DRIVERS FOR REVERSE LOGISTICS PACKAGING IN CIRCULAR ECONOMY FOR THAILAND BEVERAGE INDUSTRY FROM THE MANUFACTURER PERSPECTIVE

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แรงขับเคลื่อนที่ส่งผลต่อการทำโลจิสติกส์ย้อนกลับของบรรจุภัณฑ์ในระบบเศรษฐกิจหมุนเวียนสำหรับอุตสาหกรรมเครื่องดื่มของประเทศไทย จากมุมมองของผู้ผลิต

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สถานการณ์ปัจจุบันของประเทศไทย พบว่าปัญหาขยะมูลฝอยเป็นปัญหาที่สำคัญมาก จากสถิติพบว่า 15% ของขยะที่เกิดนั้นมีสาเหตุมาจากบรรจุภัณฑ์หลังการบริโภคของเครื่องดื่มที่ถูกทิ้งไว้ตามแหล่งบริโภค งานวิจัยนี้มีจุดมุ่งหมายเพื่อวิเคราะห์หาแรงขับเคลื่อนในการทำโลจิสติกส์ย้อนกลับบรรจุภัณฑ์หลังการบริโภคของเครื่องดื่มที่มีจำหน่ายในประเทศไทย รวมถึงการตรวจหาความสัมพันธ์และผลกระทบจากการทำโลจิสติกส์ย้อนกลับในมิติของความยั่งยืน การวิจัยครั้งนี้ได้ใช้ตัวแปรทั้งสิ้น 39 ตัว ซึ่งประกอบด้วยแรงขับเคลื่อน ปัจจัยสำเร็จ รวมถึงปัจจัยผลกระทบด้านความยั่งยืน ทั้งในมิติเศรษฐกิจ สิ่งแวดล้อม และสังคม ข้อคำถามได้ถูกออกแบบโดยใช้มาตรวัด 11 ระดับ และได้ตรวจหาค่าความเที่ยงตรงของแบบสอบถามกับผู้เชี่ยวชาญทั้งในภาคการศึกษาและภาคอุตสาหกรรม โดยมีกลุ่มตัวอย่างจำนวน 210 ชุด จากผู้ปฏิบัติงานในบริษัทผู้ผลิตเครื่องดื่มในประเทศไทย ทั้งเครื่องดื่มมีและไม่มีแอลกอฮอล์ หลังจากนั้นจึงได้นำข้อมูลที่ได้มาประมวลผลโดยใช้เทคนิคการวิเคราะห์โมเดลสมการโครงสร้าง เพื่อทดสอบสมมติฐาน ผลการวิจัยพบว่า ปัจจัยภายใน และปัจจัยภายนอก ต่างส่งผลที่เป็นบวกต่อปัจจัยสำเร็จในการทำโลจิสติกส์ย้อนกลับ ซึ่งเมื่อพิจารณาเพิ่มเติมจะพบว่าปัจจัยภายในส่งผลต่อปัจจัยสำเร็จสูงกว่าปัจจัยภายนอก นอกจากนั้นยังพบว่า ปัจจัยสำเร็จยังส่งผลที่เป็นบวกต่อปัจจัยความยั่งยืนทั้งด้านเศรษฐกิจ สิ่งแวดล้อมและสังคม โดยเรียงตามลำดับ ท้ายสุดนี้ งานวิจัยข้างต้นจะช่วยสร้างคุณประโยชน์ให้กับอุตสาหกรรมเครื่องดื่มไทย ให้เข้าใจบทบาทและความสำคัญของแรงขับเคลื่อน และปัจจัยสำเร็จในการทำโลจิสติกส์ย้อนกลับ เพื่อนำไปปรับใช้และพัฒนาให้เกิดความยั่งยืนต่อไป

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Patiparn Sajjasophon : DRIVERS FOR REVERSE LOGISTICS PACKAGING IN CIRCULAR ECONOMY FOR THAILAND BEVERAGE INDUSTRY FROM THE MANUFACTURER PERSPECTIVE. Advisor: Prof. KAMONCHANOK SUTHIWARTNARUEPUT, Ph.D. Co-advisor: Assoc. Prof. PONGSA PORNCHAIWISESKUL, Ph.D.

In Thailand, Municipal Solid Waste (MSW) problems exist, and 15% are due to post-consumption beverage packaging that is left behind after the point of consumption. This study aimed to analyze driving forces in reverse logistics of post consumption packaging for Thailand beverage industry and examine impact of sustainability. 39 variables related to drivers, key success factors including sustainability also modeled. Questionnaire has been designed based on 11-point rating scale and Item-Objective Congruence performed by experts from the academic and business. Sampling conducted through 210 respondents from alcoholic and non-alcoholic manufacturers. Collected data analyzed by using structural equation modeling for hypotheses testing. Results show that both internal and external drivers have the positive impact to key success factors but internal has a stronger impact, while the success factors are positively impact to economics, environmental and social performance respectively. Lastly, this research contributed to Thailand beverage industry for understanding significance of drivers and key success factors in order to improve sustainably.

Field of Study:	Logistics and Supply Chain Management	Student's Signature ....
Academic Year:	2020	Advisor's Signature ....
		Co-advisor's Signature ....

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Last but not least, I would like to thanks my beloved parents and family for supporting me every moment of my life especially my beloved daughter, INDY for being my source of energies; my colleagues and classmates (Khun Giant and Khun Tua) for always helping each other and encourage to fight side by side.

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Introduction

1,1 Rationale & Background

Municipal solid waste (MSW), more commonly known as garbage, is a high-priority issue that has an impact at both global and local levels. Most MSW is post-consumption waste, which increases as population grows. The level of MSW produced is currently at 1.3 billion tonnes per year, and this is expected to rise to 2.2 billion tonnes per year by 2025 (Hoornweg & Bhada-Tata, 2012). It is undeniable that the garbage problem has been managed improperly, due to lacking either funds or education/knowledge.

The government and the private sector are now putting in efforts to seek a sustainable solution for managing the garbage problem by encouraging the “3 Rs” concept, which consists of reduce, reuse, and recycle, to be implemented across the entire supply chain process, from planning, sourcing, manufacture, delivery, and return.

The European Commission (2019) has guided on the sustainability concept to influence the business world during the past decade, to take a holistic view touching on economic, environmental, and social aspects as a practical framework for doing business with integrity and responsibility to the public. It is not only the way of doing business but is defined as a standard or requirement for sourcing suppliers/ vendors. If a company does not comply with the sustainability code of conduct, they may not be allowed to register on the approved vendor list. It can be said that the sustainability concept has sometimes been used as a trade barrier to block trade competitors, especially for international trade. Some countries have set environmental protection policies, such as eco-friendly production processes, and post-consumption management policy to reduce garbage problems to a minimum level or close to zero.

At the global level, many countries in regions such as Europe have announced zero waste policies and plans for 100% of plastic packaging to be recyclable by 2030. This has also forced manufacturers to be seriously concerned about environmental issues (Foschi & Bonoli, 2019).

For Thailand itself, the garbage problem has been increasing continuously, caused by the growth and expansion in the economy and society, which had driven more production of various types of goods to satisfy consumer demands in both the product itself and attractive packaging. The promotion of tourism and the expansion of the urban population has also impacted consumption.

In 2018, there were approximately 27.82 million tonnes of MSW produced in Thailand, or 76,220 tonnes per day nationwide. Only 9.58 million tonnes (35%) of MSW could be recycled, the remaining 18.24 million tonnes had to be disposed of. Unfortunately, only 39% or approximately 10.88 million tonnes were disposed of properly, another 26% or approximately 7.36 million tonnes were improperly disposed (Pollution Control Department, 2019), as demonstrated in Figure 1.

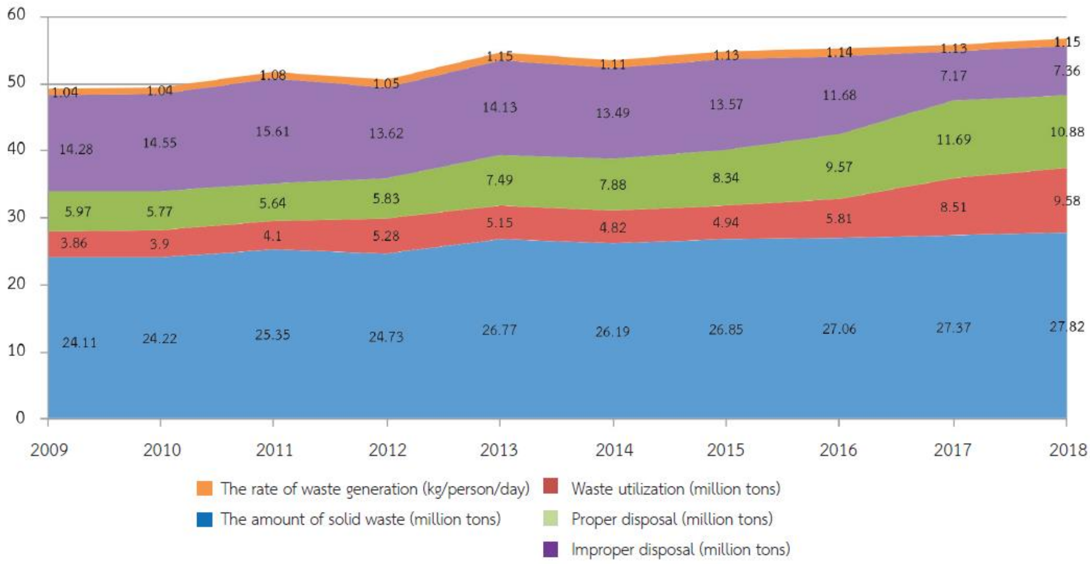


Figure 1 MSW levels in Thailand from 2009–2018

From residual waste collection the events using International Coastal Cleanup (ICC) standards at Thailand’s beaches, coral reefs, and mangrove forest in 48 locations covering 24 provinces nationwide, 569,657 pieces of trash were collected and classified into top ten residual waste types, as shown in Table 1:

Description	Proportion (%)
Miscellaneous plastic bags	18.9
Plastic beverage bottles	8.6
Plastic shopping bags	8.4
Foam dishes and bowls	6.9
Glass beverage bottles	6.6
Food and snack packages	6.1
Straws and swizzle sticks	4.6
Foam scraps	4.4
Foam meal boxes	3.8
Plastic cups	3.6
Others	28.1

Table 1 Top ten types of MSW in Thailand

In the Thai beverage industry, the post-consumption management of packaging such as glass bottles, plastic bottles, aluminum cans, paper cartons, etc., is critical and difficult to manage sustainably. Most of the packaging is leftover at the point of consumption, especially in popular tourist areas. For example, Samui Island produces more than 250,000 tons of MSW, some caused by beverage packaging.

The general reverse logistics flow of beverage packaging in Thailand is illustrated in Figure 2.

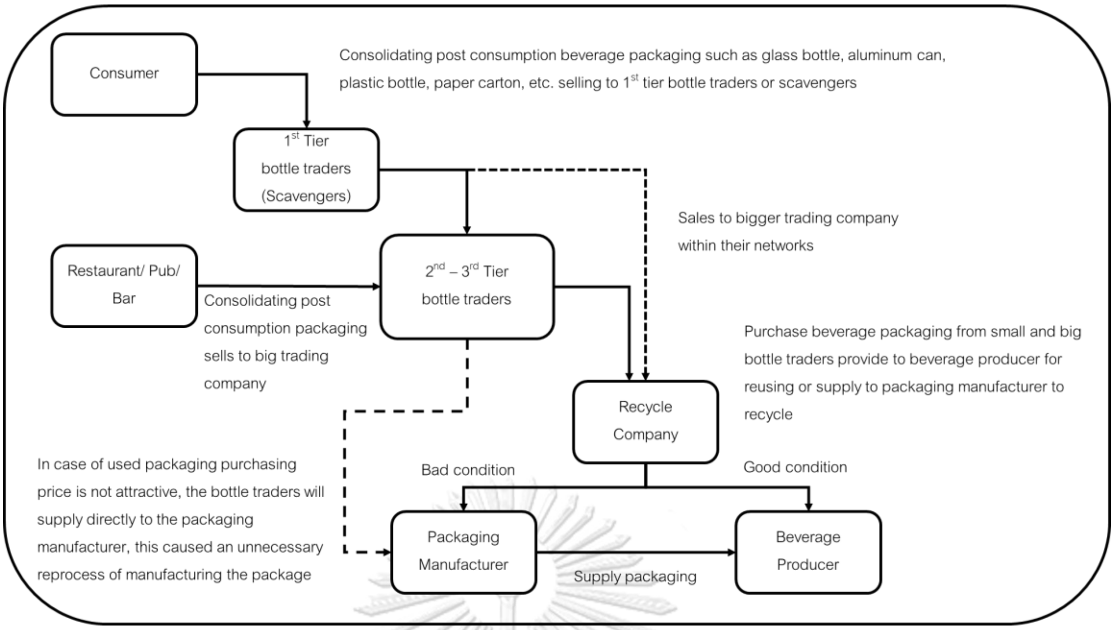


Figure 2 General reverse logistics flow of beverage packaging in Thailand

The key issue for this industry is the very low percentage of reverse logistics (RL) packaging. Much packaging has been treated as if it is garbage and caused the extraction of materials to produce new content. This will affect the cost of goods sold and the competitive advantage of a firm to cope with an RL strategy.

The characteristics of beverage packaging in this study represent Thailand's beverage industry's efforts to collect packaging back for reuse and recycle to support sustainability in the economy, environment, and society. The study aims to explore the driving forces that impact the key success factors in RL packaging and the impact related to sustainability, as well as propose strategies to improve RL efficiency.

1.2 Research Objectives

1. To analyze the driving forces that affect the implementation of post-consumption beverage packaging reverse logistics in Thailand
2. To understand the key success factors for reverse logistics post-consumption beverage packaging and impact in terms of sustainability
3. To formulate a reverse logistics strategy for improving efficiency and performance in the context of the Thai beverage industry

1.3 Research Questions

1. What are the driving forces for reverse logistics of post-consumption packaging in Thailand’s beverage industry?
2. What are the impacts on sustainability that have been affected by reverse logistics in Thailand’s beverage industry?
3. What strategy should be used in Thailand’s beverage industry to succeed in the execution of reverse logistics?

1.4 Research Methodology

Surveys were sent through the mail with a link to an online questionnaire, beginning in September 2020. Several reminders were sent to non-respondents, with a cut-off date for data collection of March 2021. In total, 210 respondents completed questionnaires. The data were then analyzed using structural equation modeling (SEM) in AMOS, version 22.

1.5 Scope of the Study

This study focused on the beverage industry in Thailand.

1.6 Expected Contribution

This study developed SEM to analyze and identify the driving forces for RL and also point out the key success factors for the implementation of RL, including its impact in terms of sustainability.

The results will be useful for the academic, business, and government sectors, to improve the performance of and motivate the implementation of RL in the beverage industry, which will subsequently lead to improved sustainability.

1.7 Research Timeline

To conduct the research, the researcher planned and implemented key activities and timelines, as detailed in Figure 3.

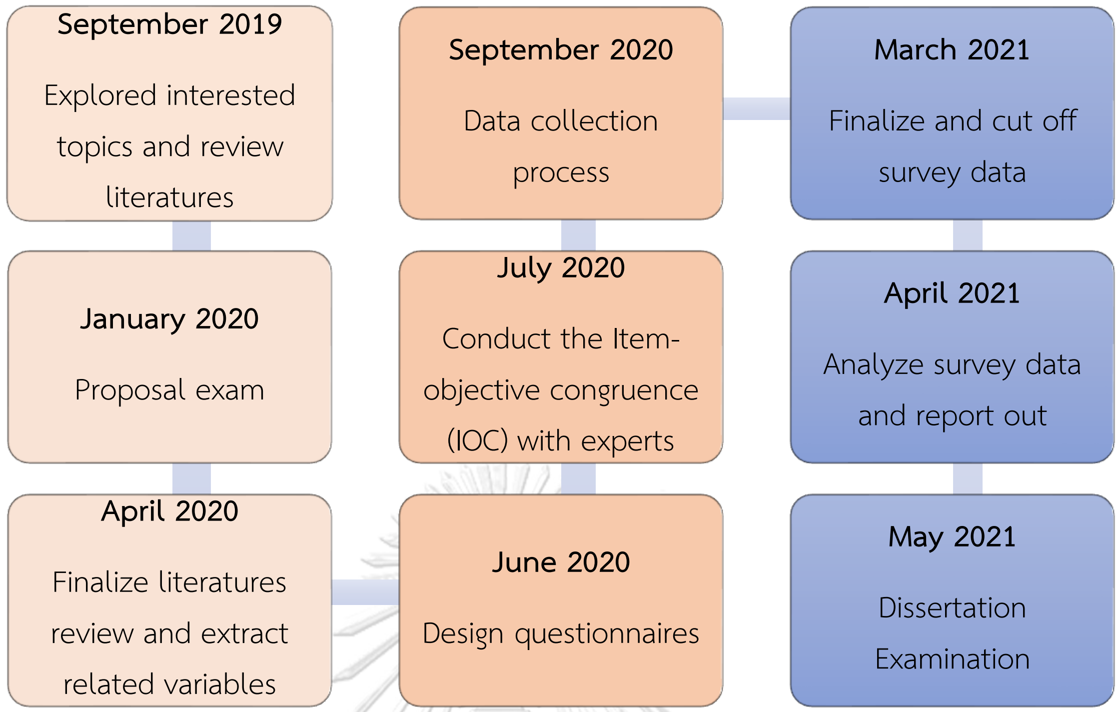


Figure 3 Research timeline

1.8 Synopsis of the Study

This study comprises five chapters, detailed as follows.

Chapter 1: Introduction

This chapter will present the background and motivation for the research, including RL practices in the beverage industry. Research questions, objectives, and contributions are also illustrated.

Chapter 2: Literature review

The theoretical framework and related literature review are explored and conceptualized to the variables in the model.

Chapter 3: Research methodology

The research framework and model, including sampling and methodology, are described.

Chapter 4: Data analysis

The survey results and statistical analyses, including confirmation factor analysis (CFA) and SEM were conducted to explore the causal relationships between factors. Hypothesis testing was also performed.

Chapter 5: Discussion & Conclusions

The statistical results from chapter 4 will be interpreted and discussed. The strategies for implementation are also recommended, along with managerial implications and limitations of the study. Finally, suggestions for further studies will be made.

Chapter 2
Literature Review

The objective of this chapter is to study and identify the driving forces for implementing reverse logistics, key success factors, and the impact in terms of sustainability. Therefore, this chapter will describe the literature review that related to the theories and principles that will be implemented for the study, according to the following topics:

2.1 Reverse Logistics

2.1.1 Reverse logistics definition and processes

2.1.2 Driving forces and key success factors for reverse logistics

2.1.3 Reverse logistics strategy

2.2 Sustainability Development

2.3 Structural Equation Modeling (SEM)

The finding of the literature review are detailed below.

2.1 Reverse logistics

2.1.1 Reverse logistics definition and process

The Council of Logistics Management (CLM) defined the term "reverse logistics" as "the role of logistics in recycling, waste disposal, and management of hazardous materials; a broader perspective includes all activities relating to logistics activities carried out in source reduction, recycling, substitution, reuse of materials and disposal", which Stock (2001) elaborated in the typical flow diagram as shown in Figure 4.

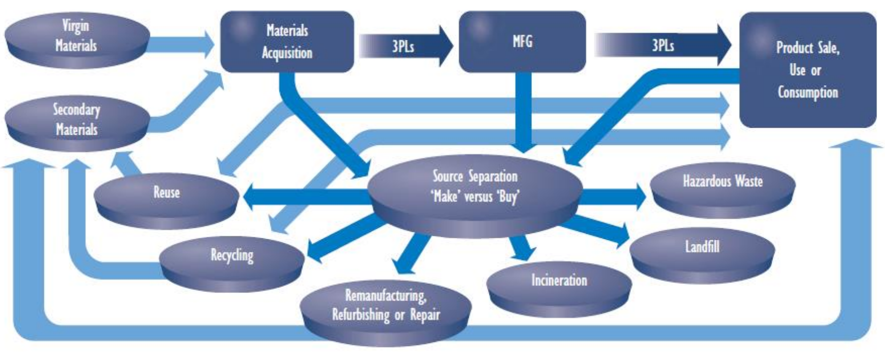


Figure 4 Reverse logistics flows diagram

According to Figure 4, it shows that product return after consumption and rejected parts from the process considered as the most important part of reverse logistics activity. This can be in any form, such as returned products, recalled products, expired products, end of shelf-life products, etc.

After retrieving the reversed contents, a firm must screen the condition of products to define their proper management. For those in good condition, it will involve the processes of reusing, recycling, or remanufacturing; waste products will need to be disposed of by incineration or as landfill.

Thierry, Salomon, Van Nunen, and Van Wassenhove (1995) supported Stock by developing an integrated supply chain with product recovery options, as illustrated in Figure 5.

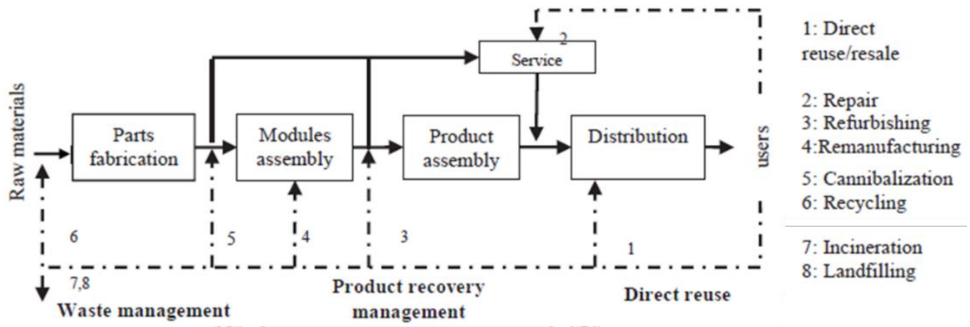


Figure 5 Integrated supply chain product flows

From Figure 5, there are three main groups of product which appears in every part of supply chain activity.

Stock (2001) also pointed out that most of the benefits of reverse logistics are on the firm and supply side, so it needs to be balanced with forward logistics, with its value recognized by customers to create a win-win strategy to gain both efficiency and effectiveness along with customer satisfaction. The success of reverse logistics will improve a firm's financial performance and service level to customers; moreover, all supply chain members will be improved as well. However, there are some factors or "truths" that firms need to understand to perform efficient reverse logistics activities, as follow:

1. Synergize resources: such as logistics networks, facilities, material handling equipment, etc. on both forward and reverse logistics for better cost reductions and improved service levels
2. Uncontrollable demand: due to the reverse logistics demand, since it depends on the consumption volume and also sometimes includes recalled or damaged products. It needs to be carefully balanced whether a firm should develop the reverse logistics part or improve their forward logistics programs, such as product quality, better on-time delivery performance, or a reduction in damages.
3. Product shelf-life: the speed of forward and reverse logistics must consider this aspect as well, the faster action required to perform before the product obsoletion such as in the fast moving consumer goods, electronics, etc. The product value will drastically decrease from time to time, so firms must manage the flow while the product is still in its mature period, otherwise profit will be lost.
4. Logistics operation compatibility between forward and reverse logistics: most logistics infrastructure, such as distribution centers, warehouses, and even trucks, is not designed to handle reverse logistics operations. Even logistics staff still have insufficient knowledge to handle reverse logistics effectively.

