07. House of reverse logistics: an approach to analyse the factors influencing company performance and customer complaint

By Farida Pulansari

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Abstract: This paper presents a house of reverse logistics (HRL). HRL is proposed as an effective design method for integrating reverse logistics (RL) problems and creating consumers satisfaction. HRL is explicitly addressed the translation of customer needs into reverse logistics perspective. HRL is very important because this approach successfully meets customer expectations, requirement and complaint. The complaint is signalling of customer dissatisfaction that indicates the important information directly from customers. The design of HRL was adopted from the quality function deployment (QFD).

Keywords: reverse logistics; customer; satisfaction; complaint.

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1 Introduction

As concerns grow for environmental problems, companies need to consider some regulations, such as social responsibility, corporate image, legislation, economic benefit and customer awareness (Pokharel and Mutha, 2009). Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE) and Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in EEE (RoHS) are some global regulation examples. At the same time, the increasing social and regulatory demands have led companies to perform in an environmentally conscious manner at global scale. Hence, developing new products needs to concurrently consider product functionality, cost, value and environmental impacts.

Ellinger et al. (1999) reports that the communication between buyers and sellers is central to the supply chain philosophy. The trend toward more detailed customer requirements has made it even more important for companies to solicit inputs and feedback from their customers in order to improve their offerings to customer needs.

Complaint is a signal that indicates an important information directly from customers and is a major indicator of customer dissatisfaction (Lee et al., 2015). Wagner (1994) reports that customer service complaints will give valuable information in the sense that they improve the distribution system and the product performance. To understand customer complaints and identify customers' emotions, companies need to plan recovery strategies to maintain the customer satisfaction and loyalty (Varela-Neira et al., 2010). Filip (2013) finds out that migration of profitable customers can be ignored if companies consider complaint as an indication of some problems or failures in the internal processes that need quick recovery. As the number of complaints increase, companies should devise new ways to manage them more effectively in order to obtain a positive return on their investments and enhance financial performance (Cambra-Fierro et al., 2015). Further, companies require information about customers, who they are and what they want, including their desires and tastes.

In reality, consumers sometimes complain about the received goods or services provided by company. The company has to maintain the quality of products or services as customer satisfaction is influenced by the perceived quality of the product. Thus, it is necessary to construct a technical response and give the priority to solve the consumer needs. On the other hand, customer complaints can be influenced by two factors, i.e., attitudinal and perceptual mediators (Kim et al., 2003). The ability to respond to dynamic demands of customers and to maintain the customer satisfaction and loyalty are also required (V[illegible]dh et al., 2013). Customer complaints can give critical information for company. Handling complaints successfully can resolve crises and help maintain customer loyalty (Lee et al., 2015). A study from Yilmaz et al. (2015) reports, that complaint management is affected by two factors, namely, customer response and organisational learning. The recent study shows, the complaints need to be handled in a manner that is appropriate, timely and effective in order to retain existing customers and acquire new ones (Faed et al., 2016). Dissatisfaction will diminishes the customer base and erodes the firm's reputation (Garin-Munoz et al., 2016). Finally, the successfully of company performance depends on creation of distinctive value in services they offer in an effective way for customers (Namin, 2017).

Further, customer complaint begins to be linked to environmental issues. At this time, QFD practices to translating customer complaint (customer needs) into engineering characteristics. One example of QFD applications is to develop strategy, to help implant methods, to develop product, to develop software, to develop services and to help planning (Carnevalli and Miguel, 2008). On the other hand, Büyüközkan and Berkol (2011) report that QFD has transform into eco-quality function deployment (Eco-QFD) and sustainable quality function deployment (SQFD) to cover customer complaint (customer needs) and environmental issues. However, up to the present, only a few environmental problem researches discuss customer needs in the QFD methods.

In this research, we propose to design the house of reverse logistics (HRL) to define customer needs or complaints by translating them into company technical response priority. The objective of the research is to understand the voice of customers and their expectation about reverse logistics (RLs) applications. The HRL was adopted from the quality function deployment (QFD) method. The significant differences between HRL and QFD are described in the widely familiar WHAT's matrix (Customer Requirements). The calculation of correlation matrix, relation matrix, customer competitive assessment and technical competitive assessment are conducted in the same procedure as the QFD method. The HRL is proposed to be one of solution methods for these problems. HRL is very important because this approach successfully meets customer requirement, especially environmental problems (RLs application), then translating it into engineering characteristics to develop company strategic.

2 Review of the literature

2.1 Quality function deployment

QFD can be defined as a method of converting the consumers' requirement for quality characteristics and developing a design quality of the finished product by systematically deploying the relationship between the demands and the characteristics (Akao, 1990). Cohen (1995) proposes that the QFD is a method of structural products planning and innovation that enables an innovation team to specify clearly the customer's wants and need, then to evaluate each proposed product or service capability systematically in term of its impact on meeting those needs. Govers (1996) concludes that the QFD method has strong relationships between product development and producing the new product which is appropriate with consumers' expectation.

