables are valid, and it was also recommended by the experts to input 5 more variables, which are shown in Table III.

Table III. Additional variables for IOC.

Variables	Definition
Define budget and responsibility unit	Company sets financial budget and responsibility unit for performing reverse logistics activities
Internally monitor progress	Reverse logistics activities are important for the relevant internal person to monitor the progress
Manufacturing technology support	The company has the manufacturing technology to support the use of reused packaging
Sustainability vision	The company has made an announcement on the sustainability vision to be applied in the Business-as-Usual operations
Quality stakeholder standards	Stakeholders required to adhere to more standards/ protocols in doing business

Finally, a total of 18 variables were used to conduct a questionnaire in this pilot study. An 11-point rating scale was used to represent the respondents' opinions on each variable (0: Very strongly disagree; and 10: Very strongly agree).

Then, to perform the reliability test, Cronbach's alpha coefficient was used. The results showed that the alpha coefficient was 0.922, and all 18 variables are valid, with a high consistency, as detailed below in Table IV:

Table IV. Reliability test

Variables	Cronbach's Alpha	Variables	Cronbach's Alpha
1. Policy and involvement from top management	0.918	2. Define budget and responsibility unit	0.920
3. Joint internal operation	0.922	4. Internally monitor progress	0.916
5. Sustainability vision	0.914	6. Information system support	0.915
7. Manufacturing technology support	0.917	8. Cost-efficiency	0.925
9. Laws and regulations compliance	0.919	10. Quality stakeholder standards	0.919
11. Green marketing	0.917	12. Consumer awareness	0.918
13. Corporate citizenship	0.916	14. Virgin natural resources usage	0.917
15. Pollution	0.916	16. Future laws and regulations compliance	0.916
17. Decline of resources	0.921	18. Pressure from customers/suppliers	0.921

Purposive random sampling was used to select a pilot group for 57 samples from major market share beverage manufacturers in Thailand, with over 20 subsidiaries companies who produce alcoholic and non-alcoholic beverage using several types of packaging (glass bottles, plastic bottles, and aluminum cans). The demographic of the respondents is shown in Table 5:

Table V. Demographics of the respondents.

Area	Respondent's Demographic	No.of Respondents	Percentage
Products	1: Spirits	5	8.77%
	2: Beer	3	5.26%
	3: NAB	23	40.35%
	4: Beer and NAB	1	1.75%
	5: Spirits, Beer, and NAB	25	43.86%
Packaging	1: Glass bottle	6	10.53%
	2: Plastic bottle	13	22.81%
	3: Aluminum can	2	3.51%
	4: Glass and PET bottle	1	1.75%
	5: Glass bottle and Aluminum can	7	12.28%
Company nationality	1: Thai	47	82.46%
	2: JV	10	17.54%
No. of employees	1: 1–1,000	26	45.61%
	2: 1001–2,000	2	3.51%
	3: More than 2,000	29	50.88%
Years of experience	1: Less than 5 years	19	33.33%
	2: 5–10 years	12	21.05%
	3: 11–15 years	10	17.54%

Area	Respondent's Demographic	No.of Respondents	Percentage
	4: 16–20 years	6	10.53%
	5: More than 20 years	10	17.54%
Role and responsibility	1: Strategy	15	26.32%
	2: Procurement	2	3.51%
	3: Production	5	8.77%
	4: Logistics planning	3	5.26%
	5: Transport	13	22.81%
	6: Warehouse	4	7.02%
	7: Accounting/ Finance	3	5.26%
	8: Other	12	21.05%
Position	1: CEO/ Managing Director	3	5.26%
	2: Vice President	14	24.56%
	3: Manager	13	22.81%
	4: Assistant manager	14	24.56%
	5: Operation/ Administrator	11	19.30%
	6: Other	2	3.51%

The general information and business profiles of the companies, obtained from the respondents, showed that the majority (approximately 43.86%) are companies that pro-duce all types of beverages (spirits, beer, and NAB), while the NAB producers are in second place with 40.35%. Most of the packaging types used are plastic bottles (with 22.81%) and both glass and aluminum cans (with 12.28%). The nationality of most of the companies is Thai.

The three most influential driving forces for reverse logistics of the post-consumption packaging are: (1) "green marketing", (2) "pollution", and (3) "quality stakeholder standards", while the three least influential driving forces are: (1) internally monitored progress, (2) information system support, and (3) internal joint operation, as shown in Table VI:

Table VI. Descriptive statistics.

Variables	No. of Respondent	Min	Max	Average	Std. Deviation
Green marketing	57	5	10	9.07	1.147
Pollution	57	5	10	8.91	1.184
Quality stakeholder standards	57	6	10	8.86	1.008
Policy and involvement from top management	57	3	10	8.81	1.342
Consumer awareness	57	5	10	8.77	1.488
Cost-efficiency	57	0	10	8.74	1.541
Virgin natural resources usage	57	4	10	8.67	1.406
Sustainability vision	57	2	10	8.67	1.468
Decline of resources	57	2	10	8.63	1.665
Laws and regulations compliance	57	5	10	8.63	1.234
Corporate citizenship	57	4	10	8.56	1.239
Future laws and regulations compliance	57	5	10	8.53	1.241
Manufacturing technology support	57	3	10	8.47	1.525
Definition of budget and responsibility unit	57	5	10	8.40	1.545
Pressure from customers/suppliers	57	5	10	8.39	1.250
Joint internal operation	57	3	10	8.37	1.472
Information system support	57	4	10	8.25	1.584
Internally monitored progress	57	3	10	8.21	1.589

A factor analysis has been conducted to analyze the variables associated with the driving forces for the reverse logistics of post-consumption packaging. As for the Kaiser-Meyer-Olkin (KMO) and Bartlett's test, the KMO was highest at 0.793, which is greater than the Bartlett's test result (0.7). The orthogonal rotation was used with the Varimax method and filtered out only the factor loading greater than 0.3, which may indicate that it has an impact on the factor, as illustrated in Table VII.