Shaharudin, Govindan, Zailani, and Tan (2015) have explored product returns to achieve supply-chain sustainability, based on five case studies. Their results showed that there are several reasons for implementing reverse logistics, such as regulatory requirements, compliance with certificates, and service to customers. Including with product images. Their study also showed that all five companies who implemented product returned management as reverse logistics gained benefits, such as improvements in company performance, competitive advantages, green performance, green competitiveness, cost reductions, employee morale, customer satisfaction, and loyalty. However, a large-scale survey was also proposed as a further study to reconfirm these findings.

Olejnik and Werner-Lewandowska (2018) carried out an extensive literature review on a maturity model for reverse logistics, which included the stakeholders and diversified types of material flows that could be used to evaluate a firm's intention to operate RL. The evaluation criteria can be classified into six main areas, detailed in Figure 6.

Aspect	Level 1	Level 2	Level 3	Level 4	Level 5
Physical network (A1)	Lack of network	Single objects	Physical network exists and works inefficiently	Good-working	Physical network exists, constant development
Formalization (A2)			YES		
Structuration (A3)		YES			
Performance measurement (A3)				YES	
Information flow & data exchange (A4)	Available	Accessible	Useable	Data exchange	Real data exchange with all RL network participants
Optimization (A5)					YES
Stakeholders' relations & engagement (A6)	no	weak	proper	good	Integrated, relevant

Figure 6 Reverse logistics maturity model

2.1.2 Driving forces and key success factors for reverse logistics

De Brito and Dekker (2004) proposed a framework for reverse logistics by considering three main aspects in Figure 7.

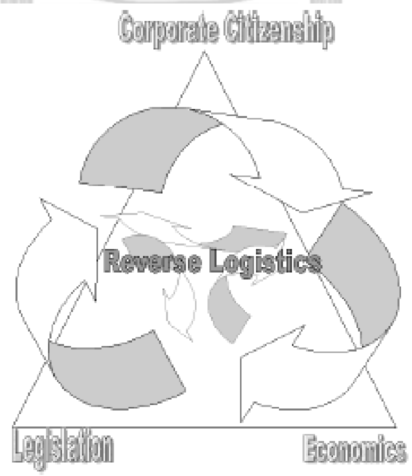


Figure 7 Reverse logistics drivers

Economics: consisting of direct and indirect gains related to tangible and intangible benefits

Legislation: To comply with government policy on taking back products, which mostly impacts trade and environmental issues

Corporate citizenship: related to the responsibility of the company to society

Akdoğan and Coşkun (2012) adopted the reverse logistics drivers framework of De Brito and Dekker (2004) in their research on exploring the drivers of RL that are significant in household industries in Turkey. Their results aligned with the work of De Brito and Dekker (2004) in addition to providing in-depth details and dimensions as shown in Figure 8. However, their study needs to carry out further on the empirical data research.

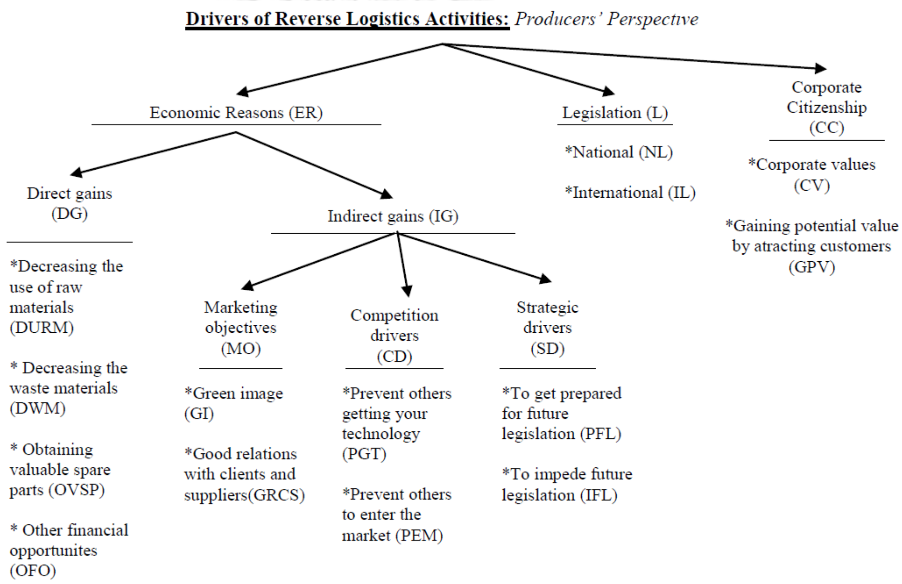


Figure 8 Drivers of RL from a hierarchical perspective

Ho, Choy, Lam, and Wong (2012) studied the factors influencing the implementation of reverse logistics in Hong Kong. Their study found nine factors that affected the implementation. The statistical analyses showed that financial and human as internal factors play an important role while partner and government support can also improve implementation.

Chiou, Chen, Yu, and Yeh (2012) also considered factors affecting RL implementation. Their study revealed that many factors are considered to be drivers of RL, such as recycling volumes, costs, environmental regulations, consumer awareness, pressure from stakeholders, corporate social responsibility, also advertising and promoting a positive image. The results of their analysis of data provided by 12 environmental experts revealed that the reason given the greatest weight by most companies when implementing RL was economic needs, while the second and third were environmental needs and social needs, respectively

Brauchle, Henne, Maier, and Thanwadeechinda (2015) researched decision-making for RL in the German construction industry and found that 16 factors influenced RL, such as availability of landfill, green image, landfill costs, legislative pressure, etc. After performing factor analysis, four factors were extracted: constraints, investment, cost, and management. The results showed that the constraints factor has a strong relationship with management and cost; however, investment was mostly driven by management decisions. There was no relationship between cost and investment at all.

Khor, Udin, Ramayah, and Hazen (2016) studied whether institutional pressure, which is based on regulatory and ownership pressure, has a relationship with business performance, which consisted of three main areas: environmental outcomes, profitability, and sales growth. The results showed that a strong relationship was found between institutional pressures and business performance.

Chinda (2017) explored the factors influencing the implementation of RL and found that there were 17 associated factors. This research showed that the top three key factors were 1) compliance, 2) open-mindedness, and 3) management experience.

Govindan and Bouzon (2018) researched literature from 54 papers concerning topical areas and found that there were 37 drivers and 36 barriers which cover all areas from an organizational perspective, extending to society's perspective, government perspective, and customers' perspective. Drivers are concerned with multiple areas, such as regulatory pressure, motivation laws, long-term sustainability, eco-design, reduction of raw materials, value recovery, economic viability, green marketing, corporate citizenship, environmental conservation, consumer awareness, etc. Their paper proposed a framework and acknowledged the consequences to management of understanding the drivers and preparing for the changes by considering positive influential factors.

Y. Li et al. (2018) proposed a benchmark for the recovery process for RL service providers by evaluating processes involved in RL. The factors that concern customers for RL include driving forces from stakeholders, technology, value recovery, collaboration with suppliers and stakeholders, and awareness among end-users.

For the implementation of RL to succeed, the key factors consist of government incentives and support, management commitment, technical capabilities, customer involvement, transportation management, appropriate site locations, etc.

Rogers and Tibben-Lembke (2001) studied the importance of RL by interviewing logistics managers. They found that the barriers that impact the execution of RL consisted of eight main areas. The least important factor was legal, which was contrary to expectations and literature that may cause from the firm has been implemented reverse logistics primarily in the last few years followed by-laws and environmental pressures.

Waqas, Dong, Ahmad, Zhu, and Nadeem (2018) studied the critical barriers to implementing RL in the manufacturing industry. Their results showed eight factors that affected implementation.

Kaviani et al. (2020) investigated the barriers to RL and found that the main obstacles were related to economics.

Kiatcharoenpol and Sirisawat (2020) carried out research to identify the barriers to RL (the opposite of drivers) in the Thai electronics industry. Their study showed that eight factors affected RL performance, which were management, organization, product, technology, infrastructure, financial, involvement and support, and legal.

Mangla, Govindan, and Luthra (2016) studied the success factors by applied 25 observed variables which can be grouped to 5 factors, which are regulatory, global competitiveness, economic, human resources (HR) and organizational, and strategic.

2.1.3 Reverse logistics strategy

De Brito and Dekker (2004) proposed a reverse logistics strategy based on three levels in Figure 9.

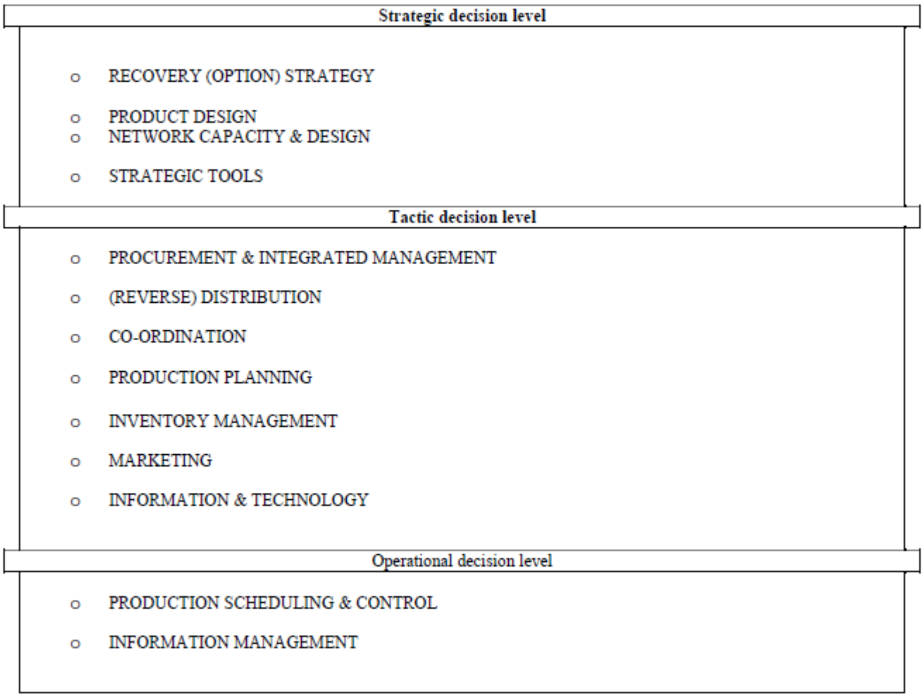


Figure 9 The three-level RL strategy

Strategic decision-making consists of three levels, which are the strategic level, tactical level, and operational level.

The strategic level involves long-term decision-making that needs to suit the business direction. It must consider all related factors, such as product characteristics and recovery value, to formulate a proper strategy not only for logistics but also the supply chain since it is related to long-term investment for sustainable business.

The tactical level involves medium-term decision making as the direction to shape up the operational level, such as transportation management, inventory management, and production planning, which should integrate flows of finished goods and recycle them together.

The operational level involves the day-to-day issues, most of which are to control and manage operations to meet the targets that are aligned to the tactical and strategic levels.

V. D. R. Guide, Gunes, Souza, and Van Wassenhove (2008) studied returned product. Their results showed that there the profit increase from implementing disposition policy.

Fleischmann et al. (1997) studied the reverse distribution strategy, which is the process of taking back products during transportation management. It was found that many patterns have been implemented such as combining this with the finished goods, separating it into a dedicated network, or partially integrated.

Rogers, Melamed, and Lembke (2012) studied the modeling and analysis of reverse logistics by using simulation techniques whereas it can be an opportunity of RL by considering on the forward logistics process such as network design and planning, etc.

V. D. Guide and Pentico (2010) studied a cycle of product reuse driven by product returns, which a firm needs to consider in three stages, as shown in Figure 10.

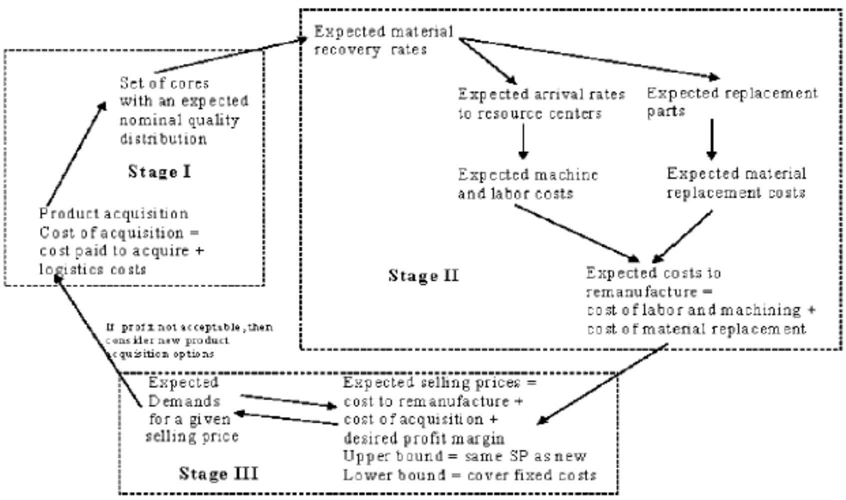


Figure 10 Key decisions in the three stages for re-manufacturing and reuse

Tibben-Lembke and Rogers (2002) studied the differences between forward and reverse logistics and found that many practitioners think that RL is the opposite of finished-goods flow. The study found that the characteristics and activities are different and much more complicated as shown in Figure 11.

Forward	Reverse
Forecasting relatively straightforward	Forecasting more difficult
One to many transportation	Many to one transportation
Product quality uniform	Product quality not uniform
Product packaging uniform	Product packaging often damaged
Destination/routing clear	Destination/routing unclear
Standardized channel	Exception driven
Disposition options clear	Disposition not clear
Pricing relatively uniform	Pricing dependent on many factors
Importance of speed recognized	Speed often not considered a priority
Forward distribution costs closely monitored by accounting systems	Reverse costs less directly visible
Inventory management consistent	Inventory management not consistent
Product lifecycle manageable	Product lifecycle issues more complex
Negotiation between parties straightforward	Negotiation complicated by additional considerations
Marketing methods well-known	Marketing complicated by several factors
Real-time information readily available to track product	Visibility of process less transparent

Figure 11 Differences between forward and reverse logistics

Moreover, when considering the cost perspective, the study also showed that the cost of reverse logistics cost can also be impacted by the consequences and activities of RL itself, as shown in Figure 12.

Cost	Comparison with forward logistics
Transportation	Greater
Inventory holding cost	Lower
Shrinkage (theft)	Much lower
Obsolescence	May be higher
Collection	Much higher – less standardized
Sorting, quality diagnosis	Much greater
Handling	Much higher
Refurbishment/repackaging	Significant for RL, non-existent for forward
Change from book value	Significant for RL, non-existent for forward

Figure 12 Comparison of RL and FL costs

The costs of RL are not equal to the costs of forward logistics. RL costs are more complicated, which firms should be well aware of and deploy accounting systems to support this.

Guide Jr and Van Wassenhove (2001) developed a framework for analyzing the cost structure that is related to RL to consider the profit which will justify the its implementation as shown in Figure 13.

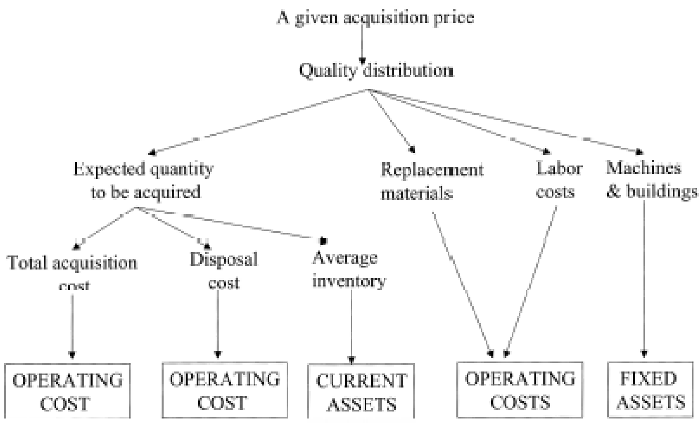


Figure 13 The influences of acquisition price on profitability

Fleischmann (2003) studied the structure and design of reverse logistics networks has and identified three main areas, which are 1) centralization–decentralization, 2) uncertainty on the supply side, and 3) the alignment and integration between both flows.

Fleischmann, Beullens, BLOEMHOF-RUWAARD, and Van Wassenhove (2001) studied product recovery in logistics network design and revealed that the logistics infrastructure is a fundamental structure that will be more effective if flows can be integrated for both finished goods and product take-back. This can reduce the costs for business such as disposal costs, transportation costs, etc.

Gu, Wang, Dai, Wei, and Chiang (2019) studied the factors that influence RL strategy in China. Their results showed that it has been influenced by six main factors, which are ordered from highest to lowest: government policy, the external market, economic, social, environment, and internal enterprise management.

Moreover, many studies have proposed the implementation of an RL strategy that helps to improve the efficiency of RL, especially in logistics issues such as logistics network, transportation management, logistics infrastructure, and return policy details in Table 2.

Area	Description	Reference
1. Location of the distribution warehouse, collection center, sorting center, and remanufacturing plant	• Optimizing numbers of location, capacity including activities inside the facility • Integrate the network design of reverse logistics facility with finished goods flow • Manage the operations by of technologies support	Fleischmann et al. (2001), Lieckens and Vandaele (2007), Kara, Rugrungruang, and Kaebernick (2007), Ahluwalia and Nema (2006), Chen, Wang, Wang, and Chen (2017), Shih (2001), M. I. Salema, Póvoa, and Novais (2006), J.-q. Li et al. (2017), Pishvaee, Jolai, and Razmi (2009), Jayaraman, Guide, and Srivastava (1999), Fonseca, García-Sánchez, Ortega-Mier, and Saldanha-da-Gama (2010)
2. Inventory and flows management	• Optimizing inventory policies in remanufacturing products included safety stock planning	Pishvaee, Farahani, and Dullaert (2010), Jayaraman et al. (1999), Min and Ko (2008),

Area	Description	Reference
	• Optimizing product flows between finished goods and recovered products • Optimizing flow between facilities	(Pishvaee, Kianfar, & Karimi, 2010), Vieira, Vieira, Gomes, Barbosa-Póvoa, and Sousa (2015), Minner (2001)
3. Transportation Management	• Integrate transportation of reverse logistics to forward logistics • Optimize transportation model with the integration of delivery and pick up strategy • Dynamic VRP with capacitated constrained • Initiate transport scheduling problems to manage forward and reverse flows for optimizing routing	Kumar, Kumar, Brady, Garza-Reyes, and Simpson (2017), Lieckens and Vandaele (2007), Du and Evans (2008), M. I. G. Salema, Barbosa-Povoa, and Novais (2007), Jayaraman et al. (1999), Dethloff (2001), Kim, Yang, and Lee (2009), Ramos, Gomes, and Barbosa-Póvoa (2014)
4. Returned and product acquisition policy	• The optimal acquisition price for returned products by considering all related cost	Srivastava (2008), Mukhopadhyay and Setoputro (2004), V. D. R. Guide et al. (2008),

Area	Description	Reference
	• Disposition decision for a various grade of return product	Agrawal and Singh (2019)

Table 2 RL strategy for implementation

For RL strategies, not only is the implementation of the strategy very important but also the methodology of execution needs to be considered. This means that the company or the focal firm must analyze whether the RL activity should be carried out by the firm itself or whether it should be outsourced. There are many criteria or models which have been proposed as mechanisms to help with this decision, as follows.

Cheshmberah, Makui, and Seyedhoseini (2011) proposed a framework for decision-making for reverse logistics in the aeronautical industry, which uses four main dimensions in Figure 14.

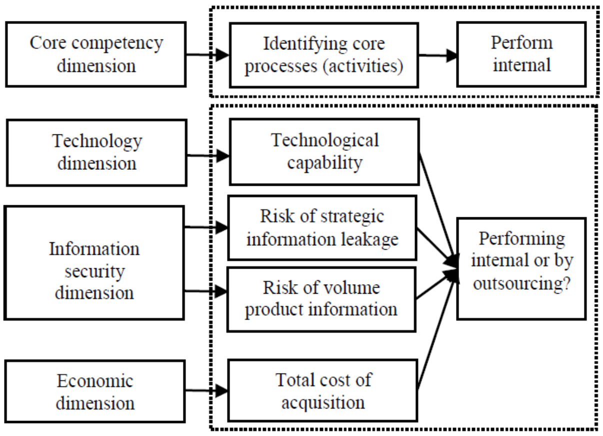


Figure 14 Decision-making on whether to perform RL internally or outsource it

As can be seen, all four of the main dimensions are not only concerned with the capability aspect but also consider the risk aspect, which is aligned with the study of Kremic, Tukel, and Rom (2006), who investigated the logic or process flows for deciding to outsource by considering the benefits and risks as shown in Figure 15.

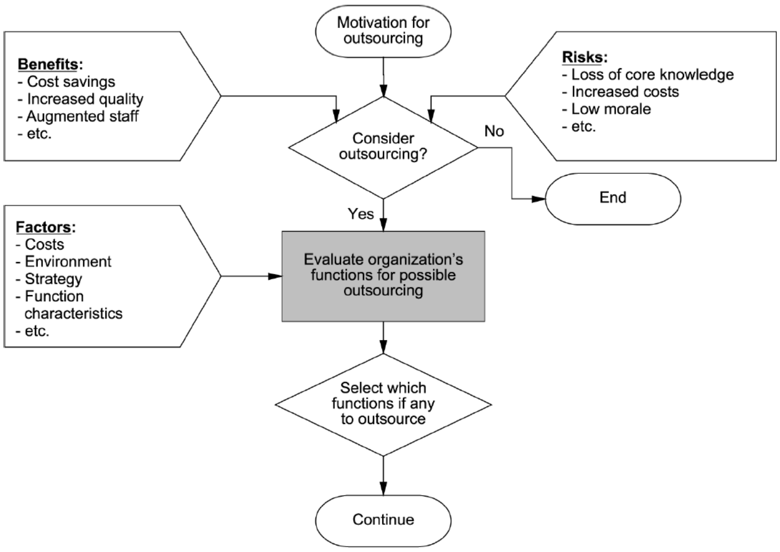


Figure 15 Decision-making process flow for outsourcing

Ordoobadi (2009) proposed a framework for considering the inhouse and outsourcing strategies by considering two dimensions, which are significance and cost advantages, as evaluated by the framework shown in Figure 16.