A similar definition proposed by Dikmen et al. (2005) points out that the QFD is one of techniques to deal with customer needs and expectation which is more systematically for achieving the most important objective. According to Kim and Kim (2009), the QFD is a mechanism for translating the voice of customer (VOC) into the language of engineers throughout various stages of a new product innovation. Thus, the QFD can be considered as a useful tool to produce higher quality products and decrease the cost and the development time (Bennera et al., 2003). Carnevalli and Miguel (2008) report that the QFD is a method dedicated to translating client requirements into activities of developing products and services. Kuijt-Evers et al. (2009) also conclude that the QFD is an effective design method to translate customer needs into engineering characteristics by integrating ergonomic needs and comforting them into a hand tool design.

There are many benefits for companies which implement the QFD method, i.e., able to focus more on the customer, establish time efficiency, and direct the staffs toward teamwork-oriented and documentation-oriented. Some of the advantages that can be drawn from the implementation of QFD are:

a providing a standard format to translate the customer needs into technical requirements to fulfil those needs

b helping the design team to focus on the planning process based on VOC, not based on intuition

c during the design process, decisions are recorded in a matrix, so that it can be examined and modified again.

2.2 Reverse logistics

According to Rogers and Tibben (1998), Bernon et al. (2011) and Lambert et al. (2011), RL consists of planning, processing, implementing and controlling, the cost-effective flow of raw materials for in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal. RL has implication to basically not only a process of planning and implementation but also controlling from raw material to work processes of a finished goods.

Pokharel and Mutha (2009) report that the RL research studies began in the 1960s. The research has been focused on a network design, production planning strategies and the RL model, and environmental issues. In 1990s until 2000s, the research topics were focused on product distribution, raw material planning, inventory control, production planning, transportation and packaging, purchasing and environmental issues. In 2000s, RL research focused on the interaction between sustainability and supply chain by considering environmental issues regarding product design, product life extension and product recovery at end-of-life. It has been also reported by deBrito et al. (2002) that manufacturing return, commercial return (B2B and B2C), B2B (short-life product) and B2C (product quality), product recall, warranty return, service return, end-of-use return and end-of-life return are included in the research scope of RL. Prahinski and Kocabasoglu (2006) and Kocabasoglu et al. (2007) summarise that the returned products are generally collected from customers, collection centre, recycled centres of many kind reasons like defective products, malfunctioning products, product recall, unsold product and expired product. Since 2008 until now, the RL research areas have been focused on secondary material, pricing, waste and sustainability environmental, and customer satisfaction and loyalty. The current research of the RL was on flexibility, corporate social responsibility (CSR) and development framework to change system thinking, improve production process and solve environmental problems (Lambert et al., 2011; Bai and Sarkis, 2013; Nikolaou et al., 2013).

Further, the implementation of the RL has provided some benefits for the government, customer and environmental sustainability. Obtained from an investigation conducted in 125 companies, a single company gets the total revenue potential up to 50%–70% derived from remanufacturing systems which are a part of the RL implementation (Moore, 2005). Research by Kumar and Putnam (2008) indicate that the RL has significant impact to minimise energy saving until 74%, including 90% for the use of virgin material, 97% of mining waste, 88% of air emissions and 76% for reduction of water. Genchev (2009) reports that a company, which has implemented the RL, can result in saving a cost of up to $43 billion. According to Wrap (2010), problems such as waste, cost, carbon impact and health or safety can be minimised by the implementation of the RL. Giri and Sharma (2015) conclude that a product recovery program gives impact on the decrease of life-cycle of a daily-used product. Also, RL is a systematic approach to improve company environmental impact and to ensure sustainability in business (Mangla et al., 2016). Good RL management will support the sustainable production and consumption (Khor et al., 2016).

3 House of reverse logistics

Pokharel and Mutha (2009) have classified RL research into four perspectives, i.e., RL Inputs, RL Process, RL Structure and RL Outputs. The classification of research on RL has grown since the '60s until 2008. The RL Inputs address several issues, such as the selection of raw materials, product returns forecast, safety stock, and inventory cost control with a declining period (Minner, 2001; Pati et al., 2006; Donghong et al., 2008; Peng et al., 2009). The goals of RL Inputs are the mechanism raw materials preparation. The materials refer to new or used products or parts, i.e., recycled materials. Moreover, studies in RL Inputs are related to the collection activities. Good collaboration and strategies between manufacturing and third party providers will facilitate the collection of the used products.

On the other hand, the research scope of the RL Process includes disassembly processes, coordinated supply chain, recycle, remanufactured processes, refurbish, recondition and production planning, and product return process (Kleber et al., 2002; Dobos, 2003; Yalabik et al., 2005). Hu et al. (2002) report that modelling systems or simulation can minimise the cost of many constraints on multi-time-step, multi-type-hazardous-waste RL system. Infrastructure design, capacity production, and the reverse network flow research can also be categorised in the RL process (Shih, 2001; Bayındır et al., 2007; Qu and William, 2008). The aims of this perspective are how to process the materials. Remanufacturing, refurbishing, reconditioning, recycling are examples of the process from this perspective. The good communication across supply chain actors such as collection centre, disassembly centre until inventory control strategies from manufacturer are needed.