Table VII. Factor analysis

No.	Variables	Factor Loading
	Driving forces 1- Organization vision, policy, and collaborations	
	Eigen Value = 8.176, % of Variance = 45.423	
1	Joint internal operation	0.848
2	Internally monitored progress	0.843
3	Manufacturing technology support	0.839
4	Policy and Involvement from top management	0.767
5	Definition of budget and responsibility unit	0.731
6	Sustainability vision	0.644
7	Information system support	0.642
	Driving forces 2-Environment and social	

No.	Variables	Factor Loading
Eigen Value = 2.996, % of Variance = 16.642		
1	Virgin natural resources usage	0.893
2	Green marketing	0.841
3	Pollution	0.789
4	Future laws and regulation compliance	0.778
5	Consumer awareness	0.649
6	Corporate citizenship	0.587
Driving forces 3-Laws, regulation and standard Eigen Value = 1.435, % of Variance = 7.975		
1	Laws and regulations compliance	0.885
2	Pressure from customers/suppliers	0.754
3	Quality stakeholder standards	0.718
Driving forces 4-Cost competitiveness Eigen Value = 1.187, % of Variance = 6.594		
1	Cost-efficiency	0.762
2	Decline of resources	0.724

From the analysis, the result of this study revealed that there are 4 factors as the driving forces of post-consumption packaging reverse logistics, which are as follows:

Driving force 1, "organization vision, policy, and collaborations", which consists of 7 variables. The factor loading is from 0.848–0.642, while the Eigen value is 8.176. The highest factor loading is "joint internal operation" (0.848).

Driving force 2, "Environmental and social", which consists of 6 variables. The factor loading is from 0.893–0.587, while the Eigen value is 2.996. The highest factor loading is "Virgin natural resources usage" (0.893).

Driving force 3, "Laws, regulations, and standards", which consists of 3 variables. The factor loading is from 0.885–0.718, while the Eigen value is 1.435. The highest factor loading is "Laws and regulations compliance" (0.885).

Driving force 4, "Cost competitiveness", which consists of 2 variables. The factor loading is from 0.762–0.724, while the Eigen value is 1.187. The highest factor loading is "Cost-efficiency" (0.762).

IV. Discussions and Conclusions

The study revealed that the most influential driving forces are (1) "green marketing", (2) "pollution", and (3) "Quality stakeholder standards". This is consistent with the global trend toward companies having to foster an environmentally friendly image, including a reputation that allows them to overcome the trade barrier caused by stakeholder standards. This finding is consistent with many studies [1,10]. An exploratory factor analysis was conducted to extract all variables in order to identify the aspect of internal and external factors as key driving forces in the reverse logistics of post-consumption. The results showed that there are 4 driving forces that have influences on the reverse logistics of post-consumption beverage packaging, which are detailed as follows:

A. Internal Factors

The variable, "organization vision, policy, and collaborations", which is the most influential factor. It can be proven that Thailand's reverse logistics needs to be driven internally, starting with vision, policy, and top management support. This must involve collaborations among related parties, from upstream to downstream, in order to bring about a type of management that creates both top management awareness and cooperation among supply chain partners [10].

The variable, "cost competitiveness", which is related to economic needs in relation to the reuse or recycling of post-consumption packaging, rather than the extraction of virgin natural resources to produce new packaging, such as the fact that the former is more beneficial in terms of cost. However, there are some contradictions with the results from the interview, which show that for the Thai Beverage industry, the cost of recycling is not the main factor driving the implementation of reverse logistics; rather, the actual drivers come from sustainability and the firm's image.

B. External Factors

The variable, "environmental and social", which is related to the trend of environ-mental preservation and being able to maintain a sustainable business in the long term that complies with the changes in laws and regulations, also meets the expectation of stakeholders, e.g., consumers, customers, the community, etc. Corresponding to the study which proved that environmental consciousness and regulation is vital for businesses to implement reverse logistics [9].

The variable, "laws, regulations, and standards", which is related to complying with government and regulator enforcement, also meets the standard required by stakeholders for maintaining business in the long term. This is also consistent with the trade barrier issue, which appears in the form of policy. It is also aligned with the situation in other industries, such as the electronics industry in Taiwan, whereas the regulatory and government sector becomes a significance factor in the implementation of reverse logistics in the supply chain [18].

In conclusion, it has been shown that the trends associated with globalization, such as environmental consciousness, have forced businesses to reconsider sustainability and announce policies that trades are forced to follow. Firms need to take action internally and externally to comply with those policies in order to sustain their business, even though it is not worthwhile in terms of direct gain (economics). However, the intangible is worth-while as a fundamental requirement for business to proceed[1].

Further study employing Structure Equation Modelling to examine the causal relationship between the abovementioned factors and identify the impacts of reverse logistics from the sustainability perspective (economic, environmental, and social) is needed.

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