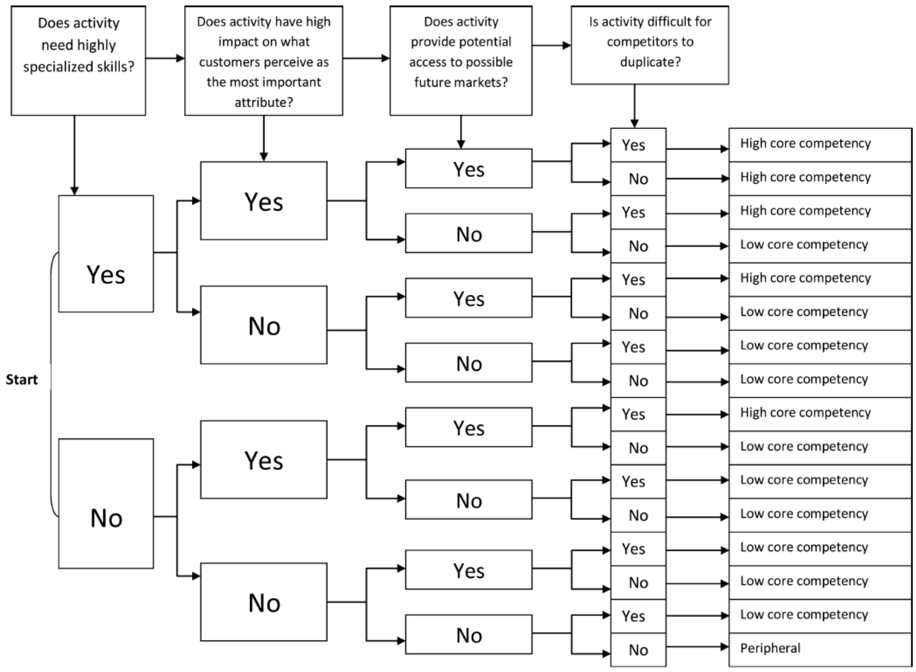


Figure 16 Evaluation of the significance in activity

Cost advantages can be calculated according to the following equation:

ΔCost = inhouse cost – outsourcing cost

If ΔCost>0; the outsourcing process has a cost advantage

If ΔCost<0; performing the process in-house has a cost advantage

After evaluating with two dimensions, the matrix shown in Figure 17 can be used to define the strategy for operating RL.

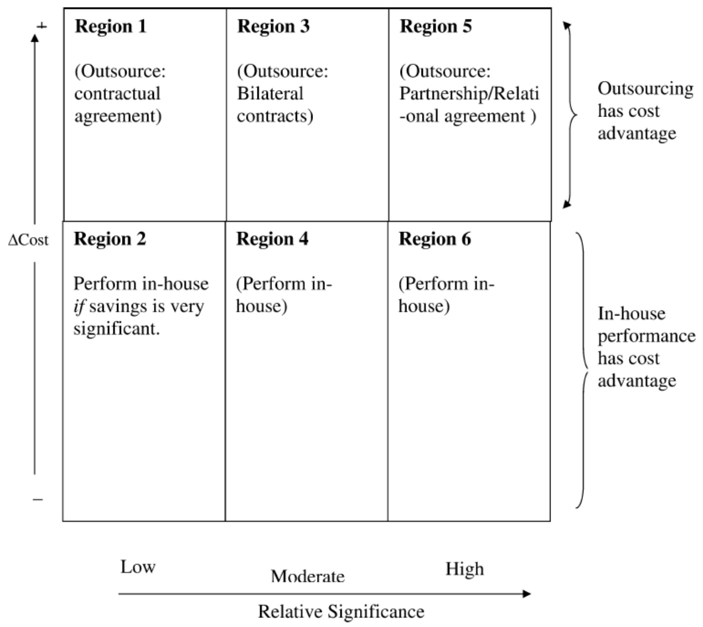


Figure 17 Decision matrix

Region 1: Contract third parties

Region 2: If the saving is high, the company should consider self-operated

Region 3: Conduct bilateral contract rather than transactional level

Region 4: Self-operated for cost-saving

Region 5: Extend partnership model and maintain a relationship

Region 6: Self-operated only

2.2 Sustainability Development

In 2015, the United Nations (UN) developed the Sustainable Development Goals (SDGs) to be a framework to take action of which the ultimate goal is to end poverty and protect the environment while creating peace and prosperity by 2030. These UN SDGs consist of 17 goals that focused on each area; however, it is considered in the holistic view for taking action along with stakeholders in the supply chain with long-term synergy and collaboration. The UNSDGs are shown in Figure 18.

Figure 18 The United Nations' Sustainable Development Goals

Linton, Klassen, and Jayaraman (2007) conducted a study of sustainable supply chains, which found that environmental management and operations have been leveraged from a local to a global issue; this will create an impact on the entire supply chain (from suppliers to consumers). Firms needed to re-think and develop new models of business to align on.

Singh (2016) carried out an intensive literature review on sustainable development and showed the evolution of the maturity of the sustainability program, which originally came from the idea of protecting the environment. However, it also evolved to consider issues of poverty and human rights and aims to tackle in the long-term all three pillars: economics, environment, and social.

Tippayawong, Niyomyat, Sopadang, and Ramingwong (2016) studied 28 factors that affect green supply chain performance and found that the factor of reverse logistics has a strong relationship in terms of economy especially in the asset turnover ratio.

Schenkel, Krikke, Caniëls, and der Laan (2015) researched the three key success factors in a closed-loop supply chain (CLSC), which is an integral part of forward and reverse logistics, implementation impact to value creation to stakeholders in sustainability view.

Organizational sustainability consists of three components: the natural environment, society, and economic performance, which simultaneously considers and balances economic, environmental, and social goals as shown in Figure 19 (Carter & Rogers, 2008; Elkington, 1998).

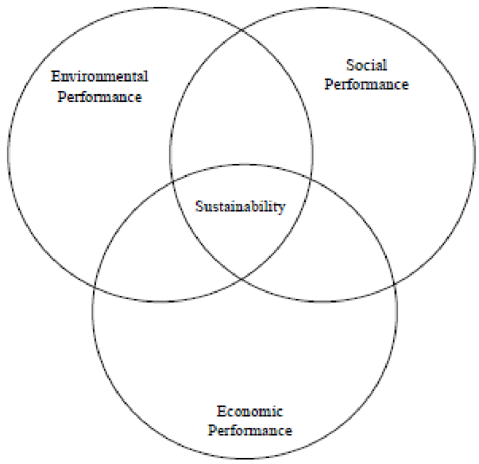


Figure 19 Triple bottom-lines for organization sustainability

Agrawal and Singh (2019) studied the impact of RL in triple bottom-line approaches (sustainability), which measure the impact of internal and external factors on the effectiveness of dispositioning decisions and their relationship to sustainability in all three dimensions Their study showed that both internal and external factors have a positive influence on the effectiveness of deposition decisions in RL and also have a positive impact on the social, economic, and environmental aspects, in that order.

2.3 Structural Equation Modeling (SEM)

SEM has frequently been used to analyze and explore causal relationships between variables (Pearl, 2012). SEM can be used to conduct both confirmatory and exploratory modeling to reconfirm theory and empirical data. SEM is a powerful tool that facilitates researchers to estimate and modify model according to their context (Dragan & Topolšek, 2014)

The structure of an SEM consists of two parts, a measurement model and a structural model. The objective is to identify the causal relationship inside the latent variables and among factors. It is very popular and suitable for use as a quantitative method for testing relationships and measurement errors (Raykov & Marcoulides, 2006).

In the RL literature, SEM is a very popular statistical tool used for analyses found in many types of literature. Table 3 shows some reviews of the drivers of and barriers to RL.

Author(s)	Analysis	Objective
Mangla et al. (2016)	Critical success factors	Determine critical success factors of RL in the Indian industry
Agrawal and Singh (2019)	Internal and external drivers	To determine the relationship between drivers and disposition decision making to triple bottom-lines
Brauchle et al. (2015)	Influencing RL decisions	To determine influencing factors for RL in construction industries
Kiatcharoenpol and Sirisawat (2020)	Barriers	To determine barriers to RL in the Thai electronics industry
Waqas et al. (2018)	Barriers	To determine barriers to RL in the manufacturing industry

Author(s)	Analysis	Objective
González-Torre, Álvarez, Sarkis, and Adenso-Díaz (2010)	Barriers	To determine barriers to RL in the Spanish automotive industry

Table 3 RL literature using SEM

2.4 Summary of variables

From the mention literature review, the variables in this study can be concluded in this table;

2.4.1 Drivers in RL

Variable	Definition	References
1. Policy and involvement from top management (internal)	Values and principles of the organization, which are passed down from the top management	Akdoğan and Coşkun (2012), Y. Li et al. (2018), Govindan and Bouzon (2018), Kiatcharoenpol and Sirisawat (2020), Waqas et al. (2018), Ho et al. (2012)
2. Internal joint operation (internal)	Collaboration among units in the organization	Agrawal and Singh (2019), Y. Li et al. (2018), Tippayawong et al. (2016), Govindan and Bouzon (2018), Olejnik and Werner-Lewandowska (2018), Kiatcharoenpol and Sirisawat (2020), Waqas et al. (2018), Ho et al. (2012)
3. Information system support (internal)	Information system, which supports	Agrawal and Singh (2019), Y. Li et al. (2018),

Variable	Definition	References
	visibility in reverse logistics activities	Tippayawong et al. (2016), Govindan and Bouzon (2018), Olejnik and Werner-Lewandowska (2018), Brauchle et al. (2015), Kiatcharoenpol and Sirisawat (2020), Gu et al. (2019), Ho et al. (2012)
4. Cost efficiency (internal)	Cost benefits from the reuse and recycling of packaging; trade-off with using new packaging	Agrawal and Singh (2019), Y. Li et al. (2018), Chiou et al. (2012), Khor et al. (2016), Govindan and Bouzon (2018), Brauchle et al. (2015), Kiatcharoenpol and Sirisawat (2020), Gu et al. (2019), Waqas et al. (2018), Ho et al. (2012)
5. Laws and regulations compliance (external)	Business proceeding to align with the enforcement of environmental laws	Akdoğan and Coşkun (2012), Agrawal and Singh (2019), Y. Li et al. (2018), Chiou et al. (2012), Khor et al. (2016), Shaharudin et al. (2015), Tippayawong et al. (2016), Govindan and Bouzon (2018)

Variable	Definition	References
		Brauchle et al. (2015), Kiatcharoenpol and Sirisawat (2020), Gu et al. (2019), Waqas et al. (2018), Ho et al. (2012)
6. Green marketing (external)	Doing business with an image of environmental consciousness, which can increase opportunities in business	Akdoğan and Coşkun (2012), Chiou et al. (2012), Khor et al. (2016), Shaharudin et al. (2015), Govindan and Bouzon (2018), Brauchle et al. (2015), Kiatcharoenpol and Sirisawat (2020), Gu et al. (2019)
7. Consumer awareness (external)	Consumer concerns regarding the environment and setting consumer purchasing priority to eco-friendly companies	Agrawal and Singh (2019), Y. Li et al. (2018), Khor et al. (2016), Shaharudin et al. (2015), Tippayawong et al. (2016), Govindan and Bouzon (2018), Olejnik and Werner-Lewandowska (2018), Gu et al. (2019)
8. Corporate citizenship (external)	Code of conduct and doing business with ethics by considering the impacts on other parties and	Akdoğan and Coşkun (2012), Y. Li et al. (2018), Chiou et al. (2012), Khor et al. (2016),

Variable	Definition	References
	stakeholders	Shaharudin et al. (2015), Govindan and Bouzon (2018), Olejnik and Werner-Lewandowska (2018), Gu et al. (2019), Waqas et al. (2018)
9. Pollution (external)	Decreasing waste management and environmental pollution	Akdoğan and Coşkun (2012), Govindan and Bouzon (2018), Gu et al. (2019), Waqas et al. (2018)

Table 4 Summary of drivers in RL variables

2.4.2 KSF in RL

Variable	Definition	References
1. Logistics network coverage	Reverse logistics network to support collection and consolidation post-consumption packaging	Y. Li et al. (2018)
2. Supplier and partnership network	Cooperation with business partner/supplier to operate reverse logistics activities for e.g., acquisition, operations, etc.	Y. Li et al. (2018) Mangla et al. (2016)
3. Logistics operation resources	Sufficiency of logistics infrastructure to operate RL operations for e.g., trucks, warehouse, collecting & sorting center	Y. Li et al. (2018) Mangla et al. (2016)

Variable	Definition	References
4. IT System	Readiness for IT system to support RL operations and support activities	Y. Li et al. (2018) Mangla et al. (2016)
5. Optimal operating cost	Ability to control RL cost performance in an acceptable range	Agrawal and Singh (2019)
6. Value added	Ability to create added value from post-consumption packaging for e.g., upcycling processes, etc.	Y. Li et al. (2018)
7. Value recovery	Ability to recover the value of post-consumption packaging back to the business by reuse or recycling	Y. Li et al. (2018)
8. Stakeholders; collaboration	Cooperation with customers and suppliers in terms of policy in the long-term	Y. Li et al. (2018) Mangla et al. (2016)
9. Government and regulator support	Rules and regulations support for facilitating or incentivizing the beverage industry to proceed with RL of post-consumption packaging	Y. Li et al. (2018) Mangla et al. (2016)

Table 5 Summary of KSF in RL variables

2.4.3 Economic Performance

Variable	Definition	References
1. Profit	Benefits from acquiring post-consumption packaging in terms of cost of goods sold, return on investment, profits, etc.	Agrawal and Singh (2019) Khor et al. (2016) Mangla et al. (2016)
2. Business opportunity	New business opportunities from acquiring post-consumption packaging for e.g., upcycling for new product development	Agrawal and Singh (2019) Khor et al. (2016) Mangla et al. (2016)
3. New packaging cost	Reduction in the cost for purchasing new packaging or components or subassemblies	Khor et al. (2016)
4. Used packaging cost	Significant improvement in post-consumption packaging cost acquisition and operations	Agrawal and Singh (2019) Khor et al. (2016)
5. Waste management cost	Reducing waste disposal costs such as landfill etc.	Agrawal and Singh (2019) Khor et al. (2016) Mangla et al. (2016)
6. Operating expenditure	RL activities also incurred incremental cost to the company	Agrawal and Singh (2019) Tibben-Lembke and Rogers (2002)
7. Workload & effort	RL activities consume more workload and effort of staff to operate in	Tibben-Lembke and Rogers (2002)

Variable	Definition	References
	addition to forward logistics, which is considered in terms of business as usual	

Table 6 Summary of economic performance variables

2.4.4 Environmental Performance

Variable	Definition	References
1. Energy consumption	Significant reduction in energy consumption in producing new packaging	Agrawal and Singh (2019) Khor et al. (2016) Mangla et al. (2016)
2. Reusable rate	Increasing the turnover rate/ratio of reusing post-consumption packaging	Agrawal and Singh (2019) Mangla et al. (2016)
3. Carbon footprint	Reduce carbon credit in cost of goods sold	Khor et al. (2016) Mangla et al. (2016)
4. Natural extraction	Reducing virgin resource-extraction by optimum use of raw materials	Agrawal and Singh (2019) Mangla et al. (2016)

Table 7 Summary of environmental performance variables

2.4.5 Social Performance

Variable	Definition	References
1. Community complaints	Reduce community complaints and issues	Agrawal and Singh (2019)
2. Health and safety	Improve the quality of living in terms of health and safety of the community	Agrawal and Singh (2019)

Variable	Definition	References
3. Social confidence	Improve customers, consumers, and also stakeholder's awareness of social responsibility and participation	Y. Li et al. (2018) Agrawal and Singh (2019) Mangla et al. (2016)
4. Job occupancy	Improve job opportunities and employment in communities	Agrawal and Singh (2019)
5. Engagement	Improve employee and stakeholder engagement to collaborate through RL activities and incentives, including benefits	Agrawal and Singh (2019) Mangla et al. (2016)

Table 8 Summary of social performance variables

2.5 Chapter 2 Summary

To summarize chapter 2, a total of 34 variables were identified during the literature review, including drivers, KSF in RL, and sustainability, related to Thailand's beverage industry.

In chapter 3, all of these variables will be tested on their content validity with experts and then the questionnaire will be formulated. The research methodology and process for conducting the research will also be explained.

Chapter 3
Research Methodology

To achieve the research objectives, this chapter will explain the process of the study from the design stage, framework, and hypothesis, including the methodology for gathering data and data analysis, detailed as follows.

3.1 Research Design

To properly conduct the research, the researcher designed the process as shown in Figure 20.

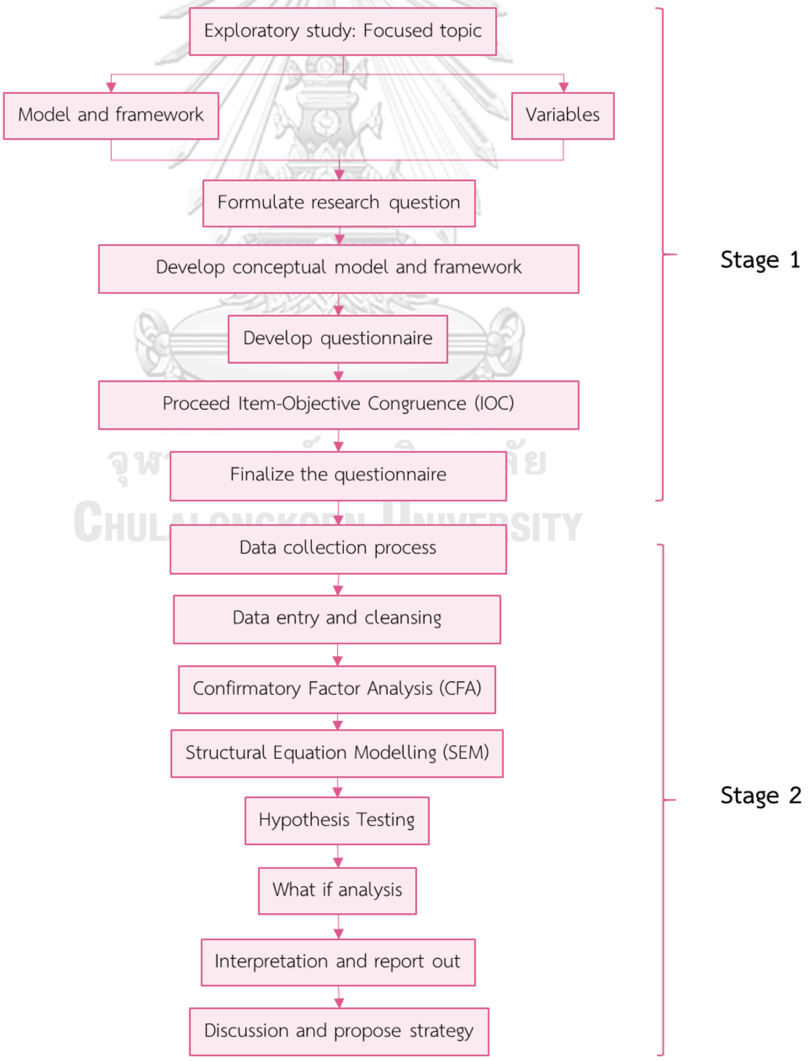


Figure 20 Research design

3.2 Research Framework and Hypotheses

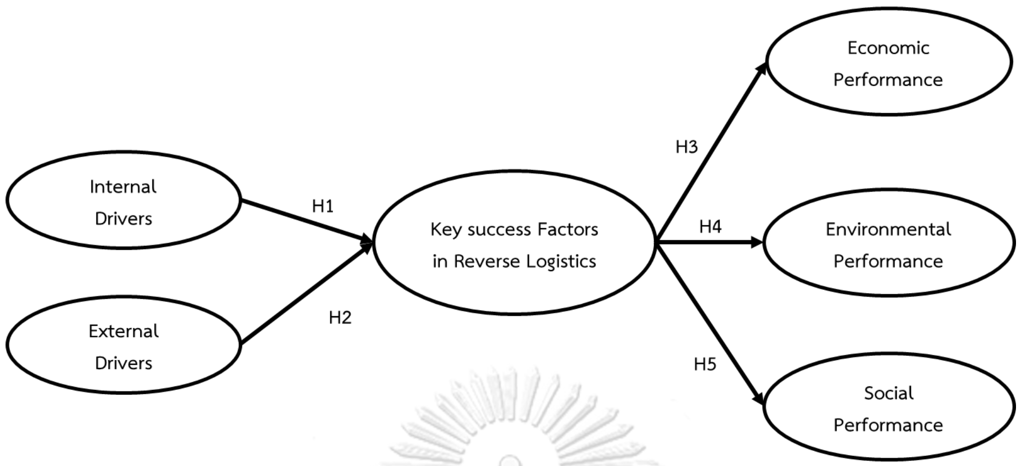


Figure 21 Research framework

With the research framework in Figure 21, the hypotheses are:

- H1: Internal drivers have a positive impact on key success factors in RL
- H2: External drivers have a positive impact on key success factors in RL
- H3: Key success factors in RL have a positive impact on economic performance
- H4: Key success factors in RL have a positive impact on environmental performance
- H5: Key success factors in RL have a positive impact on social performance

3.3 Research methodology

3.3.1 Sample

The sample of this study comprised beverage manufacturing companies, focusing mainly on large-scale businesses that sell their products in Thailand. They are all Thai national companies, international companies, or joint ventures. The products that are produced include both alcoholic and non-alcoholic beverage (NAB), with multiple types of packaging e.g., glass bottles, plastic (PET) bottles, aluminum cans, etc.

The sample sizes for SEM can vary (Hair, 2009). Many studies have confirmed that a minimum sample size for SEM analysis should be 100–200 respondents (Kline, 2010; Osterlind, Tabachnick, & Fidell, 2001), which aligned with Ding, Velicer, and Harlow (1995) who recommended there should be at least 100–150 participants to analyze.

For this study, the majority of company profiles were collected from Thai Beverage Association (https://www.thai-tba.or.th) members, which includes more than 30 Thai beverage manufacturers.

3.3.2 Questionnaire design

The questionnaire was developed in English and translated into Thai to ensure a clear understanding of the meaning of the questions, as shown in the appendix. An 11-point Likert scale was used to measure responses in Table 9.

10 - Very strongly agree	4 – Slightly disagree
9 – Strongly agree	3 – Mostly disagree
8 – Agree	2 – Disagree
7 – Mostly agree	1 – Strongly disagree
6 – Slightly agree	0 – Very strongly disagree
5 – Neither agree nor disagree	

Table 9 The 11-point Likert scale measurement and meaning

The questionnaire was divided into five parts in Table 10.

Questionnaire part	Description
Part 1: Company business information	• Product types • Packaging types • Nationality

Questionnaire part	Description
	• No. of employees • Status of implementation of RL
Part 2: Driving forces for RL	• Internal, 4 variables • External, 5 variables • 9 variables in total
Part 3: Key success factors in RL	• 9 variables in total
Part 4: Expected impact according to the sustainability aspect	• Economic, 7 variables • Environment, 4 variables • Social, 5 variables • 16 variables in total
Part 5: Respondents' general information	• Work experience • Role and responsibility • Job position • Suggestions for RL

Table 10 Questionnaire structure

3.3.3 Item-objective congruence with the expert panel

A panel of experts, comprising experienced representatives from the academic and business sector in the beverage industry, reviewed the variables and the questionnaire, and checked the item-objective congruence (IOC) to ensure that all variables were suited to the Thai context as shown in Table 11.

Name	Role	Organization
Expert 1	Academic	A professor from a leading university in Thailand
Expert 2	Business expert	A representative from the Thai Beverage Association

Name	Role	Organization
Expert 3	Business expert	Management representative from a beverage recycling company

Table 11 Expert panel for checking IOC

The IOC result showed that all 34 variables were valid at 0.98, which is in the acceptable range of 0.67–1.00 (Rovinelli & Hambleton, 1977; Turner & Carlson, 2003). The experts also recommended that the researcher added five more variables, which are shown in Table 12.

Variable	Definition	Type
1. Define budget and responsible unit	The company sets a financial budget and responsibility unit for performing reverse logistics activities	Internal Drivers
2. Internally monitor progress	Reverse logistics activities are important so there is a relevant internal person to monitor progress	Internal Drivers
3. Sustainability vision	The company has made an announcement on the sustainability vision to be applied in their business as usual operations	Internal Drivers
4. Manufacturing technology support	The company has the manufacturing technology to support the use of reused packaging	Internal Drivers
5. Qualify stakeholders' standards	Stakeholders required to adhere to more standards/protocols when doing business	External Drivers

Table 12 Recommended variables for drivers in RL

Hence, the total number of variables in this study was 39 in Table 13.

Construct	Variable	Code
Internal Drivers	Policy and involvement from top management	IN1
	Define budget and responsible unit	IN2
	Internally joint operation	IN3
	Internally monitor progress	IN4
	Sustainability vision	IN5
	Information system support	IN6
	Manufacturing technology support	IN7
	Cost efficiency	IN8
External Drivers	Laws and regulations compliance	EX1
	Qualify stakeholders' standards	EX2
	Green marketing	EX3
	Consumer awareness	EX4
	Corporate citizenship	EX5
	Pollution	EX6
KSF in RL	Logistics network coverage	KSF1
	Supplier and partnership network	KSF2
	Logistics operation resources	KSF3
	IT System	KSF4
	Optimal operating cost	KSF5
	Value-added	KSF6
	Value recovery	KSF7
	Stakeholders' collaboration	KSF8
	Government and regulator support	KSF9
Economic performance	Profit	ECOP1
	Business opportunity	ECOP2
	New packaging cost	ECOP3
	Used packaging cost	ECOP4
	Waste management cost	ECOP5

Construct	Variable	Code
	Operating expenditure	ECOP6
	Workloads & efforts	ECOP7
Environmental performance	Energy consumption	ENVP1
	Reusable rate	ENVP2
	Carbon footprint	ENVP3
	Natural extraction	ENVP4
Social performance	Community complaints	SOCP1
	Health and safety	SOCP2
	Social confidence	SOCP3
	Job occupancy	SOCP4
	Engagement	SOCP5

Table 13 Summary of total variables and constructs used in this research

3.3.4 Data Collection

To test the hypotheses, all data were collected through the online survey, which was conducted between September 2020 and March 2021 among companies in the Thailand beverage industry. E-mail and video teleconferences (Zoom application) were used to explain the questions.

One of the main challenges for the data collection was the COVID-19 pandemic, which forced meetings to be conducted online instead of offline, or face to face meetings. The researcher decided to use a Google form with an online link instead.

The target population was people who work in the fields of strategy, procurement, production, logistics planning, transportation, warehousing, accounting/finance, or other fields related to reverse logistics activity, from upstream to downstream in the beverage supply chain.

For non-respondents, emails and telephone calls were used to remind them to send their feedback. In total, 210 respondents in the beverage industry returned their forms, and the data included were used for the analysis.

3.3.5 Data Analysis

The research data were collected and analyzed using AMOS version 22 for reliability and validity testing, including SEM analysis.

3.4 Measurements

3.4.1 Content Validity

Content validity was supported by the intensive review of the relevant literature and the item–objective congruence (IOC) according to three experts in the beverage supply chain, which retrieved more variables matching to the Thai context.

3.4.2 Construct Validity

Hair, Anderson, Babin, and Black (2010) suggested the way to measure the validity of a construct is by calculating whether the average variance extracted (AVE) is greater than 0.5 (Fornell & Larcker, 1981). However, some studies also indicated that 0.5 is quite conservative and it can be used in the case that the composite reliability alone is adequate to confirm convergent validity (Lam, 2012).

3.4.3 Reliability

Cronbach's alpha coefficient was used to evaluate the scale reliability. The acceptable range is more than 0.7 (Drost, 2011; Nunnally, 1978). For SEM, the composite reliability is also the index used to measure the internal consistency of each latent variable (Hair et al., 2010). So, for this study, internal drivers, external drivers, key success factors, economic performance, environmental performance, and social performance were measured.

3.5 Model evaluation

3.5.1 Confirmatory Factor Analysis

Confirmatory factor analysis was first used to reconfirm the validity of a measurement model and whether the theoretical pattern aligned with the empirical data (Hair et al., 2010). In the present study CFA was used to confirm whether the survey data agreed with the theoretical data reviewed from the literature.

3.5.2 Structural Equation Modeling (SEM)

SEM is a statistical method used for testing hypotheses, estimating parameters and finding causal relationships in structural equations. It was used to explore the relationships between the observed and unobserved variables. The process must first be started with CFA to test the model fit of each construct and then structure the latent variables together for testing the hypotheses. SEM is a psychometric process for measuring and estimating abstract variables (Byrne, 2013; Fan et al., 2016; Hoyle, 1995; Pearson & Lee, 1903; Spearman, 1961).

3.5.3 Goodness of Fit Statistics

The goodness of fit of a model is evaluated by multiple fit indices. For this study, the likelihood ratio chi-square/degree of freedom (CMIN/DF), comparative fit index (CFI), and root mean square error of approximation (RMSEA) were used, based on background research and cut-off criteria by Hu and Bentler (1999), as detailed in Table 14.

Cutoff Criteria*

Measure	Terrible	Acceptable	Excellent
CMIN/DF	> 5	> 3	> 1
CFI	<0.90	<0.95	>0.95
SRMR	>0.10	>0.08	<0.08
RMSEA	>0.08	>0.06	<0.06
PClose	<0.01	<0.05	>0.05

Table 14 Goodness of fit cut-off criteria

Based on Table 14, the goodness of fit index that was applied in this study was as follows.

- Chi-square/df (CMIN/DF): usually accepted from less than 3 and considered a good fit when the value is near 1
- Comparative fit index (CFI) (Bentler, 1990): refers to how well the estimated model fits some alternative that has an acceptable range greater than 0.9
- (Standardized) root mean square residual (SRMR); usually accepted at less than 0.1
- Root mean square error of approximation (RMSEA): usually accepted at less than 0.08
- Pclose; in AMOS, this is a p-value which should not equal less than 0.01

3.6 Chapter 3 Summary

To summarize chapter 3, IOC was conducted to validate the questionnaire. Five more variables were added to the framework. In total, 39 variables were selected to develop the questionnaire, which was designed to survey beverage manufacturers in Thailand. Structural equation modeling techniques were used to analyze the collected data and test hypotheses, which will be explained in detail in chapter 4.

Chapter 4
Data Analysis

In this chapter, the survey data were analyzed to answer the research questions. The structure of this chapter can be illustrated as shown in Figure 22.

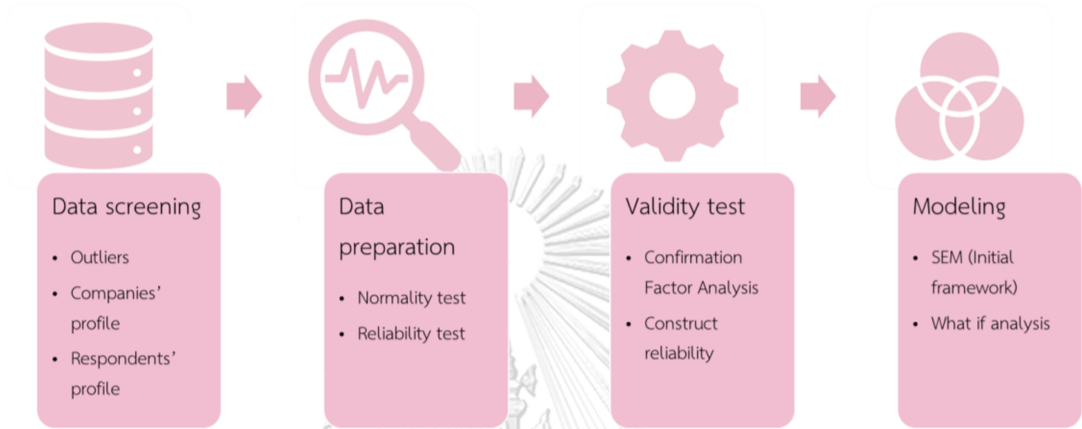


Figure 22 Data analysis design

The process will begin with data screening to screen out missing values and outliers. The overview of sample characteristics in the companies and respondents will be elaborated. Then, the data will be prepared to test the normality and reliability of the data. After that, validity tests will be conducted using CFA of each construct to ensure that the empirical data fit with the theory. Finally, SEM will be used to test both the initial framework and what-if analyses to test the hypotheses and explore the significance of factors related to the sustainability objectives in the case that the business environment has changed.

4.1 Data Screening

4.1.1 Missing values and outliers

The total data that were acquired from the survey were from 210 respondents or data sets. The questionnaires were all complete with no missing values, as the researcher set into the form so that all items were mandatory to answer, meaning that if one was skipped, the system would not allow completion of the questionnaire.

For outliers and extreme values, the researcher conducted screening using Malahanobis Distance via AMOS, which considered the observations that were the furthest from the centroid that showed p-values <0.001 (De Maesschalck, Jouan-Rimbaud, & Massart, 2000). The result showed that 161 observations were acceptable, where the p-value >0.001. Therefore, 161 observations from 161 respondents were used in this study.

4.1.2 Company profiles

Table 15 describes the respondents' company profiles, ranked by the largest to smallest.

Area	Description	No.	%
Product	1. Non Alcoholic Beverage (NAB)	97	60.25%
	2. Spirits, Beer, and NAB	42	26.09%
	3. Beer and NAB	7	4.35%
	4. Spirits	6	3.73%
	5. Beer	5	3.11%
	6. Spirits and Beer	3	1.86%
	7. Spirits and NAB	1	0.62%
Packaging type	1. Glass, Plastic (PET) bottle and aluminum can	52	32.30%
	2. Glass bottle and Aluminum can	31	19.25%
	3. Plastic (PET) bottle	21	13.04%
	4. Glass bottle	19	11.80%
	5. Glass and Plastic (PET) bottle	15	9.32%
	6. Plastic (PET) bottle and aluminum can	14	8.70%
	7. Aluminum can	8	4.97%
	8. Others	1	0.62%

Area	Description	No.	%
Nationality (Owner's Type)	1. International	90	55.90%
	2: Thai	65	40.37%
	3. Joint Venture	6	3.73%
Number of employees	1. 1–1,000	96	59.63%
	2. More than 2,000	55	34.16%
	3. 1001–2,000	10	6.21%
Implementation of RL	1. Yes, already implemented	149	92.55%
	2. Not yet implemented	12	7.45%

Table 15 Company profiles

Product: The majority of companies surveyed (60.25%) produce non-alcoholic beverages (NAB), for example, carbonated drinks, sweetened drinks, and still water. The second most common (26.09%) were companies who produce all types of beverages, which include spirits, beer, and NAB, while the remainder were approximately 13.66%.

Packaging types: the type of packaging indicates on the coverage of the study that it can cover up the diversity of packaging, as the majority of respondents are companies who use all types of packaging (glass and plastic (PET) bottles and aluminum cans) to contain their products (32.30%).

Nationality (owner's type): The majority of the companies were owned by international companies (55.90%), Thai-owned companies comprised 40.37%, while a minority were joint venture companies, at 3.73%.

The number of employees: Most of the companies in this study had employees in the range of 1 to 1,000 people (59.63%), followed by "More than 2,000" (34.16%), while the remainder (6.21%) were companies that have between 1,001 and 2,000 employees.

Implementation of RL: 92.55% of respondents stated their company already implemented RL, while the rest (7.45%) still do not implement it.

4.1.3 Respondents' profiles

Area	Description	No.	%
Work experience	1. 16–20 years	58	36.02%
	2. 11–15 years	47	29.19%
	3. More than 20 years	23	14.29%
	4. Less than 5 years	18	11.18%
	5. 5–10 years	15	9.32%
Role and Responsibility	1. Production	37	22.98%
	2. Strategy	34	21.12%
	3. Transportation	31	19.25%
	4. Warehousing	21	13.04%
	5. Logistics planning	19	11.80%
	6. Others	9	5.59%
	7. Accounting/ Finance	6	3.73%
	8. Procurement	4	2.48%
Working position/Job level	1 Senior Management	77	47.83%
	2. Manager	42	26.09%
	3. Assistant manager	23	14.29%
	4. Operation/ Administrator	16	9.94%
	5. CEO/ Managing Director	2	1.24%
	6. Other	1	0.62%

Table 16 Respondents' profiles

Work experience: The majority of the respondents had 16–20 years of experience (36.02%), followed by 11–15 years of experience, at 29.19%.

Role and Responsibility: Production comprised the most frequent function for those who responded to this survey, which contributed 22.98%, followed by strategy and transportation, which contributed 21.12% and 19.25%, respectively.

Working position/Job level: Senior management staff comprised the majority of respondents, which contributed 47.83%, followed by manager and assistant manager, which contributed 26.09% and 14.29%, respectively.

4.2 Data Preparation

4.2.1 Normality Test

To proceed with the SEM analysis, the data needed to be tested for a normal distribution by using the skewness and Kurtosis values (Kline, 2015). The analysis of the normality tests is shown in Table 17.

Construct	Variables	Min	Max	Mean	S.D.	Skewness	Kurtosis
Internal Drivers	IN1	7	10	9.46	0.72	-1.05	0.12
	IN2	6	10	8.96	1.00	-0.76	-0.11
	IN3	7	10	9.20	0.85	-0.72	-0.41
	IN4	6	10	8.91	0.85	-0.50	0.01
	IN5	7	10	9.52	0.71	-1.26	0.56
	IN6	7	10	9.32	0.85	-0.92	-0.29
	IN7	6	10	9.36	0.75	-1.06	1.35
	IN8	7	10	9.34	0.73	-0.73	-0.40
External Drivers	EX1	7	10	9.51	0.67	-1.29	1.41
	EX2	7	10	9.53	0.66	-1.35	1.66
	EX3	7	10	9.69	0.58	-1.93	3.54
	EX4	7	10	9.61	0.59	-1.46	2.04
	EX5	7	10	9.25	0.83	-0.84	-0.14
	EX6	7	10	9.49	0.68	-1.23	1.19
KSF in RL	KSF1	6	10	8.84	0.88	-0.52	-0.06
	KSF2	7	10	8.98	0.79	-0.50	-0.06
	KSF3	7	10	9.44	0.76	-1.20	0.71
	KSF4	6	10	9.24	0.83	-1.06	1.06
	KSF5	6	10	9.27	0.89	-1.09	0.60

Construct	Variables	Min	Max	Mean	S.D.	Skewness	Kurtosis
	KSF6	6	10	9.02	0.78	-0.68	0.84
	KSF7	7	10	8.98	0.77	-0.38	-0.21
	KSF8	7	10	9.21	0.80	-0.70	-0.26
	KSF9	7	10	9.43	0.81	-1.38	1.20
Economic performance	ECOP1	7	10	9.40	0.82	-1.20	0.62
	ECOP2	6	10	9.19	0.78	-0.89	1.09
	ECOP3	7	10	9.24	0.80	-0.75	-0.20
	ECOP4	7	10	9.41	0.76	-1.11	0.49
	ECOP5	7	10	9.15	0.77	-0.43	-0.68
	ECOP6	6	10	9.14	1.03	-0.98	0.04
	ECOP7	4	10	9.22	1.00	-1.49	3.53
Environmental performance	ENVP1	7	10	9.24	0.87	-0.95	0.09
	ENVP2	7	10	9.22	0.74	-0.47	-0.72
	ENVP3	6	10	8.87	0.87	-0.48	-0.10
	ENVP4	7	10	9.45	0.77	-1.13	0.24
Social performance	SOCP1	7	10	9.45	0.76	-1.13	0.30
	SOCP2	7	10	9.53	0.69	-1.28	0.75
	SOCP3	7	10	9.65	0.63	-1.73	2.42
	SOCP4	7	10	9.49	0.72	-1.15	0.30
	SOCP5	7	10	9.25	0.78	-0.72	-0.22

Table 17: Normality Test

Many studies indicate that the cut-off criteria for acceptable values fall between 3 and -3 for skewness and 10 to -10 for Kurtosis when utilizing SEM (Brown, 2015). Even Lei and Lomax (2005) indicated that skewness values outside of -2 to 3.5 generally indicated extreme skewness and Curran, West, and Finch (1996) noted that Kurtosis with an absolute value above 7 indicated a serious problem of non-normal distribution.

However, when considering the normality test, all the data from this study is passed the cut-off criteria from the above literature, so it can be claimed that all data were normally distributed and ready to use for SEM.

4.2.2 Reliability test

After gathering all data, the researcher performed reliability testing using SPSS version 22 and obtained the results shown in Table 18.

Construct	Variable	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
Internal Drivers	IN1	64.627	20.598	0.759	0.898	0.912
	IN2	65.124	18.872	0.711	0.903	
	IN3	64.882	19.517	0.778	0.895	
	IN4	65.174	19.807	0.724	0.900	
	IN5	64.565	20.885	0.720	0.901	
	IN6	64.764	20.406	0.641	0.907	
	IN7	64.727	20.575	0.725	0.900	
	IN8	64.745	20.853	0.704	0.902	
External Drivers	EX1	47.578	6.908	0.622	0.837	0.856
	EX2	47.559	6.723	0.697	0.823	
	EX3	47.398	7.016	0.711	0.823	
	EX4	47.472	7.026	0.694	0.826	
	EX5	47.832	6.265	0.624	0.842	
	EX6	47.596	7.017	0.575	0.845	
KSF in RL	KSF1	73.559	27.186	0.683	0.925	0.929
	KSF2	73.422	27.720	0.707	0.923	
	KSF3	72.957	27.392	0.790	0.918	
	KSF4	73.161	26.886	0.770	0.919	
	KSF5	73.130	25.777	0.844	0.914	

Construct	Variable	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
	KSF6	73.379	27.599	0.736	0.921	
	KSF7	73.422	28.045	0.690	0.924	
	KSF8	73.186	27.203	0.763	0.920	
	KSF9	72.963	27.749	0.680	0.925	
Economic performance	ECOP1	55.342	17.039	0.839	0.884	0.909
	ECOP2	55.553	18.099	0.696	0.899	
	ECOP3	55.503	17.889	0.711	0.898	
	ECOP4	55.329	17.710	0.790	0.890	
	ECOP5	55.590	18.531	0.640	0.905	
	ECOP6	55.602	16.028	0.762	0.893	
	ECOP7	55.516	16.639	0.701	0.901	
Environmental performance	ENVP1	27.534	4.000	0.725	0.789	0.847
	ENVP2	27.559	4.423	0.746	0.784	
	ENVP3	27.907	4.448	0.563	0.862	
	ENVP4	27.329	4.360	0.732	0.788	
Social performance	SOCP1	37.925	6.294	0.850	0.913	0.933
	SOCP2	37.839	6.499	0.889	0.906	
	SOCP3	37.727	7.062	0.794	0.924	
	SOCP4	37.882	6.555	0.825	0.917	
	SOCP5	38.118	6.442	0.774	0.929	

Table 18 Reliability test

Acceptable Cronbach's alpha values should be more than 0.7 (Nunnally, 1978). Table 18 shows that all variables and constructs had a Cronbach's alpha above the threshold. Therefore, the researcher was confident to use all variables for analysis in SEM.

4.3 Validity Test

In this study, the model factors were confirmed via the construct validity test by using CFA (Farooq, Shankar, & Shankar, 2016; Hair et al., 2010).

4.3.1 Assessment of construct validity through CFA

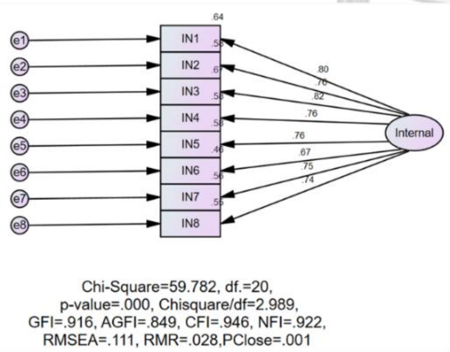
The objective of conducting CFA is to check whether the theoretical structure is aligned with the surveyed data. Each construct was individually validated and assembled to be rechecked in the full model (Hair et al., 2010). By performing CFA in AMOS, the validity can be assessed through the goodness of fit index, which can be concluded using goodness of fit statistics mentioned in Chapter 3.

4.3.2 Construct Validity

Before analyzing the structural model, each measurement model or each construct needs to analyzed for validity. The findings are shown in Table.

4.3.2.1 Internal Drivers

Initial Model



Final Model

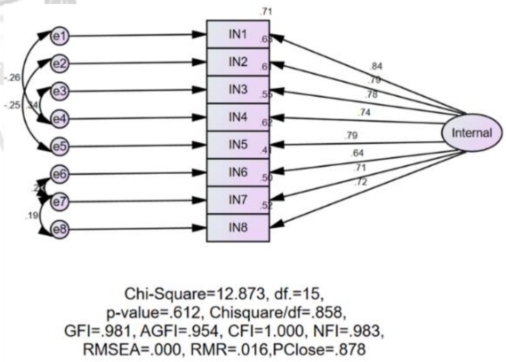


Figure 23 Internal drivers construct validity

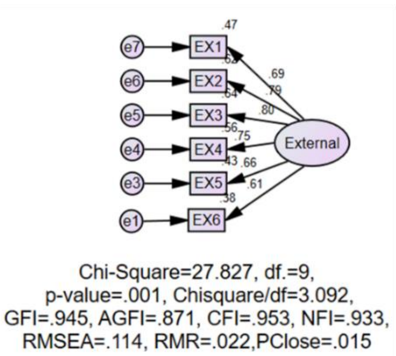
Details	χ2	χ2/Df	CFI	RMSEA	RMR	PClose
Criteria	-	≤ 3.00	≥ 0.90	≤ 0.07	≤ 0.08	>0.05
Initial model	59.782	2.989	0.946	0.111	0.028	0.001
Final model	12.873	0.858	1.000	0.000	0.016	0.878

Table 19 Internal drivers' goodness of fit

The internal drivers (Internal) were grouped into eight indicators (IN1, IN2, IN3, IN4, IN5, IN6, IN7, and IN8). The results showed that there was compliance between the hypothesis and empirical data with a good fit (χ2 =12.78, χ2/Df = 0.858, CFI = 1.000, RMSEA = 0.000, RMR = 0.016 and Pclose = 0.878). This implied that the internal drivers were influenced by the eight variables. Policy and involvement from top management (IN1) was the highest factor that drives internal drivers (R^2 = 0.707), while information system support (IN6) is the lowest (R^2 = 0.406). The remaining variables consisted of define budget and responsible unit (IN2) (R^2 = 0.627), sustainability vision (IN5) (R^2 = 0.623), internally joint operation (IN3) (R^2 = 0.613), internally monitor progress (IN4) (R^2 = 0.551), cost efficiency (IN8) (R^2 = 0.521), and manufacturing technology support (IN7) (R^2 = 0.505).

4.3.2.2 External Drivers

Initial Model



Final Model

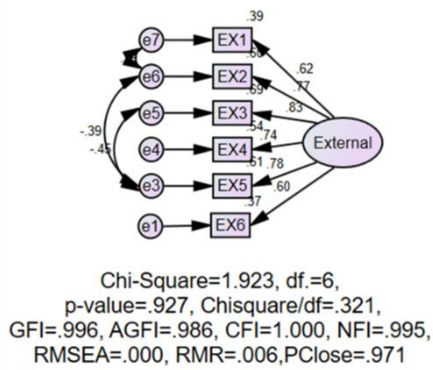


Figure 24 External drivers construct validity

Detail	$\chi 2$	$\chi 2$/Df	CFI	RMSEA	RMR	PClose
Criteria	-	≤ 3.00	≥ 0.90	≤ 0.07	≤ 0.08	>0.05
Initial model	27.827	3.092	0.953	0.114	0.022	0.015
Final model	1.923	0.321	1.000	0.000	0.006	0.971

Table 20 External drivers' goodness of fit

The external drivers (External) were grouped into six indicators (EX1, EX2, EX3, EX4, EX5, and EX6). The results showed that there was compliance between the hypothesis and empirical data with a good fit ($\chi 2$ =1.923, $\chi 2$/Df = 0.321, CFI = 1.000, RMSEA = 0.000, RMR = 0.006 and Pclose = 0.971). This implies that the external drivers were influenced by the six variables. Green marketing (EX3) is the highest factor that drives external drivers (R^2 = 0.693), while pollution (EX6) was the lowest (R^2 = 0.366). The remaining variables consisted of corporate citizenship (EX5) (R^2 = 0.605), qualify stakeholders' standards (EX2) (R^2 = 0.595), consumer awareness (EX4) (R^2 = 0.544), and laws and regulations compliance (EX1) (R^2 = 0.387).

4.3.2.3 Key Success Factors in RL

Initial Model Final Model

Figure 25 Key success factors in RL construct validity

Details	$\chi2$	$\chi2$/Df	CFI	RMSEA	RMR	PClose
Criteria	-	≤ 3.00	≥ 0.90	≤ 0.07	≤ 0.08	>0.05
Initial model	165.871	6.143	0.867	0.179	0.040	0.000
Final model	38.177	2.009	0.982	0.079	0.022	0.091

Table 21 Key success factors in RL's goodness of fit

The KSF in RL (KSF) was grouped into nine indicators (KSF1, KSF2, KSF3, KSF4, KSF5, KSF6, KSF7, KSF8, and KSF9). The results showed there was good compliance between hypothesis and empirical data with a good fit ($\chi2$ =38.177, $\chi2$/Df = 2.009, CFI = 0.982, RMSEA = 0.079, RMR = 0.022 and Pclose = 0.091). This implies that the KSF in RL was influenced by the nine variables. Optimal operating cost (KSF5) is the highest factor that drives key success factors in RL (R^2 = 0.791), while value recovery (KSF7) is the lowest (R^2 = 0.399). The remaining variables consisted of logistics operation resources (KSF3) (R^2 = 0.695), IT system (KSF4) (R^2 = 0.645), stakeholder collaboration (KSF8) (R^2 = 0.602), logistics network coverage (KSF1) (R^2 = 0.584), supplier and partnership network (KSF2) (R^2 = 0.574), value added (KSF6) (R^2 = 0.538), and government and regulator support (KSF9) (R^2 = 0.529).

4.3.2.4 Economic performance

Initial Model Final Model

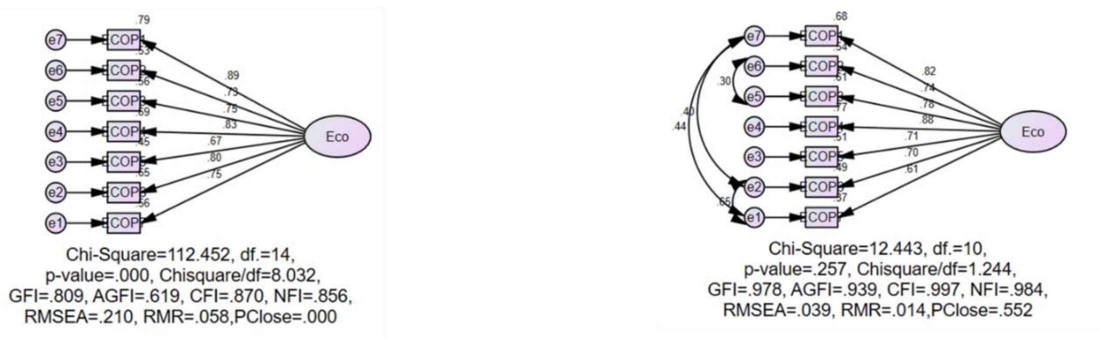


Figure 26 Economic performance construct validity

Details	$\chi 2$	$\chi 2$/Df	CFI	RMSEA	RMR	PClose
Criteria	-	≤ 3.00	≥ 0.90	≤ 0.07	≤ 0.08	>0.05
Initial model	112.452	8.032	0.870	0.210	0.058	0.000
Final model	12.443	1.244	0.997	0.039	0.014	0.552

Table 22 Economic performance goodness of fit

Economic performance (ECO) was grouped into seven indicators (ECOP1, ECOP2, ECOP3, ECOP4, ECOP5, ECOP6, and ECOP 7). The results showed that there was compliance between hypothesis and empirical data with a good fit ($\chi 2$ =12.443, $\chi 2$/Df = 1.244, CFI = 0.997, RMSEA = 0.039, RMR = 0.014 and Pclose = 0.552). This implied that economic performance was influenced by the seven variables. Used packaging cost (ECOP4) is the highest factor that drives economic performance (R^2 = 0.767), while the workloads and effort (ECOP7) is the lowest (R^2 = 0.373). The remaining variables consisted of profit (ECOP1) (R^2 = 0.677), new packaging cost (ECOP3) (R^2 = 0.614), business opportunity (ECOP2) (R^2 = 0.543), waste management cost (ECOP5) (R^2 = 0.511), and operating expenditure (ECOP6) (R^2 = 0.489).

4.3.2.5 Environmental performance

Initial Model Final Model

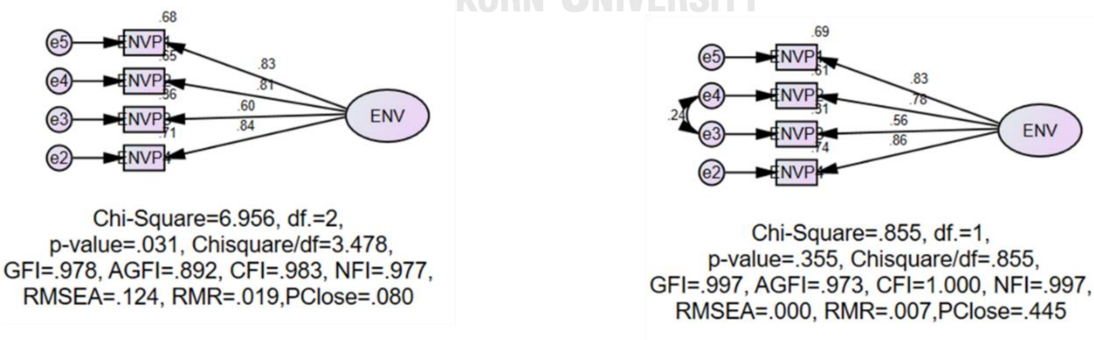


Figure 27 Environmental performance construct validity

Details	$\chi 2$	$\chi 2$/Df	CFI	RMSEA	RMR	PClose
Criteria	-	≤ 3.00	≥ 0.90	≤ 0.07	≤ 0.08	>0.05
Initial model	6.956	3.478	0.983	0.124	0.019	0.080
Final model	0.85	0.855	1.000	0.000	0.007	0.445

Table 23 Environmental performance goodness of fit

Environmental performance (ENV) was grouped into four indicators (ENVP1 ENVP2, ENVP3, and ENVP4). The results showed that there was compliance between hypothesis and empirical data with a good fit ($\chi 2$ =0.85, $\chi 2$/Df = 0.855, CFI = 1.000, RMSEA = 0.000, RMR = 0.007 and Pclose = 0.445). This implied that environmental performance was influenced by the four variables. Natural extraction (ENVP4) is the highest factor that drives environmental performance (R^2 = 0.741), while the carbon footprint (ENVP3) was the lowest (R^2 = 0.309). The remaining variables consisted of energy consumption (ENVP1) (R^2 = 0.693) and reusable rate (ENVP2) (R^2 = 0.611).

4.3.2.6 Social performance

Initial Model Final Model

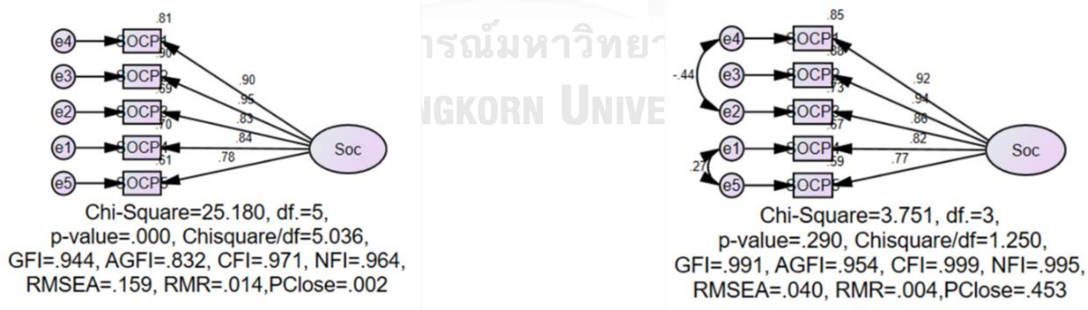


Figure 28 Social performance construct validity

Details	$\chi 2$	$\chi 2/Df$	CFI	RMSEA	RMR	PClose
Criteria	-	≤ 3.00	≥ 0.90	≤ 0.07	≤ 0.08	>0.05
Initial model	25.180	5.036	0.971	0.159	0.014	0.002
Final model	3.751	1.250	0.999	0.040	0.004	0.453

Table 24 Social performance goodness of fit

Social performance (SOC) was grouped into five indicators (SOCP1, SOCP2, SOCP3, SOCP4, and SOCP5). The results showed that there was compliance between hypothesis and empirical data with a good fit ($\chi 2$ =3.751, $\chi 2/Df$ = 1.250, CFI = 0.999, RMSEA = 0.040, RMR = 0.004 and Pclose = 0.453). This implied that social performance was influenced by the five variables. Health and safety (SOCP2) is the highest factor that drives social performance (R^2 = 0.881), while engagement (SOCP5) is the lowest (R^2 = 0.587). The remaining variables consisted of community complaints (SOCP1) (R^2 = 0.852), social confidence (SOCP3) (R^2 = 0.735), and job occupancy (SOCP4) (R^2 = 0.673).

4.3.2.7 Composite reliability and convergent validity test of CFA

After conducting CFA of each construct, the composite reliability and convergent validity were determined, as shown in Table 25.

Construct	Variable	Factor loading	Composite Reliability (CR) and R square	Average Variance Extracted (AVE) and error term
Int			0.913	0.569
	IN1	0.841	0.707	0.293
	IN2	0.792	0.627	0.373
	IN3	0.783	0.613	0.387
	IN4	0.743	0.551	0.449
	IN5	0.789	0.623	0.377
	IN6	0.638	0.406	0.594
	IN7	0.710	0.505	0.495

Construct	Variable	Factor loading	Composite Reliability (CR) and R square	Average Variance Extracted (AVE) and error term
	IN8	0.722	0.521	0.479
Ex			0.871	0.532
	EX1	0.622	0.387	0.613
	EX2	0.772	0.595	0.405
	EX3	0.833	0.693	0.307
	EX4	0.738	0.544	0.456
	EX5	0.778	0.605	0.395
	EX6	0.605	0.366	0.634
KSF			0.929	0.595
	KSF1	0.764	0.584	0.416
	KSF2	0.757	0.574	0.426
	KSF3	0.833	0.695	0.305
	KSF4	0.803	0.645	0.355
	KSF5	0.890	0.791	0.209
	KSF6	0.733	0.538	0.462
	KSF7	0.632	0.399	0.601
	KSF8	0.776	0.602	0.398
	KSF9	0.727	0.529	0.471
Eco			0.901	0.568
	ECOP1	0.823	0.677	0.323
	ECOP2	0.737	0.543	0.457
	ECOP3	0.784	0.614	0.386
	ECOP4	0.876	0.767	0.233
	ECOP5	0.715	0.511	0.489
	ECOP6	0.699	0.489	0.511
	ECOP7	0.611	0.373	0.627
Env			0.848	0.589

Construct	Variable	Factor loading	Composite Reliability (CR) and R square	Average Variance Extracted (AVE) and error term
	ENVP1	0.833	0.693	0.307
	ENVP2	0.782	0.611	0.389
	ENVP3	0.556	0.309	0.691
	ENVP4	0.861	0.741	0.259
Soc			0.936	0.746
	SOCP1	0.923	0.852	0.148
	SOCP2	0.939	0.881	0.119
	SOCP3	0.857	0.735	0.265
	SOCP4	0.820	0.673	0.327
	SOCP5	0.766	0.587	0.413

Table 25 Summary reliability and validity test of CFA

Hair et al. (2010) proposed that the convergent validity test can be assessed in two ways. First, by factor loading size, which should be greater than 0.5, and second, the average variance extracted (AVE) should be greater than 0.5 to explain the latent factor.

Composite reliability (CR) was also used to assess the reliability of each construct in SEM. The acceptable range of CR should be more than 0.6 (Bagozzi & Yi, 1988). Hence, it can be claimed that all variables and constructs in the model were reliable and valid for performing SEM analysis.

4.3.2.8 Confirmatory Factor Analysis (Multi-factors)

After conducting CFA for each construct, overall multi-factors analysis was performed to test the model fit and correlation in Figure 29.

Initial Model Final Model

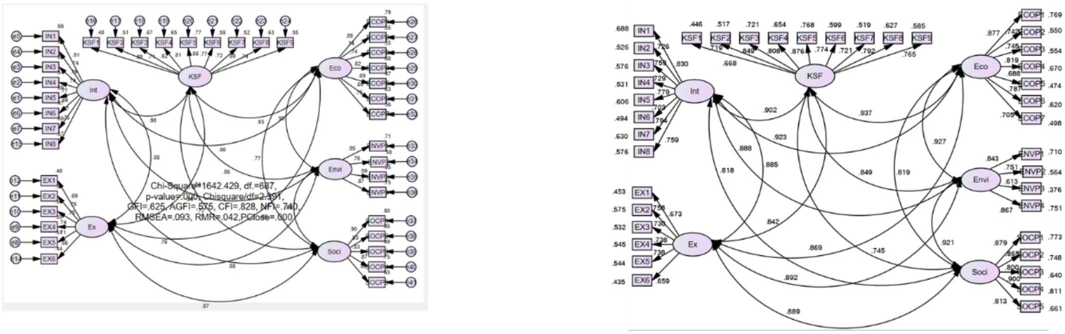


Figure 29 Confirmatory factor analysis (multi-factors)

Details	χ^2	χ^2/Df	CFI	RMSEA	RMR	PClose
Criteria	-	≤ 3.00	≥ 0.90	≤ 0.07	≤ 0.08	>0.05
Initial model	1642.429	2.391	0.828	0.093	0.042	0.000
Final model	663.535	1.181	0.982	0.034	0.031	0.998

Table 26 Confirmatory factor analysis (multi-factors) goodness of fit

The relationship between measurement models showed a good fit with the empirical data (χ^2 =663.535, χ^2/Df = 1.181, CFI = 0.982, RMSEA = 0.034, RMR = 0.0031 and Pclose = 0.998). The correlations between latent variables were all positive, between 0.745–0.937. The highest correlated latent variables were KSF in RL and economic performance, at 0.937, while the lowest correlated variables were KSF in RL and social performance, at 0.745.

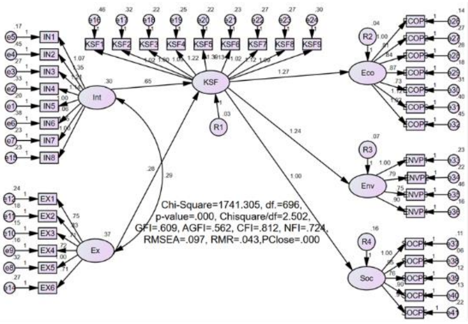
Henseler, Ringle, and Sarstedt (2014) suggested that the correlation of each construct in CFA can be at a very high level of 0.95 and still can be used for SEM analysis.

4.4 Modeling

4.4.1 SEM Model

The validity and acceptability of the structural model can be evaluated in terms of model fit through goodness of fits. After analysis, the results can be expressed in Figure 30.

Initial Model



Final Model

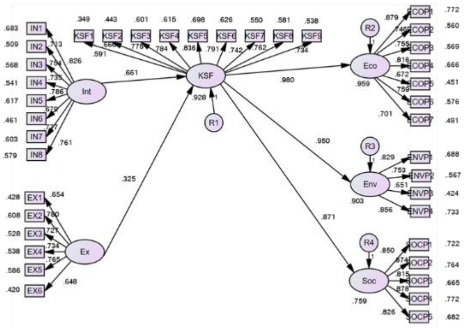


Figure 30 SEM Model

Details	$\chi2$	$\chi2$/Df	CFI	RMSEA	RMR	PClose
Criteria	-	≤ 3.00	≥ 0.90	≤ 0.07	≤ 0.08	>0.05
Initial model	1741.305	2.502	0.812	0.097	0.043	.000
Final model	660.790	1.182	0.982	0.034	0.029	0.998

Table 27 SEM model's goodness of fit

The models showed a good fit with the empirical data ($\chi2$ =660.790, Df=559, $\chi2$/Df = 1.182, CFI = 0.982, RMSEA = 0.034, RMR = 0.029, and Pclose = 0.998). The standardized factor loading from the internal drivers to KSF in RL was 0.661 while the external drivers to KSF in RL were 0.325. The highest factor loadings of KSF to sustainability were in the order of economic performance, environmental performance, and social performance, at 0.980, 0.950, and 0.871, respectively

The factor loading and R^2 of each observed variable in each construct are shown in Table 28 and are ordered from the largest to the smallest value.

Construct	Code	Variables	Factor loading	R^2
INT	IN1	Policy and involvement from top management	0.826***	0.683

Construct	Code	Variables	Factor loading	R^2
	IN5	Sustainability vision	0.786***	0.617
	IN7	Manufacturing technology support	0.777***	0.603
	IN8	Cost efficiency	0.761***	0.579
	IN3	Internally joint operation	0.754***	0.568
	IN4	Internally monitor progress	0.735***	0.541
	IN2	Define budget and responsible unit	0.713***	0.509
	IN6	Information system support	0.679***	0.461
EX	EX2	Qualify stakeholders' standard	0.780***	0.608
	EX5	Corporate citizenship	0.765***	0.586
	EX4	Consumer awareness	0.734***	0.538
	EX3	Green marketing	0.727***	0.528
	EX1	Laws and regulations compliance	0.654***	0.428
	EX6	Pollution	0.648***	0.420
KSF	KSF5	Optimal operating cost	0.836***	0.698
	KSF6	Value added	0.791***	0.626
	KSF4	IT System	0.784***	0.615
	KSF3	Logistics operation resources	0.775***	0.601
	KSF8	Stakeholder collaboration	0.762***	0.581
	KSF7	Value recovery	0.742***	0.550
	KSF9	Government and regulator support	0.734***	0.538
	KSF2	Supplier and partnership network	0.666***	0.443
	KSF1	Logistics network coverage	0.591***	0.349
Eco	ECOP1	Profit	0.879***	0.772
	ECOP4	Used packaging cost	0.816***	0.666
	ECOP6	Operating expenditure	0.759***	0.576
	ECOP3	New packaging cost	0.755***	0.569
	ECOP2	Business opportunity	0.746***	0.560
	ECOP7	Workloads & efforts	0.701***	0.491

Construct	Code	Variables	Factor loading	R^2
	ECOP5	Waste management cost	0.672***	0.451
Env	ENVP4	Natural extraction	0.856***	0.733
	ENVP1	Energy consumption	0.829***	0.688
	ENVP2	Reusable rate	0.753***	0.567
	ENVP3	Carbon footprint	0.651***	0.424
Soc	SOCP4	Job occupancy	0.878***	0.772
	SOCP2	Health and safety	0.874***	0.764
	SOCP1	Community complaints	0.850***	0.722
	SOCP5	Engagement	0.826***	0.682
	SOCP3	Social confidence	0.815***	0.665

Remark: *** P<0.001, **P<0.01 * P<0.05

Table 28 Standardized factor loading

The results showed that all 39 observed variables were significant at the highest level, with P-values <0.001.

4.4.2 Hypothesis Testing by Path Analysis

After analyzing the SEM model to understand the causal relationships between internal drivers, external drivers to KSF in RL, and for KSF in RL to sustainability performance, the hypotheses are summarized in Table 29.

H	Structural path	Std. Estimate	T- value	Result
H1	INT → KSF	0.661***	5.415	Supported
H2	Ex → KSF	0.325**	3.045	Supported
H3	KSF → Eco	0.980***	9.838	Supported
H4	KSF → Env	0.950***	9.158	Supported
H5	KSF → Soc	0.871***	8.821	Supported

*** P<0.001, **P<0.01 * P<0.05

Table 29 Hypothesis testing results

For the hypothesis testing, the regression analysis showed the following results:

1. INT has a positive impact on KSF (β = 0.661; p < 0.001; supporting H1),
2. EXT has a positive impact on KSF (β = 0.325 p < 0.01; supporting H2).
3. KSF has a positive impact on ECO (β = 0.980 p < 0.001; supporting H3).
4. KSF has a positive impact on ENV β = 0.950 p < 0.001; supporting H4).
5. KSF has a positive impact on SOC (β = 0.871 p < 0.001; supporting H5).

In conclusion, the analysis of the empirical data showed that they support all five hypotheses.

4.4.3 Testing direct and indirect effects

After testing the hypotheses, the researcher continued testing the direct and indirect effects that impact each construct, with the details shown in Table 30.

Variables	Internal Drivers			External Drivers			Key success Factors in RL		
	DE	IE	TE	DE	IE	TE	DE	IE	TE
KSF	0.661	0.000	0.661	0.325	0.000	0.325	0.000	0.000	0.000
ECO	0.000	0.647	0.647	0.000	0.319	0.319	0.980	0.000	0.980
ENV	0.000	0.628	0.628	0.000	0.309	0.309	0.950	0.000	0.950
SOC	0.000	0.576	0.576	0.000	0.283	0.283	0.871	0.000	0.871

DE = Direct Effect, IE = Indirect Effect, TE = Total Effect

Table 30 Summary of direct and indirect effect tests

For the direct impact and indirect impact analyses, the results can be summarized as below:

1. Internal drivers have a higher effect (0.661) on the KSF than external drivers (0.325)
2. ECO has an indirect effect from internal drivers (0.647) higher than that of external drivers (0.319)
3. ENV has an indirect effect from internal drivers (0.628) higher than that of external drivers (0.309)
4. SCO has an indirect effect from internal drivers (0.576) higher than that of external drivers (0.283)
5. KSF has the highest direct effect on ECO, at 0.980, while giving the lowest direct effect to SOC at 0.871; for ENV, it receives an effect from KSF at 0.950

4.4.4 What-if analysis for testing significance of KSF in RL

The researcher also continued to determine whether the KSF is significant to the impact of RL sustainability performance. So, the what-if analysis also comes up to prove.

4.4.4.1 What-if analysis framework

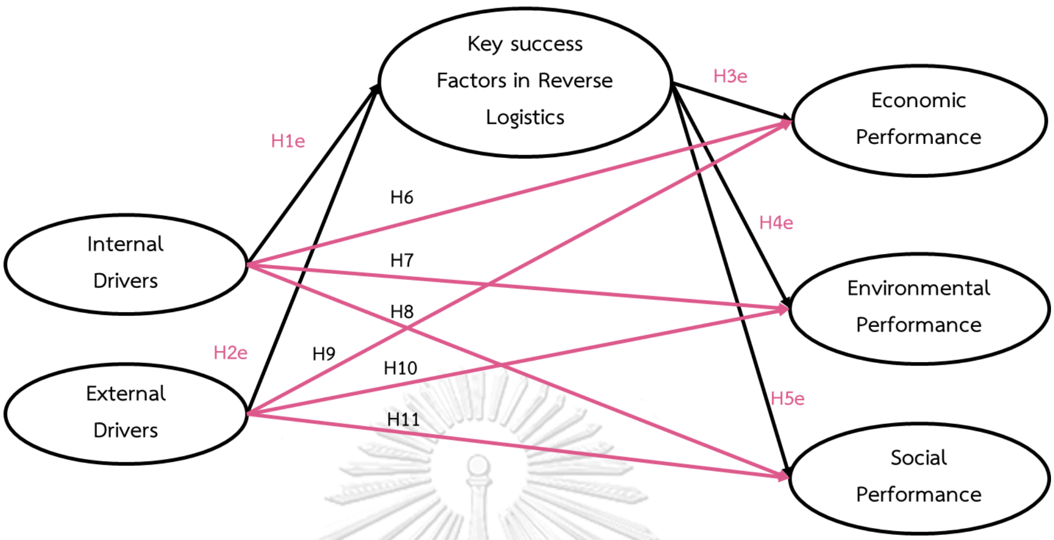


Figure 31 What-if analysis framework for testing the significance of KSF in RL

4.4.4.2 What-if analysis hypotheses

The hypotheses in the what-if analysis were divided into two parts. First, for the initial framework to test whether the model still supports the hypotheses; details are shown below:

- H1e: Internal drivers have a positive impact on KSF in RL
- H2e: External drivers have a positive impact on KSF in RL
- H3e: KSF in RL has a positive impact on economic performance
- H4e: KSF in RL has a positive impact on environmental performance
- H5e: KSF in RL has a positive impact on social performance

Second, for testing the direct impact of whether the KSF in RL are significant; additional hypotheses are listed below:

- H6: Internal driver has a positive direct impact on Economic performance
- H7: Internal drivers have a positive direct impact on environmental performance

- H8: Internal drivers have a positive direct impact on social performance
- H9: External drivers have a positive direct impact on economic performance
- H10: External drivers have a positive direct impact on environmental performance
- H11: External drivers have a positive direct impact on social performance

4.4.4.3 What-if analysis SEM Model

Initial Model Final Model

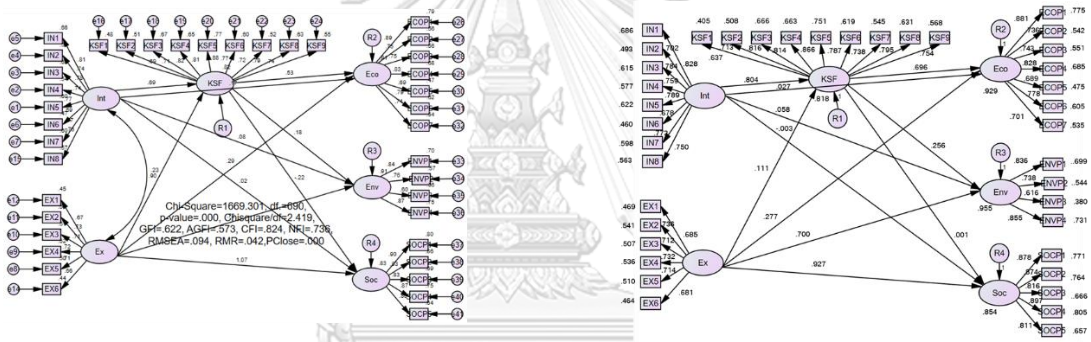


Figure 32 What-if analysis SEM Model

Details	χ^2	χ^2/Df	CFI	RMSEA	RMR	PClose
Criteria	-	≤ 3.00	≥ 0.90	≤ 0.07	≤ 0.08	>0.05
Initial model	1669.301	2.419	0.824	0.094	0.042	0.000
Final model	810.023	1.436	0.956	0.052	.0290	0.320

Table 31 What-if analysis goodness of fit

After running AMOS, the models showed a good fit with the empirical data (χ^2 =810.023, Df=564, χ^2/Df = 1.436, CFI = 0.956, RMSEA = 0.052, RMR = 0.029, and Pclose = 0.320).

The factor loading and R^2 of each observed variable in each construct are shown in Table 32 and ordered from the largest to the smallest value.

Construct	Code	Variable	Factor loading	R2
INT	IN1	Policy and involvement from top management	0.828***	0.686
	IN5	Sustainability vision	0.789***	0.622
	IN3	Internally joint operation	0.784***	0.615
	IN7	Manufacturing technology support	0.773***	0.598
	IN4	Internally monitor progress	0.759***	0.577
	IN8	Cost efficiency	0.750***	0.563
	IN2	Define budget and responsible unit	0.702***	0.493
	IN6	Information system support	0.678***	0.460
EX	EX2	Qualify stakeholders' standard	0.736***	0.541
	EX4	Consumer awareness	0.732***	0.536
	EX5	Corporate citizenship	0.714***	0.51
	EX3	Green marketing	0.712***	0.507
	EX1	Laws and regulations compliance	0.685***	0.469
	EX6	Pollution	0.681***	0.464
KSF	KSF5	Optimal operating cost	0.866***	0.751
	KSF3	Logistics operation resources	0.816***	0.666
	KSF4	IT System	0.814***	0.663
	KSF8	Stakeholder collaboration	0.795***	0.631
	KSF6	Value added	0.787***	0.619
	KSF9	Government and regulator support	0.754***	0.568
	KSF7	Value recovery	0.738***	0.545
	KSF2	Supplier and partnership network	0.713***	0.508
	KSF1	Logistics network coverage	0.637***	0.406
Eco	ECOP1	Profit	0.881***	0.775
	ECOP4	Used packaging cost	0.828***	0.685
	ECOP6	Operating expenditure	0.778***	0.605
	ECOP3	New packaging cost	0.743***	0.551

Construct	Code	Variable	Factor loading	R2
	ECOP2	Business opportunity	0.736***	0.542
	ECOP7	Workloads & efforts	0.731***	0.535
	ECOP5	Waste management cost	0.689***	0.475
Env	ENVP4	Natural extraction	0.855***	0.731
	ENVP1	Energy consumption	0.836***	0.699
	ENVP2	Reusable rate	0.738***	0.544
	ENVP3	Carbon footprint	0.616***	0.380
Soc	SOCP4	Job occupancy	0.897***	0.805
	SOCP1	Community complaints	0.878***	0.771
	SOCP2	Health and safety	0.874***	0.764
	SOCP3	Social confidence	0.816***	0.666
	SOCP5	Engagement	0.811***	0.657

Remark: *** P<0.001, **P<0.01 * P<0.05

Table 32 Standardized factor loading in the what-if analysis

The results showed that all 39 observed variables were significant at the highest level, with P-values <0.001

4.4.4.4 What-if analysis hypothesis testing

After analyzing the SEM model, the hypotheses are summarized in Table 33.

H	Structural path	Std. Estimate	T-value	Result
H1e	INT → KSF	0.804***	5.196	Support
H2e	EX → KSF	0.111	0.807	Not Support
H3e	KSF → ECO	0.696***	5.613	Support
H4e	KSF → Env	0.256*	2.071	Support
H5e	KSF → SOC	0.001	0.006	Not support

H	Structural path	Std. Estimate	T-value	Result
H6	INT → ECO	0.027	0.186	Not support
H7	INT → Env	0.958	0.352	Not support
H8	INT → SOC	-0.003	-0.019	Not support
H9	EX → ECO	0.277**	2.695	Support
H10	EX → Env	0.700***	5.328	Support
H11	EX → SOC	0.927***	5.915	Support

*** P<0.001, **P<0.01 * P<0.05

Table 33 Summary of the what-if analysis hypothesis testing

For the hypothesis testing, i the regression analysis results were as follows:

1. INT has a positive impact on KSF in RL (β = 0.804; $p < 0.001$; supporting H1e),
2. EX has a positive impact on KSF in RL (β = 0.111; $p > 0.05$; not supporting H2e),
3. KSF has a positive impact on ECO (β = 0.696; $p < 0.001$; supporting H3e),
4. KSF has a positive impact on ENV (β = 0.256; $p < 0.05$; supporting H4e),
5. KSF has a positive impact on SOC (β = 0.001 $p > 0.05$; not supporting H5e),
6. INT has a positive direct impact on ECO (β = 0.027; $p > 0.05$; not supporting H6),
7. INT has a positive direct impact on ENV (β = 0.958; $p > 0.05$; not supporting H7),
8. INT has a positive direct impact on SOC (β = -0.003; $p > 0.05$; not supporting H8),
9. EXT has a positive direct impact on ECO (β = 0.277; $p < 0.01$; supporting H9),
10. EXT has a positive direct impact on ENV (β = 0.700; $p < 0.001$; supporting H10),

11. EXT has a positive direct impact on SOC (β = 0.927; $p < 0.001$; supporting H11)

4.4.4.5 What-if analysis testing direct and indirect effects

After testing the hypotheses, the researcher continued testing the direct and indirect effects that impacted each construct, with details shown in Table 34.

Variables	Internal Drivers			External Drivers			Key success Factors in RL		
	DE	IE	TE	DE	IE	TE	DE	IE	TE
KSF	0.804	0.000	0.804	0.111	0.000	0.111	0.000	0.000	0.000
ECO	0.027	0.560	0.587	0.277	0.077	0.354	0.696	0.000	0.696
ENV	0.058	0.206	0.264	0.700	0.028	0.728	0.256	0.000	0.256
SOC	-0.003	0.001	-0.002	0.927	0.000	0.927	0.001	0.000	0.001

DE = Direct Effect, IE = Indirect Effect, TE = Total Effect

Table 34 What-if analysis testing of direct and indirect effects

For the analysis of direct and indirect impacts, the results can be summarized as follows:

1. Internal drivers have a positive direct impact on KSF (0.804), ECO (0.027), ENV (0.058), and SOC (-0.003)
2. External drivers have a positive direct impact on KSF (0.111), ECO (0.277), ENV (0.700), and SOC (0.927)
3. KSF in RL have a positive direct impact on ECO (0.696), ENV (0.256), and SOC (0.001)
4. Internal drivers have no direct impact on ECO, ENV, and SOC
5. External drivers have a direct impact on ECO, ENV, and SOC
6. KSF in RL is influenced by internal drivers only
7. KSF in RL has a direct impact on ECO and ENV but not SOC

4.5 Chapter 4 Summary

To summarize chapter 4, the researcher analyzed the collected data using the SEM technique. The statistical results showed that for the initial framework, all hypotheses were supported by the empirical data related to literature review. However, the researcher also proceeded further with a what-if analysis to test the significance of KSF in RL factors related to sustainability, in cases where there was a direct impact from internal and external drivers to sustainability. The statistical results were quite surprising in that the condition of direct impacts existed, KSF in RL impact to economic performance and environmental performance, but not social performance. Internal drivers had no direct impact on sustainability and need KSF in RL to create an impact on economics and the environment. External drivers are factors that have a direct impact on all sustainability but no impact for KSF in RL.

Next, in chapter 5, the statistical results will be interpreted and discussed based on the literature review, questionnaire, and business practices to understand the results and take proper actions.

Chapter 5
Discussion and Conclusions

The discussion and analysis of results from the study comprise this final chapter, along with the theoretical and managerial implications. Limitations are noted and further study for future development will be outlined.

5.1 Discussion

This research examined the structural model of the drivers of RL to understand the influences on and relationships of RL and the impact on organizational sustainability, viewed as the triple bottom-line. A total of 39 variables were analyzed by SEM using AMOS version 22. There were 210 completed surveys that were collected; after screening out the outliers, a data set of 161 questionnaires were used to test the hypotheses.

Based on the results, several key insights and implications for management are discussed.

5.1.1 Internal Drivers

The impact of internal drivers and KSF in RL was addressed in the literature review. In this research, internal and external drivers were tested and the results revealed that the internal drivers had a positive impact on the KSF, with a direct effect at 0.661 in Table 35.

H	Structural path	Std. Estimate	T-value	Result
H1	INT → KSF	0.661***	5.415	Supported

Table 35 Internal drivers impact on KSF in RL

When considering the level of impact of each internal driver, the results are shown in Table 36, ordered from the largest to the smallest value.

Variable	Definition	Factor loading
IN1	Policy and involvement from top management	0.826
IN5	Sustainability vision	0.786
IN7	Manufacturing technology support	0.777
IN8	Cost efficiency	0.761
IN3	Internally joint operation	0.754
IN4	Internally monitor progress	0.735
IN2	Define budget and responsible unit	0.713
IN6	Information system support	0.679

Table 36 Internal drivers' factor loading

The results showed that the highest influencing variable which can represent internal drivers is IN1 (Policy and involvement from top management), with a loading of 0.826, which is consistent with many of the studies reviewed (Brauchle et al., 2015; Chinda, 2017; Y. Li et al., 2018; Waqas et al., 2018).

Surprisingly, IN5 (sustainability vision), the loading of which was 0.786, implied that most of the beverage companies have applied a sustainability program to be ranked in the Dow Jones Sustainability Indices (DJSI) which it can be influenced to the score.

IN7 (manufacturing technology support) and IN8 (cost efficiency) were in third and fourth place, with loadings of 0.777 and 0.761, respectively. This shows that manufacturing technology support, such as bottling machines that can be used with reused packaging are also high-level drivers to the firm including with the RL operating cost which needs to control and optimize based on the trade-off with a new packaging cost which most of beverages company also operate RL by themselves along with forward logistics (Fleischmann et al., 2001; Guide Jr & Van Wassenhove, 2001).

IN3 (internally joint operation), IN4 (internally monitor progress), and IN2 (information system support) were at moderate level, with loadings of 0.754, 0.735, and 0.713, respectively, while the lowest was IN6 (information system support), which had a loading of 0.679, so it can be implied that most of the beverage companies still operate RL based on forward logistics platforms and focus on physical flows more than information flows.

5.1.2 External Drivers

The impact of external drivers and KSF in RL were addressed in the literature review. The results revealed that external drivers have a positive impact on the KSF, with a direct effect at 0.325 in Table 37.

H	Structural path	Std. Estimate	T-value	Result
H2	Ex → KSF	0.325**	3.045	Supported

Table 37 External drivers impact on KSF in RL

When considering the impact level of each external driver, the results are shown in Table 38 and ordered from the largest to the smallest value.

Variable	Definition	Factor loading
EX2	Qualify stakeholders' standard	0.780
EX5	Corporate citizenship	0.765
EX4	Consumer awareness	0.734
EX3	Green marketing	0.727
EX1	Laws and regulations compliance	0.654
EX6	Pollution	0.648

Table 38 External drivers' factor loading

The results showed that the highest influencing variable that can represent external drivers is EX2 (qualify stakeholders' standard), with a loading of 0.780, which was consistent with many of the studies reviewed (Govindan & Bouzon, 2018; Y. Li et al., 2018)

EX5 (corporate citizenship), EX4 (consumer awareness), and EX3 (green marketing) were in second, third, and fourth places, with loadings of 0.765, 0.734, and 0.727, respectively. This shows that the pressure from external factors is mostly caused by the expectation of social responsibility and management of customer awareness to help the firm to successfully implement RL.

EX1 (laws and regulations compliance) and EX6 (pollution) were in the fifth, and the last place, with loadings of 0.654, and 0.648 respectively. They are quite surprised that EX1 and EX6 should be the higher considerations for beverage companies to comply with the law. However, this is supported by the study by (Rogers & Tibben-Lembke, 2001), as most of the companies have been engaged with law enforcement and pollution standards for many years. So, the trend may shift to focus on the EX2 (qualify stakeholders' standard) instead.

5.1.3 KSF in RL

The impact of KSF in RL on the triple bottom-line was explored in the literature review. The results revealed that KSF in RL has a positive direct effect on all three constructs: economics (with a loading of 0.980), environmental (0.950), and social (0.871), detailed in Table 39.

H	Structural path	Std. Estimate	T-value	Result
H3	KSF → Eco	0.980***	9.838	Supported
H4	KSF → Env	0.950***	9.158	Supported
H5	KSF → Soc	0.871***	8.821	Supported

Table 39 KSF In RL impact on the triple bottom-line

When considering the impact level of each KSF in RL, the results are shown in Table 40 and are ordered from the largest to the smallest value.

Variable	Definition	Factor loading
KSF5	Optimal operating cost	0.836
KSF6	Value added	0.791
KSF4	IT system	0.784
KSF3	Logistics operation resources	0.775
KSF8	Stakeholders' collaboration	0.762
KSF7	Value recovery	0.742
KSF9	Government and regulator support	0.734
KSF2	Supplier and partnership network	0.666
KSF1	Logistics network coverage	0.591

Table 40 KSF in RL's factor loading

The results showed that the variables that most influence sustainability and that can represent the KSF in RL were KSF5 (optimal operating cost) and KSF6 (value added), which were in first and second place with loadings of 0.836 and 0.791, respectively. This implies that most beverage companies consider financial perspectives to justify whether the operating costs and post-consumption packaging are worthwhile operating. This was consistent with many studies in the literature review (V. D. Guide & Pentico, 2010; Kaviani et al., 2020).

However, another variable, KSF7 (value recovery), was in sixth place, which surprisingly contrasts with the objective of RL to recover the value of post-consumption packaging to reuse rather than conversion to other products.

KSF4 (IT system), KSF3 (logistics operation resources), KSF8 (stakeholders' collaboration), and KSF9 (government and regulator support) were in third, fourth, fifth, and seventh place, with loadings of 0.784, 0.775, 0.762, and 0.734, respectively. This shows that beverage companies also consider the infrastructure in both physical and information flows, including the collaboration with stakeholders and government support in the beverage supply chain for stabilizing RL operations.

Lastly, KSF2 (supplier and partnership network), and KSF1 (logistics network coverage) were in eighth and the last place, with loadings of 0.666 and 0.591, respectively. This implies that beverage companies consider their RL activities based on their network (forward logistics) of sold products rather than acquired others. Moreover, it points out that most companies have the capability to acquire the post-consumption reverse logistics by themselves rather than rely on others' networks and capabilities.

5.1.4 Economic Performance

The results revealed that the KSF in RL have a positive impact on economic performance, with a direct effect at 0.980, as shown in Table 41.

H	Structural path	Std. Estimate	T- value	Result
H3	KSF → Eco	0.980***	9.838	Supported

Table 41 KSF In RL impact on economic performance

When considering the impact level of each economic performance, the results are shown in Table 42 and are ordered from the largest to the smallest value.

Variable	Definition	Factor loading
ECOP1	Profit	0.879
ECOP4	Used packaging cost	0.816
ECOP6	Operating expenditure	0.759
ECOP3	New packaging cost	0.755
ECOP2	Business opportunity	0.746
ECOP7	Workload & effort	0.701
ECOP5	Waste management cost	0.672

Table 42 Economic performance's factor loading

The results showed that the highest influencing variable that can represent economic performance were ECOP1 (profit) and ECOP4 (used packaging cost) in first and second place with loadings of 0.879 and 0.816, respectively. Thailand's beverage companies realized that the highest impact for performing RL is to gain financial benefits for their business in the case of total cost saving and revenue on the investment of RL activities.

ECOP6 (operating expenditure) and ECOP7 (workload & effort) were in third and sixth place, with loadings of 0.759 and 0.701, respectively. The beverage companies also acknowledged that RL activities come with cost and workload increased; however, their concerns were at a moderate level compared with benefits from financial gains.

ECOP3 (new packaging cost), ECOP2 (business opportunity), and ECOP5 (Waste management cost) were in fourth, fifth, and seventh place, with loadings of 0.755, 0.746, and 0.672, respectively. This implies that for the post-consumption packaging, the reduction in new packaging costs and business opportunities has come in later priority, as it is a derived effect and the new packaging has to order to fulfill the incremental production sales volume time by time.

For the waste management cost, it is the least impact benefits, which implies that, normally, the beverage companies have not taken much responsibility for bringing back their sold packaging to manage the environmental and social problems afterward. However, this also contrasts with other industries, such as the electrical and electronics industries or construction whereas they concerned on the benefits of the reduction of waste management cost in priority to concern (Brauchle et al., 2015; Chiou et al., 2012; Kiatcharoenpol & Sirisawat, 2020).

5.1.5 Environmental Performance

The results revealed that the KSF in RL have a positive impact on environmental performance, with a direct effect at 0.950, as shown in Table 43.

H	Structural path	Std. Estimate	T-value	Result
H4	KSF → Env	0.950***	9.158	Supported
H5	KSF → Soc	0.871***	8.821	Supported

Table 43 KSF In RL impact on environmental performance

When considering the impact level of each environmental performance, the results are shown in Table 44 and are ordered from the largest to the smallest value.

Variable	Definition	Factor loading
ENVP4	Natural extraction	0.856
ENVP1	Energy consumption	0.829
ENVP2	Reusable rate	0.753
ENVP3	Carbon footprint	0.651

Table 44 Environmental Performance's factor loading

The results showed that the highest influencing variables that can represent environmental performance were ENVP4 (natural extraction) and ENVP1 (energy consumption), in first and second place with loadings of 0.856 and 0.829, respectively.

Thailand's beverage companies are mostly concerned with the environmental aspects of reducing the level of natural extraction and reducing the energy consumed for producing new packaging; however, this could be an impact for improving internally for improving organizational capabilities, while another two variables, ENVP2 (reusable rate) and ENVP3 (carbon footprint), have moderate impacts.

5.1.6 Social Performance

The results revealed that the KSF in RL have a positive impact on social performance, with a direct effect at 0.871 as shown in Table 45.

H	Structural path	Std. Estimate	T-value	Result
H5	KSF → Soc	0.871***	8.821	Supported

Table 45 KSF In RL impact on social performance

When considering the impact level of each social performance, the results are shown in Table 46 and ordered from the largest to the smallest value.

Variable	Definition	Factor loading
SOCP4	Job occupancy	0.878
SOCP2	Health and safety	0.874
SOCP1	Community complaints	0.850
SOCP5	Engagement	0.826
SOCP3	Social confidence	0.815

Table 46 Social Performance's factor loading

The results showed that all variables in social performance have a very high impact, with SOCP4 (job occupancy) having the highest loading of 0.878. The remaining variables, which are SOCP2 (health and safety), SOCP1 (community complaints), SOCP5 (engagement), and SOCP3 (social confidence) had loadings of 0.874, 0.850, 0,826, and 0.815, respectively. These results imply that most companies are concerned about jobs and employment with health and safety proposing to the community to strengthen the relationship according to the sustainability concept, while the engagement and confidence of stakeholders come later.

5.1.7 What-if analysis

According to the what-if analysis hypotheses testing of the direct impact from internal drivers and external drivers on sustainability performance, the results showed that two hypotheses were not aligned with the initial framework, with details shown in Table 47.

H	Structural path	Std. Estimate	T-value	Result	Matched or mismatched to the initial framework
H1e	INT → KSF	0.804***	5.196	Support	Matched
H2e	EX → KSF	0.111	0.807	Not Support	Mismatched
H3e	KSF → ECO	0.696***	5.613	Support	Matched
H4e	KSF → Env	0.256*	2.071	Support	Matched
H5e	KSF → SOC	0.001	0.006	Not support	Mismatched
H6	INT → ECO	0.027	0.186	Not support	The initial framework does not contain these hypotheses
H7	INT → Env	0.958	0.352	Not support	
H8	INT → SOC	-0.003	-0.019	Not support	
H9	EX → ECO	0.277**	2.695	Support	
H10	EX → Env	0.700***	5.328	Support	
H11	EX → SOC	0.927***	5.915	Support	

Table 47 Comparing the what-if analysis with the initial framework

Form the hypotheses testing during the what-if analysis, the KSF in RL was tested for its significance. The results were as follows:

1. Internal drivers rely on KSF in RL for influencing ECO and ENV
2. Internal drivers have no direct impact on any sustainability aspects (ECO, ENV, SOC)
3. KSF which were influenced by internal drivers have a positive impact on ECO and ENV but no impact on SOC
4. External drivers have a direct impact on all SOC, ENV, and ECO factors but there was no relationship with KSF at all
5. Companies that aim to improve ECO should focus on internal drivers by the direction of top management and also support by investment

or restructuring the firm by KSF to optimize operational costs should be priorities

6. Companies that aim to improve ENV and SOC should focus on external drivers, with collaboration among stakeholders and concern for customers' awareness are the highest priorities

5.1.8 Comparison of the initial framework with the what-if analysis

After understanding the differences between the initial framework and the what-if analysis by considering the path analysis, this section will compare the factor loadings of each observed variable to see the changes.

5.1.8.1 Internal drivers

Details of the factor loadings of internal drivers of the initial framework and what-if analysis are shown in Figure 33.

Initial framework

Variables	Description	Factor loading	R^2
IN1	**Policy and Involvement from top management**	**0.826*****	**0.683**
IN5	Sustainability vision	0.786***	0.617
IN7	Manufacturing technology support	0.777***	0.603
IN8	Cost efficiency	0.761***	0.579
IN3	Internally joint operation	0.754***	0.568
IN4	Internally monitor progress	0.735***	0.541
IN2	Define budget and responsible unit	0.713***	0.509
IN6	Information system support	0.679***	0.461

What-if analysis

Variables	Description	Factor loading	R^2
IN1	**Policy and Involvement from top management**	**0.828*****	**0.686**
IN5	Sustainability vision	0.789***	0.622
IN3	Internally joint operation	0.784***	0.615
IN7	Manufacturing technology support	0.773***	0.598
IN4	Internally monitor progress	0.759***	0.577
IN8	Cost efficiency	0.750***	0.563
IN2	Define budget and responsible unit	0.702***	0.493
IN6	Information system support	0.678***	0.460

Figure 33 Internal drivers factor loading comparison

The results showed that policy and involvement from top management (IN1) and sustainability vision (IN2) were again the highest priorities. Moderate levels are shifted by the internally joint operation (IN3), manufacturing technology support (IN7), and internal monitoring progress (IN4), while the cost efficiency (IN8) was less important.

Define budget and responsible unit (IN2) and information system support (IN5) were also still at a low level, as in the initial framework. This again indicated that with or without the direct impact of internal drivers to sustainability, the factor loadings were not significantly different.

5.1.8.2 External drivers

The factor loadings of external drivers of the initial framework and what-if analysis are shown in Figure 34.

Initial framework

Variables	Description	Factor loading	R^2
EX2	**Qualify stakeholders' standard**	**0.780*** **	**0.608**
EX5	Corporate citizenship	0.765***	0.586
EX4	Consumer awareness	0.734***	0.538
EX3	Green marketing	0.727***	0.528
EX1	Laws and regulations compliance	0.654***	0.428
EX6	Pollution	0.648***	0.420

What-if analysis

Variables	Description	Factor loading	R^2
EX2	**Qualify stakeholders' standard**	**0.736*** **	**0.541**
EX4	Consumer awareness	0.732***	0.536
EX5	Corporate citizenship	0.714***	0.51
EX3	Green marketing	0.712***	0.507
EX1	Laws and regulations compliance	0.685***	0.469
EX6	Pollution	0.681***	0.464

Figure 34 External drivers factor loading comparison

The results showed that the qualify stakeholders' standard (EX2) was still considered to be the highest priority for external drivers in RL. Consumer awareness (EX4) and corporate citizenship (EX5) were also positioned in the higher ranks.

The remainder, i.e., green marketing (EX3), laws and regulation compliance (EX1), and pollution (EX6) remained the same, with no changes. This also indicated that with or without the direct impact of external drivers on sustainability the factor loadings did not differ significantly.

5.1.8.3 KSF in RL

The factor loadings of KSF in RL of the initial framework and what-if analysis is shown in Figure 35.

Initial framework

Variables	Description	Factor loading	R^2
KSF5	**Optimal operating cost**	**0.836*** **	**0.698**
KSF6	Value added	0.791***	0.626
KSF4	IT System	0.784***	0.615
KSF3	Logistics operation resources	0.775***	0.601
KSF8	Stakeholders collaboration	0.762***	0.581
KSF7	Value recovery	0.742***	0.550
KSF9	Government and regulator support	0.734***	0.538
KSF2	Supplier and partnership network	0.666***	0.443
KSF1	Logistics network coverage	0.591***	0.349

What-if analysis

Variables	Description	Factor loading	R^2
KSF5	**Optimal operating cost**	**0.866*** **	**0.751**
KSF3	Logistics operation resources	0.816***	0.666
KSF4	IT System	0.814***	0.663
KSF8	Stakeholders collaboration	0.795***	0.631
KSF6	Value added	0.787***	0.619
KSF9	Government and regulator support	0.754***	0.568
KSF7	Value recovery	0.738***	0.545
KSF2	Supplier and partnership network	0.713***	0.508
KSF1	Logistics network coverage	0.637***	0.406

Figure 35 KSF in RL factor loading comparison

The results showed that optimal operating cost (KSF5) is still considered to be of the highest level of importance. Logistics operation resources (KSF3), IT system (KSF4), stakeholders' collaboration (KSF8), and value-added (KSF6) were also high priorities to create impact.

Government and regulator support (KSF9) and value recovery (KSF7) were at a moderate level ,while supplier and partnership network (KSF2) and logistics network coverage (KSF1) were the lowest priorities. This also indicated that with or without the direct impact of external drivers on sustainability, the factor loadings did not differ significantly.

5.1.8.4 Economic Performance

The factor loadings of the economic performance of the initial framework and what-if analysis are shown in Figure 36.

Initial framework

Variables	Description	Factor loading	R^2
ECOP1	**Profit**	**0.879*** **	**0.772**
ECOP4	Used packaging cost	0.816***	0.666
ECOP6	Operating expenditure	0.759***	0.576
ECOP3	New packaging cost	0.755***	0.569
ECOP2	Business opportunity	0.746***	0.560
ECOP7	Workloads & efforts	0.701***	0.491
ECOP5	Waste management cost	0.672***	0.451

What-if analysis

Variables	Description	Factor loading	R^2
ECOP1	**Profit**	**0.881*** **	**0.775**
ECOP4	Used packaging cost	0.828***	0.685
ECOP6	Operating expenditure	0.778***	0.605
ECOP3	New packaging cost	0.743***	0.551
ECOP2	Business opportunity	0.736***	0.542
ECOP7	Workloads & efforts	0.731***	0.535
ECOP5	Waste management cost	0.689***	0.475

Figure 36 Economic performance factor loading comparison

The results showed that all variables still have the same priority, with no changes. This also indicated that with or without the direct impact of both drivers on economic performance, the factor loadings did not differ significantly.

5.1.8.5 Environmental Performance

The factor loadings for environmental performance of the initial framework and what-if analysis are shown in Figure 37.

Initial framework

Variables	Description	Factor loading	R^2
ENVP4	**Natural extraction**	**0.856*** **	**0.733**
ENVP1	Energy consumption	0.829***	0.688
ENVP2	Reusable rate	0.753***	0.567
ENVP3	Carbon footprint	0.651***	0.424

What-if analysis

Variables	Description	Factor loading	R^2
ENVP4	**Natural extraction**	**0.855*** **	**0.731**
ENVP1	Energy consumption	0.836***	0.699
ENVP2	Reusable rate	0.738***	0.544
ENVP3	Carbon footprint	0.616***	0.380

Figure 37 Environmental performance factor loading comparison

The results showed that all variables still have the same priority, with no changes. This also indicated that with or without the direct impact of both drivers to environmental performance, the factor loadings did not differ significantly.

5.1.8.6 Social Performance

The factor loadings of social performance of the initial framework and what-if analysis are shown in Figure 38.

Initial framework

Variables	Description	Factor loading	R^2
SOCP4	**Job occupancy**	**0.878*** **	**0.772**
SOCP2	Health and safety	0.874***	0.764
SOCP1	Community complaints	0.850***	0.722
SOCP5	Engagement	0.826***	0.682
SOCP3	Social confidence	0.815***	0.665

What-if analysis

Variables	Description	Factor loading	R^2
SOCP4	**Job occupancy**	**0.897*** **	**0.805**
SOCP1	Community complaints	0.878***	0.771
SOCP2	Health and safety	0.874***	0.764
SOCP3	Social confidence	0.816***	0.666
SOCP5	Engagement	0.811***	0.657

Figure 38 Social performance factor loading comparison

The results showed that job occupancy (SOCP4) is still considered to be at the highest level of importance. Community complaints (SOCP1), health and safety (SOCP2), and social confidence (SOCP3) were also considered to be a priority, while engagement (SOCP5) came last but was still significant. This also indicated that with or without the direct impact of both drivers on social performance, the factor loadings did not differ significantly.

5.1.9 Proposed Strategy for RL

The analysis showed the relationship and impact of both drivers on sustainability performance from three perspectives. This can be mapped back to the strategy to propose based on the following process.

Figure 39 Process for proposing RL strategy

The RL strategy developed will consist of three parts that serve each of the three pillars, which are economic performance, environmental performance, and social performance. Details are shown below.

5.1.9.1 RL Strategy for Economic Performance

To improve economic performance, the SEM model indicated that two factors affecting, which are shown Figure 40.

Internal Drivers

Variables	Definition	factor loading	R^2
IN1	Policy and Involvement from top management	0.828***	0.686
IN5	Sustainability vision	0.789***	0.622
IN3	Internally joint operation	0.784***	0.615
IN7	Manufacturing technology support	0.773***	0.598
IN4	Internally monitor progress	0.759***	0.577
IN8	Cost efficiency	0.75***	0.563
IN2	Define budget and responsible unit	0.702***	0.493
IN6	Information system support	0.678***	0.46

0.804 →

KSF in RL

Variables	Definition	factor loading	R^2
KSF5	Optimal operating cost	0.866***	0.751
KSF3	Logistics operation resources	0.816***	0.666
KSF4	IT System	0.814***	0.663
KSF8	Stakeholders collaboration	0.795***	0.631
KSF6	Value added	0.787***	0.619
KSF9	Government and regulator support	0.754***	0.568
KSF7	Value recovery	0.738***	0.545
KSF2	Supplier and partnership network	0.713***	0.508
KSF1	Logistics network coverage	0.637***	0.406

0.696 →

External Drivers

Variables	Definition	factor loading	R square
EX2	Qualify stakeholder's standard	0.736***	0.541
EX4	Consumer awareness	0.732***	0.536
EX5	Corporate citizenship	0.714***	0.510
EX3	Green marketing	0.712***	0.507
EX1	Laws and regulations compliance	0.685***	0.469
EX6	Pollution	0.681***	0.464

0.277 →

Economic performance

Variables	Definition	factor loading	R^2
ECOP1	Profit	0.881***	0.775
ECOP4	Used packaging cost	0.828***	0.685
ECOP6	Operating expenditure	0.778***	0.605
ECOP3	New packaging cost	0.743***	0.551
ECOP2	Business opportunity	0.736***	0.542
ECOP7	Workloads & efforts	0.731***	0.535
ECOP5	Waste management cost	0.689***	0.475

Figure 40 RL strategy for economic performance

From the SEM results, it was found that KSF in RL creates the highest impact on economic performance factors, at 0.696, which was more than the external drivers, which also have a positive impact at 0.277. However, KSF in RL alone is not sufficient; it also needs internal drivers from a company to drive KSF in RL.

From the literature review, many studies confirmed and suggested that firms should implement operations by controlling the acquisition costs; strengthen logistics operations, by optimizing and integrating logistics resources and networks of forward and reverse logistics; and also initiate an RL IT system to improve operational efficiency which will lead to the gain of financial benefits (De Brito & Dekker, 2004; Fleischmann et al., 2001; Guide Jr & Van Wassenhove, 2001; V. D. Guide & Pentico, 2010).

5.1.9.2 RL Strategy for environmental performance

To improve environmental performance, SEM indicated that two factors affecting, which are shown in Figure 41.

Internal Drivers

Variables	Definition	factor loading	R^2
IN1	Policy and Involvement from top management	0.828***	0.686
IN5	Sustainability vision	0.789***	0.622
IN3	Internally joint operation	0.784***	0.615
IN7	Manufacturing technology support	0.773***	0.598
IN4	Internally monitor progress	0.759***	0.577
IN8	Cost efficiency	0.75***	0.563
IN2	Define budget and responsible unit	0.702***	0.493
IN6	Information system support	0.678***	0.46

0.804

KSF in RL

Variables	Definition	factor loading	R^2
KSF5	Optimal operating cost	0.866***	0.751
KSF3	Logistics operation resources	0.816***	0.666
KSF4	IT System	0.814***	0.663
KSF8	Stakeholders collaboration	0.795***	0.631
KSF6	Value added	0.787***	0.619
KSF9	Government and regulator support	0.754***	0.568
KSF7	Value recovery	0.738***	0.545
KSF2	Supplier and partnership network	0.713***	0.508
KSF1	Logistics network coverage	0.637***	0.406

0.256

External Drivers

Variables	Definition	factor loading	R^2
EX2	Qualify stakeholder's standard	0.736***	0.541
EX4	Consumer awareness	0.732***	0.536
EX5	Corporate citizenship	0.714***	0.510
EX3	Green marketing	0.712***	0.507
EX1	Laws and regulations compliance	0.685***	0.469
EX6	Pollution	0.681***	0.464

0.700

Environmental Performance

Variables	Definition	factor loading	R^2
ENVP4	Natural extraction	0.855***	0.731
ENVP1	Energy consumption	0.836***	0.699
ENVP2	Reusable rate	0.738***	0.544
ENVP3	Carbon footprint	0.616***	0.380

Figure 41 RL strategy for economic performance

According to the SEM results, it was seen that external drivers create the highest impact on the environmental performance factors, at 0.700, which was more than the KSF in RL, which also had a positive impact at 0.256. However, KSF in RL alone is insufficient; internal drivers from the company are also needed to drive forward KSF in RL.

From the literature review, many studies reconfirmed and suggested that firms grow and respond the external drivers, such as extending collaborations with stakeholders such as business partners; the government should also help to build up and motivate consumer awareness of environmental issues to help to reduce post-consumption waste (Brauchle et al., 2015; Chinda, 2017; Khor et al., 2016; Y. Li et al., 2018).

There was a surprise in relation to the laws and regulation compliance issue, which was expected at the beginning would be a high loading, but the analysis showed that its loading was the second lowest. This implies that law enforcement is a mandatory aspect that businesses should comply with and which has been affecting them for many years (Rogers & Tibben-Lembke, 2001); trade barriers in the form of qualification of stakeholders' standards is more important these days.

5.1.9.3 RL Strategy Social Performance

To improve social performance, the SEM model indicated that there was one factor that affecting this most, as shown in Figure 42.

External Drivers

Variables	Definition	factor loading	R^2
EX2	Qualify stakeholder's standard	0.736***	0.541
EX4	Consumer awareness	0.732***	0.536
EX5	Corporate citizenship	0.714***	0.51
EX3	Green marketing	0.712***	0.507
EX1	Laws and regulations compliance	0.685***	0.469
EX6	Pollution	0.681***	0.464

→ 0.927 →

Social performance

Variables	Definition	factor loading	R^2
SOCP4	Job occupancy	0.897***	0.805
SOCP1	Community complaints	0.878***	0.771
SOCP2	Health and safety	0.874***	0.764
SOCP3	Social confidence	0.816***	0.666
SOCP5	Engagement	0.811***	0.657

Figure 42 RL strategy for social performance

From the SEM results, it was found that external drivers are the only factor that is significant for social performance factors, at 0.927, while the KSF in RL and internal drivers were not significant.

From the literature review, many studies reconfirmed and suggested that firms should be concerned with consumer awareness and green marketing, which tended to grow faster and have a higher impact on society; this indicates that business and community need to sustain each other, which can be done by collaborating with stakeholders in the supply chain and also with governments and regulators (Agrawal & Singh, 2019; Akdoğan & Coşkun, 2012; De Brito & Dekker, 2004; Govindan & Bouzon, 2018; Singh, 2016). For business practice, the consortium of network partners was also established to synergize and support 360 degrees such as financial, operations, resource pooling, recognition, and promotion program, etc. to rebate for the society.

5.1.9.4 Stakeholders' actions

To summarize the strategy into action, the researcher consolidated and analyzed the statistical results that matched the literature review and added this to the information obtained from the questionnaires to identify practitioner insights, which can be described as follows:

1. Communicate issues to stakeholders to initiate and support RL activities to promote their success in the long-term
2. Leaders' visions for driving business Profit and Loss, including improvements in processes for sustainability, which should not only focus on business but also simultaneously build and strengthen the community to support business
3. Improve technologies in RL to eliminate redundant processes and improve productivity. If this process is well supported, RL will occur and be followed by social responsibility
4. Companies must optimize the cost of acquisition for reusing post-consumption packaging, as it consumes money and time during many hidden activities, such as transportation, sorting, cleaning, etc.
5. A challenge for the reuse of packaging at present occurred with PET bottles, as some products contain colors that are considered to be contamination
6. The process of RL post-consumption packaging is very risky and complicated, and it needs to be handled with care as the loading patterns are not stable. Feedback from or engagement with the operational level should be considered to improve these operations

7. Government and regulators should support RL, as one-way packaging is currently more economical for manufacturers. If taxes can be reduced or removed, manufactures can use the savings to subsidize and improve RL efficiency
8. Partnership and collaboration among supply chains is necessary for optimizing investment and operating costs. In addition, there should be cooperation with the government sector to strengthen communities, by offering employment as a long-term engagement

Finally, the researcher would like to propose actions based on a holistic view of the quantitative and qualitative data obtained, as shown in Table 48.

Who	Action
Government	• Enforce laws to oblige manufacturers to take back their products which other countries have legalized this policy (Akdoğan & Coşkun, 2012) • Incentivize both tangible and intangible benefits to motivate manufacturers and recycling businesses to engage in the reuse and recycling of content (Y. Li et al., 2018)
Beverage manufacturers	• Optimize and integrate logistics resources and networks of forward and reverse logistics to improve efficiency (Fleischmann et al., 2001) • Collaborate with stakeholders in the supply chain both upstream and downstream, including customers, to ensure a closed-loop for the packaging journey (Brauchle et al., 2015)
Packaging producers	• Develop the capability to produce packaging by using collected, recycled content rather than using extracted virgin resources

Who	Action
	• Collaborate with customers to innovate environmentally friendly packaging that can be 100% recycled, especially PET bottles
Consumers	• Increase the awareness of waste-related problems that impact on communities' well-being and environmental issues

Table 48 Stakeholder actions

5.2 Conclusions

This study aimed to analyze the driving forces in the reverse logistics of post-consumption packaging in the beverage industry in Thailand and examine the impact of sustainability associated to reverse logistics. A total of 39 variables related to drivers and key success factors, including organization sustainability perspectives, were also modeled. A questionnaire was designed based on an 11-point Likert scale and item–objective congruence was performed by experts from academia and business. Purposive sampling was conducted with 210 respondents from alcoholic and non-alcoholic beverage manufacturers. Data collection proceeded online and data were analyzed using structural equation modeling to test hypotheses.

The initial results showed that both internal and external drivers had a positive impact on key success factors, but internal drivers had a stronger impact than external drivers, while the success factors positively impacted economic, environmental, and social performance, in that order.

However, when considering what-if analysis, there might be the possibility that drivers have a direct impact on an organization's sustainability, so the researcher continued to develop a new framework and found that internal drivers had a positive impact on key success factors and affected economics and the environment, while external factors had no relationship with key success factors but had a direct impact on all triple bottom-lines.

Lastly, this research contributed to Thailand's beverage industry by increasing the understanding of the significance of drivers and key success factors to improve organizational performance in a sustainable manner.

5.3 Managerial Implications

The results of this study will be useful for the business sector, especially management, in the Thailand beverage industry, who require an understanding of how the drivers that affected the KSF in RL also impact the sustainability of performance improvements in the future.

The findings also suggested that implementing RL with proper KSF will improve economic performance in terms of financial perspectives, although it comes with an increased burden in terms of workload and time-consumed. Top-level management support is the most crucial aspect to drive a company to achieve good results in the long term. However, if companies are concerned about environmental and social perspectives, the study also revealed that there is no need to invest in infrastructure, resources, or systems. It can be achieved with proper drivers alone, especially external drivers, which have the strongest influence.

5.4 Limitations of the Research

There were several limitations to this study.

1. The data collection process was very time-consuming, as this topic is related to supply chain business in beverage companies, and many companies considered RL operations to be their intellectual property that gave them a competitive advantage, so the researcher had to remind and re-send the questionnaire to those who are opened minded or having a personal relationship in basis.
2. The COVID-19 pandemic was another obstacle that forced the researcher to contact the respondents or their representatives via an online platform.
3. The sample population for this research was mainly contributed by large-scale companies that have considerable financial support, while there are

entrepreneurs in Thailand in SMEs (small and medium enterprises) in the market who may have different driving forces or KSF in RL.

4. The study results may vary according to the sample population, especially if the populations produce or use packaging other than glass, PET bottles, and aluminum cans.
5. The proposed strategy is a framework that was developed based on the author's data and information, including business practices in Thailand. It still needs to be confirmed using a scientific methodology, such as analytical hierarchy process (AHP) for decision-making, as reviewed from the literature.

5.5 Recommendations for Future Research

Recommendations for further study are as follows:

1. Future research should consider the characteristics of the type of packaging and extend the scope of the sample to include SMEs to compare whether the internal drivers, external drivers, KSF in RL, and sustainability impacts are aligned with large-scale businesses.
2. Based on the data from the survey, packaging used for ultraheat-treated (UHT) products, such as dairy products and juice was not included, even though the researcher sent questionnaires to these companies.
3. An analysis of the proposed strategy will be necessary to reconfirm the empirical data.

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Appendix

ที่ อว64.25/ลจต246/63

หลักสูตรสหสาขาวิชาการจัดการโลจิสติกส์
และโซ่อุปทาน บัณฑิตวิทยาลัย
จุฬาลงกรณ์มหาวิทยาลัย
ถนนพญาไท ปทุมวัน กทม. 10330

7 สิงหาคม 2563

เรื่อง ขอความอนุเคราะห์เข้าพบเพื่อนำเสนองานวิจัย และเก็บข้อมูลแบบสอบถาม

เรียน นายกสมาคมอุตสาหกรรมเครื่องดื่มไทย

ด้วย นายปฏิภาณ สัจจโสภณ รหัสประจำตัว 6087778720 นิสิตระดับปริญญาเอก หลักสูตรวิทยาศาสตรดุษฎีบัณฑิต สาขาวิชาการจัดการโลจิสติกส์และโซ่อุปทาน (นานาชาติ) บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย ได้ทำการศึกษาและจัดทำวิจัยทางด้านการจัดการด้านโลจิสติกส์ เรื่อง "แรงขับเคลื่อนที่ส่งผลต่อการทำโลจิสติกส์ย้อนกลับของบรรจุภัณฑ์ในระบบเศรษฐกิจหมุนเวียนสำหรับอุตสาหกรรมเครื่องดื่มของประเทศไทย จากมุมมองของผู้ผลิต" เพื่อศึกษาปัจจัยที่เป็นแรงผลักดันและปัจจัยสำเร็จในการพัฒนากระบวนการทำโลจิสติกส์ย้อนกลับของบรรจุภัณฑ์เครื่องดื่มที่มีจำหน่ายในประเทศไทย โดยมีศาสตราจารย์ ดร. กมลชนก สุทธิวาทนฤพุฒิ (อาจารย์ที่ปรึกษาหลัก) และ รองศาสตราจารย์ ดร. พงศา พรชัยวิเศษกุล (อาจารย์ที่ปรึกษาร่วม)

ทั้งนี้ได้ทำการประสานงานกับสมาคมอุตสาหกรรมเครื่องดื่มไทยเบื้องต้นแล้ว เพื่อขอความอนุเคราะห์ในการประสานงานกับสมาชิกของสมาคมเพื่อเก็บแบบสอบถาม นำเสนอหลักการวิจัย และประโยชน์ที่จะได้รับ โดยนิสิตผู้วิจัยจะได้ประสานงานในรายละเอียดต่อไป

ในการนี้ หลักสูตรสหสาขาวิชาการจัดการโลจิสติกส์และโซ่อุปทาน (นานาชาติ) บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย จึงขอความอนุเคราะห์ดังกล่าว โดยนิสิต นายปฏิภาณ สัจจโสภณ หมายเลขโทรศัพท์ 08C-450-8532 อีเมล์ patiparn.sa@gmail.com เป็นผู้ประสานงาน หลักสูตรฯ หวังเป็นอย่างยิ่งจะได้รับความอนุเคราะห์จากท่าน และขอขอบคุณมา ณ โอกาสนี้

ขอแสดงความนับถือ

Patiparn Sajjasophon

(นายปฏิภาณ สัจจโสภณ)
นิสิตหลักสูตรวิทยาศาสตร์ดุษฎีบัณฑิตสาขาวิชาการจัดการโลจิสติกส์และโซ่อุปทาน

(ผู้ช่วยศาสตราจารย์ ดร. ธารทัศน์ โมกขมรรคกุล)
ผู้อำนวยการหลักสูตรสหสาขาวิชาการจัดการโลจิสติกส์และโซ่อุปทาน

หลักสูตรสหสาขาวิชาการจัดการโลจิสติกส์และโซ่อุปทาน
โทร. 02-2183113-4 โทรสาร. 02-251-2354

แรงขับเคลื่อนที่ส่งผลต่อการทำโลจิสติกส์ย้อนกลับของบรรจุภัณฑ์หลังการบริโภค

สำหรับอุตสาหกรรมเครื่องดื่มของประเทศไทย

(DRIVING FORCES FOR REVERSE LOGISTICS POST CONSUMPTION PACKAGING

FOR THAILAND BEVERAGE INDUSTRY)

<u>คำชี้แจงในการตอบแบบสอบถาม</u>

แบบสอบถามนี้เป็นส่วนหนึ่งของการวิจัยเรื่อง “แรงขับเคลื่อนที่ส่งผลต่อการทำโลจิสติกส์ย้อนกลับของบรรจุภัณฑ์หลังการบริโภค สำหรับอุตสาหกรรมเครื่องดื่มของประเทศไทย โดยนิสิตปริญญาเอก หลักสูตรการจัดการโลจิสติกส์และโซ่อุปทาน จุฬาลงกรณ์มหาวิทยาลัย โดยมีวัตถุประสงค์ในการวิจัยคือ

1. วิเคราะห์ปัจจัยที่เป็นแรงขับเคลื่อนในการทำโลจิสติกส์ย้อนกลับของบรรจุภัณฑ์หลังการบริโภคในอุตสาหกรรมเครื่องดื่ม
2. ระบุปัจจัยที่ส่งผลต่อสำเร็จต่อการทำโลจิสติกส์ย้อนกลับของบรรจุภัณฑ์หลังการบริโภคในอุตสาหกรรมเครื่องดื่ม
3. วิเคราะห์ระดับความสัมพันธ์และผลกระทบที่คาดหวังว่าจะได้รับจากการทำโลจิสติกส์ย้อนกลับในมิติของความยั่งยืน (เศรษฐกิจ สิ่งแวดล้อม และสังคม)
4. กำหนดกลยุทธ์ที่เหมาะสมในการพัฒนากระบวนการทำโลจิสติกส์ย้อนกลับ

ดังนั้น จึงใคร่ขอความอนุเคราะห์จากทุกท่านสละเวลาประมาณ 15 นาทีในการตอบแบบสอบถามให้ครบทุกข้อตามความเป็นจริง และตามความคิดเห็นของท่าน เพื่อจะได้นำผลการวิจัยไปใช้ประโยชน์ทางการศึกษาและพัฒนาอุตสาหกรรมเครื่องดื่มของประเทศไทยต่อไป

ข้อมูลที่ท่านตอบในแบบสอบถามทั้งหมดถือเป็นความลับ ซึ่งจะนำเสนอผลการวิจัยในลักษณะโดยรวมเท่านั้น จะไม่มีการระบุชื่อ และข้อมูลของบริษัทแต่อย่างใด

แบบสอบถามแบ่งออกเป็น 5 ส่วน ดังนี้

ส่วนที่ 1: ข้อมูลการประกอบธุรกิจของบริษัท

ส่วนที่ 2: แรงขับเคลื่อนที่ส่งผลต่อการทำโลจิสติกส์ย้อนกลับ

ส่วนที่ 3: ปัจจัยที่ส่งผลสำเร็จต่อการทำโลจิสติกส์ย้อนกลับ

ส่วนที่ 4: ผลกระทบที่คาดหวังว่าจะได้จากการทำโลจิสติกส์ย้อนกลับ

ส่วนที่ 5: ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม

จึงเรียนมาเพื่อโปรดพิจารณาให้ความอนุเคราะห์ข้อมูล และขอขอบพระคุณมา ณ โอกาสนี้

ส่วนที่ 1: ข้อมูลการประกอบธุรกิจของบริษัท

คำชี้แจง: โปรดเลือกข้อที่ตรงกับบริษัทของท่านมากที่สุด และระบุรายละเอียดหรือข้อมูลเพิ่มเติมในช่องโปรดระบุ

1. สินค้าที่บริษัทของท่านผลิต เป็นเครื่องดื่มประเภทใด (ตอบได้มากกว่า 1 ข้อ)

   ☐ สุรา ☐ เบียร์ ☐ เครื่องดื่มไม่มีแอลกอฮอล์

   ☐ อื่นๆ โปรดระบุ

2. บรรจุภัณฑ์ของสินค้าในการจำหน่าย เป็นประเภท (ตอบได้มากกว่า 1 ข้อ)

   ☐ ขวดแก้ว ☐ ขวดพลาสติกใส (PET) ☐ กระป๋อง

   ☐ อื่นๆ โปรดระบุ ...

3. ประเภทของกิจการ

   ☐ บริษัทต่างชาติ ☐ บริษัทสัญชาติไทย ☐ บริษัทร่วมทุนจดทะเบียน

4. จำนวนพนักงานในบริษัทของท่าน

   ☐ 1 – 1,000 คน ☐ 1,001 – 2,000 คน ☐ มากกว่า 2000 คนขึ้นไป

5. บริษัทของท่านมีหน่วยงานผู้รับผิดชอบโดยตรงในการทำโลจิสติกส์ย้อนกลับหารือไม่

   ☐ มี รับผิดชอบโดย......................

   ☐ ไม่มี หากในอนาคตวางแผนที่จะดำเนินกิจกรรมโลจิสติกส์ย้อนกลับ จะรับผิดชอบโดย ....

ส่วนที่ 2: แรงขับเคลื่อนที่ส่งผลต่อการทำโลจิสติกส์ย้อนกลับ

คำชี้แจง: ขอให้ท่านพิจารณา ท่านเห็นด้วยหรือไม่ ว่าปัจจัยต่างๆ เหล่านี้มีผลต่อการทำโลจิสติกส์ย้อนกลับ โดยมีระดับคะแนนดังต่อไปนี้

10	หมายถึง	เห็นด้วยมากที่สุด (Very strongly agree)		4	หมายถึง	ไม่เห็นด้วยน้อยที่สุด (Slightly disagree)
9	หมายถึง	เห็นด้วยมาก (Strongly agree)		3	หมายถึง	ไม่เห็นด้วยปานกลาง (Mostly disagree)
8	หมายถึง	เห็นด้วย (Agree)		2	หมายถึง	ไม่เห็นด้วย (Disagree)
7	หมายถึง	เห็นด้วยปานกลาง (Mostly agree)		1	หมายถึง	ไม่เห็นด้วยมาก (Strongly disagree)
6	หมายถึง	เห็นด้วยน้อยที่สุด (Slightly agree)		0	หมายถึง	ไม่เห็นด้วยมากที่สุด (Very strongly disagree)
5	หมายถึง	**ไม่ใช่** ทั้งเห็นด้วย และไม่เห็นด้วย (Neither agree nor disagree)				

0 ไม่เห็นด้วยมากที่สุด → 10 เห็นด้วยมากที่สุด

ปัจจัย	ระดับความเห็น										
	0	1	2	3	4	5	6	7	8	9	10
ส่วนที่ 1: ปัจจัยภายในบริษัท											
1. ผู้บริหารระดับสูงเข้าร่วมกำหนดนโยบายและมีส่วนร่วมในการทำกิจกรรมโลจิสติกส์ย้อนกลับสำหรับบรรจุภัณฑ์ของสินค้าที่จำหน่ายออกไป											
2. บริษัทมีการจัดตั้งงบประมาณ และผู้รับผิดชอบกิจกรรมโลจิสติกส์ย้อนกลับ											
3. หน่วยงานภายในบริษัทมีการกำหนดแผนงานหรือดำเนินโครงการร่วมกัน (Joint Operation) ในการทำกิจกรรมโลจิสติกส์ย้อนกลับ											
4. หน่วยงานภายในบริษัทมีการติดตามประสิทธิภาพการทำกิจกรรมโลจิสติกส์ย้อนกลับร่วมกัน ผ่านกลไกต่างๆ เช่น การประชุม performance review เป็นต้น											
5. บริษัทมีการกำหนดวิสัยทัศน์โดยใช้หลักการพัฒนาความยั่งยืนมาประยุกต์ใช้ในแผนการทำธุรกิจ											
6. บริษัทมีการลงทุนระบบเทคโนโลยีสารสนเทศที่มีความสามารถในการบริหารจัดการกิจกรรมโลจิสติกส์ย้อนกลับ เช่นระบบฐานข้อมูลบรรจุภัณฑ์ใช้แล้ว ระบบบริหารจัดการงานขนส่ง เป็นต้น											
7. บริษัทมีการลงทุนในกระบวนการผลิตสินค้าที่สนับสนุนกับการนำบรรจุภัณฑ์มาใช้ใหม่ เช่น เครื่องจักรคัดแยก และทำความสะอาดบรรจุภัณฑ์ใช้แล้ว เครื่องจักรที่ใช้ในการบรรจุสินค้า เป็นต้น											
8. บริษัทมีการกำหนดเป้าหมายในการนำบรรจุภัณฑ์ใช้แล้ว กลับมาใช้ใหม่ เพื่อมุ่งเน้นการลดต้นทุนการขายสินค้า (Cost of Goods Sold)											
ส่วนที่ 2: ปัจจัยภายนอกบริษัท											
1. บริษัทต้องการเตรียมความพร้อมในการรองรับการปรับเปลี่ยนของกฎ ระเบียบและนโยบายทางการค้าของภาครัฐที่มีต่ออุตสาหกรรมเครื่องดื่ม											

ปัจจัย	ระดับความเห็น										
	0	1	2	3	4	5	6	7	8	9	10
2. บริษัทต้องการตอบสนองความต้องการของคู่ค้า หรือลูกค้าที่เรียกร้องให้มีการคำนึงถึงผลกระทบต่อสิ่งแวดล้อม และความรับผิดชอบต่อสังคมมากยิ่งขึ้น											
3. บริษัทต้องการสร้างภาพลักษณ์ที่ดีในการทำธุรกิจโดยคำนึงถึงผลกระทบด้านสิ่งแวดล้อม											
4. บริษัทต้องการตอบสนองต่อความคาดหวังของผู้บริโภค ที่มีความตระหนักถึงปัญหาสิ่งแวดล้อมในปัจจุบัน											
5. บริษัทมีการกำหนดนโยบายในการติดตามผลกระทบจากบรรจุภัณฑ์ที่บริษัทจำหน่าย และรายงานให้ผู้มีส่วนได้เสียรับทราบ											
6. บริษัทมีนโยบายในการควบคุมมลพิษต่อสิ่งแวดล้อมที่เกิดจากขยะบรรจุภัณฑ์											

ส่วนที่ 3: ปัจจัยที่ส่งผลสำเร็จต่อการทำโลจิสติกส์ย้อนกลับ

คำชี้แจง: ขอให้ท่านพิจารณา ท่านเห็นด้วยหรือไม่ ว่าปัจจัยต่างๆ เหล่านี้มีผลต่อความสำเร็จในการทำโลจิสติกส์ย้อนกลับ โดยมีระดับคะแนนดังต่อไปนี้

10	หมายถึง	เห็นด้วยมากที่สุด (Very strongly agree)		4	หมายถึง	ไม่เห็นด้วยน้อยที่สุด (Slightly disagree)
9	หมายถึง	เห็นด้วยมาก (Strongly agree)		3	หมายถึง	ไม่เห็นด้วยปานกลาง (Mostly disagree)
8	หมายถึง	เห็นด้วย (Agree)		2	หมายถึง	ไม่เห็นด้วย (Disagree)
7	หมายถึง	เห็นด้วยปานกลาง (Mostly agree)		1	หมายถึง	ไม่เห็นด้วยมาก (Strongly disagree)
6	หมายถึง	เห็นด้วยน้อยที่สุด (Slightly agree)		0	หมายถึง	ไม่เห็นด้วยมากที่สุด (Very strongly disagree)
5	หมายถึง	**ไม่ใช่** ทั้งเห็นด้วย และไม่เห็นด้วย (Neither agree nor disagree)				

0 ไม่เห็นด้วยมากที่สุด → 10 เห็นด้วยมากที่สุด

ปัจจัย	ระดับความเห็น										
	0	1	2	3	4	5	6	7	8	9	10
1. ความพร้อมด้านโครงข่าย (Network) ของจุดรวบรวม หรือจุดรับซื้อบรรจุภัณฑ์ที่ใช้แล้ว ที่ครอบคลุมพื้นที่การขาย/บริโภคสินค้า											
2. การมีพันธมิตรการค้าในการซื้อ/ขายบรรจุภัณฑ์ที่ใช้แล้ว เพื่อรวบรวมกลับคืนสู่แหล่งคัดแยก/ กลับเข้าสู่กระบวนการผลิต											
3. ความพร้อมด้านทรัพยากรพื้นฐานในการดำเนินการ เช่น จำนวนรถบรรทุก / คลังสินค้า / อุปกรณ์ในการขนถ่ายสินค้า /แรงงาน ที่สามารถรองรับกับกิจกรรม โลจิสติกส์ย้อนกลับได้อย่างเหมาะสม											
4. ความพร้อมทางด้านระบบเทคโนโลยีสารสนเทศที่สนับสนุนกิจกรรมโลจิสติกส์ย้อนกลับ											
5. ความสามารถในการบริหารต้นทุนกิจกรรมโลจิสติกส์ย้อนกลับที่เหมาะสม											
6. ความสามารถในการสร้างมูลค่าเพิ่ม (Value Added) จากบรรจุภัณฑ์ที่เก็บกลับมา เช่น การ Upcycling ให้เป็นผลิตภัณฑ์อื่นๆ											
7. ความสามารถในการดึงมูลค่า (Value Recovery) ของบรรจุภัณฑ์ที่ใช้แล้วกลับมาใช้ใหม่ได้อย่างเหมาะสม เช่นการ Reuse หรือ Recycle เป็นต้น											
8. การร่วมแรงร่วมใจ และมีส่วนร่วมระหว่างหน่วยงานภายในบริษัท และภายนอกบริษัท เช่น คู่ค้า ลูกค้า พันธมิตรทางการค้า รวมถึงผู้มีส่วนได้เสียภายในห่วงโซ่อุปทาน											
9. การสนับสนุนจากภาครัฐ และภาคอุตสาหกรรม ในการผลักดันสิทธิประโยชน์ รวมถึงกฎระเบียบทางการค้าสำหรับบริษัทที่ดำเนินกิจกรรมด้านโลจิสติกส์ย้อนกลับ											

ส่วนที่ 4: ผลกระทบที่คาดหวังว่าจะได้จากการทำโลจิสติกส์ย้อนกลับ

คำชี้แจง: ขอให้ท่านพิจารณา ท่านเห็นด้วยหรือไม่ ว่าปัจจัยต่างๆ เหล่านี้คือผลกระทบที่ได้จากการทำโลจิสติกส์ย้อนกลับ โดยมีระดับคะแนนดังต่อไปนี้

10	หมายถึง	เห็นด้วยมากที่สุด (Very strongly agree)		4	หมายถึง	ไม่เห็นด้วยน้อยที่สุด (Slightly disagree)
9	หมายถึง	เห็นด้วยมาก (Strongly agree)		3	หมายถึง	ไม่เห็นด้วยปานกลาง (Mostly disagree)
8	หมายถึง	เห็นด้วย (Agree)		2	หมายถึง	ไม่เห็นด้วย (Disagree)
7	หมายถึง	เห็นด้วยปานกลาง (Mostly agree)		1	หมายถึง	ไม่เห็นด้วยมาก (Strongly disagree)
6	หมายถึง	เห็นด้วยน้อยที่สุด (Slightly agree)		0	หมายถึง	ไม่เห็นด้วยมากที่สุด (Very strongly disagree)
5	หมายถึง	**ไม่ใช่** ทั้งเห็นด้วย และไม่เห็นด้วย (Neither agree nor disagree)				

0 ไม่เห็นด้วยมากที่สุด → 10 เห็นด้วยมากที่สุด

ปัจจัย	ระดับความเห็น										
	0	1	2	3	4	5	6	7	8	9	10
ด้านเศรษฐกิจ (Economics Performance)											
1. เพิ่มผลตอบแทนจากการลงทุนในกิจกรรมด้านโลจิสติกส์ย้อนกลับ เช่น ผลกำไรจากการซื้อ-ขายบรรจุภัณฑ์เหลือใช้ เป็นต้น											
2. เพิ่มโอกาสทางธุรกิจใหม่ๆ จากการนำบรรจุภัณฑ์ที่ใช้แล้วมาแปรรูปผ่านกระบวนการต่างๆ เช่น Upcycling เป็นต้น											
3. ลดค่าใช้จ่ายในการจัดซื้อ จัดหาบรรจุภัณฑ์ใหม่ (Virgin Resources)											
4. เพิ่มสัดส่วนการหมุนเวียนใช้บรรจุภัณฑ์ให้คุ้มค่ามากขึ้น											
5. ลดค่าใช้จ่ายสำหรับการกำจัดของเสีย (Waste) ในระบบ หรือต้นทุนในการกำจัดขยะบรรจุภัณฑ์											
6. เพิ่มค่าใช้จ่ายในการดำเนินการจากกิจกรรมโลจิสติกส์ย้อนกลับที่เกิดขึ้น											
7. เพิ่มปริมาณงาน และเวลาที่ใช้ในการบริหารกิจกรรม โลจิสติกส์ย้อนกลับ											

ปัจจัย	ระดับความเห็น										
	0	1	2	3	4	5	6	7	8	9	10
ด้านสิ่งแวดล้อม (Environmental Performance)											
1. ลดการใช้พลังงานในกระบวนการผลิตบรรจุภัณฑ์ใหม่											
2. เพิ่มความสามารถในการใช้วัตถุดิบในกระบวนการผลิตได้อย่างเหมาะสม เช่น จากเดิมใช้วัตถุดิบใหม่ 100% เปลี่ยนเป็นใช้วัตถุดิบที่ได้จากการ Recycle ทดแทน เป็นต้น											
3. ลดคาร์บอน ฟุตพริ้นท์ (Carbon Footprint) ในกิจกรรมต่างๆ ลงได้ รวมถึงของเสียและขยะต่างๆ											
4. ลดการใช้ทรัพยากรทางธรรมชาติในการแปรรูปผลิตบรรจุภัณฑ์ใหม่ และสามารถบริหารจัดการทรัพยากรในการผลิตได้มีประสิทธิภาพมากยิ่งขึ้น											
ด้านสังคม (Social Performance)											
1. ลดปัญหาการกระทบกระทั่งและการร้องเรียนจากชุมชน และสังคม											
2. เพิ่มความปลอดภัย และสุขอนามัยที่ดีต่อชุมชนและสังคม											
3. สร้างความเชื่อมั่นและเปิดโอกาสให้ผู้บริโภคมีส่วนร่วมในการแสดงออกถึงความรับผิดชอบต่อสังคม											
4. เพิ่มโอกาสในการสร้างงาน และสร้างรายได้ให้กับชุมชนรอบด้าน											
5. เพิ่มระดับการมีส่วนร่วมของพนักงานในบริษัทจากการทำกิจกรรมโลจิสติกส์ย้อนกลับ เช่น CSR เป็นต้น											

ส่วนที่ 5: ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม

คำชี้แจง: โปรดเลือกข้อที่ตรงกับท่านมากที่สุด และระบุรายละเอียดหรือข้อมูลเพิ่มเติมในช่องข้อเสนอแนะ

1. ท่านมีประสบการณ์ทำงานในบริษัทนี้มาแล้ว

☐ น้อยกว่า 5 ปี ☐ 11 – 15 ปี ☐ มากกว่า 20 ปี

☐ 5 – 10 ปี ☐ 16 – 20 ปี

2. ปัจจุบันท่านรับผิดชอบงานในด้าน

☐ กลยุทธ์และการวางแผนธุรกิจ ☐ บริหารการขนส่ง

☐ บริหารการจัดซื้อ จัดหา ☐ บริหารคลังสินค้า

☐ บริหารการผลิต ☐ บัญชี/ การเงิน

☐ บริหารการวางแผนสินค้า ☐ อื่นๆ โปรดระบุ ...

3. ปัจจุบันท่านดำรงตำแหน่งในระดับ

☐ ผู้บริหารสูงสุดของบริษัท ☐ หัวหน้างาน/ ผู้ช่วยผู้จัดการ

☐ ผู้บริหารระดับสูง ☐ เจ้าหน้าที่ระดับปฏิบัติการ

☐ ผู้จัดการแผนก/ ผู้ช่วยผู้จัดการ ☐ อื่นๆ โปรดระบุ ...

4. ข้อเสนอแนะของผู้ตอบแบบสอบถาม

-- จบแบบสอบถาม –

ขอขอบพระคุณเป็นอย่างสูงที่กรุณาสละเวลาและให้ความร่วมมือในการตอบแบบสอบถาม

VITA

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