The third perspective is the RL structure. The research topics of this perspective may include location and allocation planning as well as RL network design (Kara et al., 2007; Neto et al., 2008; Lee and Dong, 2009; Kenné et al., 2012). The purpose of this perspective is to solve allocation and location for used products. Since used products are unpredictable, manufacturer needs to collaborate with a third party to handle the supply of materials.

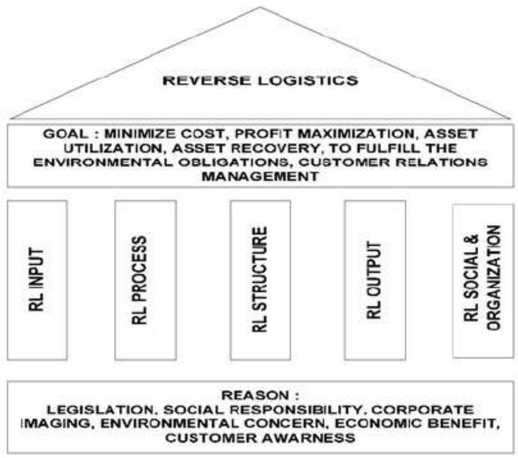
The last perspective is RL outputs. The scope of RL outputs is pricing, revenue management, product competition, customer relationship and service information (Mitra, 2007; Liang et al., 2009; Vadde et al., 2011). The goal of RL outputs is to solve the pricing problems. Many approaches and methods have been used to optimise the pricing for remanufactured products. Another goal is to manage the customer satisfaction after using the remanufactured products. Reduction in the cycle time of providing refunds is one strategy to enhance the customer satisfaction and loyalty.

The success of RL implementation does not depend only in technical terms (production process, planning and inventory) but also non-technical terms such as managing customer satisfaction and loyalty, strategic company, and regulations either from the government or company. Moreover, the purposes of those studies are commonly to minimise cost, maximise profit, utilise assets, recover assets, and fulfil the environmental obligation and customer relation management.

Further, a new perspective, i.e., RL social and organisation, has been added in this study. It has been the topic for several studies, such as return policies and RL innovation process (Richey et al., 2005; Mafakheri and Nasiri, 2013), stakeholders' influence, organisational slack, and managers' posture (Álvarez-Gil et al., 2007); market competition, regulations and globalising growth (Kumar and Putnam, 2008), RLs, human resources (Genchev, 2009), outsourcing RL and third party logistics 3PLs (Cheng and Lee, 2010; Azadi and Saen, 2011; Tavana et al., 2016; Guarnieri et al., 2015; Agrawal et al., 2016), performance measurement of RL implementation (Lee and Lam, 2012; Shaik and Abdul-Kader, 2014), and decision-making model and process (Rezaei, 2015; Vahabzadeh et al., 2015). Nevertheless, the perspective has not been adopted in the RL perspective proposed by Pokharel and Mutha (2009). The last perspective (RL social and organisation) is needed to accommodate the research focused to enhance RL enterprise performance, provide milestones for performance measurement system design, and achieve targets of RL operations. On the other hand, the new perspective gives information to company and use it to enhance the customer's business process and provide value-added process for customer retention. Finally, the perspective can help decision makers to coordinate with the parties.

In this study, we propose HRL to understanding the customer needs and wants for RL implementation (Figure 1). Moreover, HRL design is based on several reasons, among others are international regulations for environmental issues, limited number of natural resources, waste problems, social responsibility, minimising production costs, asset utilisation and maintaining the customer satisfaction and loyalty.

Figure 1 House of reverse logistics



4 The implementation of RLs in Indonesia

Indonesia today has been one of the most consistent growth rates of the world among global economies over the past ten years. The annual GDP growth average is almost 6%. This condition gives opportunity for companies to produce many goods to fulfil the demand of customers' desires and tastes. Furthermore, to fulfil the customer needs and wants, Indonesia has many environmental problems, i.e., the limitation number of natural resources and waste problems.

A research was conducted by Aid (2011), an organisation that is given funding by the Australian Government, to investigate the waste in Indonesia. Among its findings is that the total of 16.7 million tons of wastes are not collected by the municipal services. Furthermore, the collection process of waste commonly uses small hand carts which are subsequently brought to small transfer site or intermediate collection points. Eventually, the wastes from the sites are taken by trucks and delivered to final disposal centres (DC). However, only 21.7 million tons/year of wastes collected by the municipalities. Plastic, electronic wastes, and household wastes are types of wastes that are currently the largest growing waste stream. Meidiana and Gamse (2010) reports that Indonesian household wastes reach the highest percentage (43.4%) among other sources of waste such as wastes from market (20%), street (9%), public facility (9%), office (8%), industry (65), and others (4.6%). It is hazardous, complex and expensive to treat in an environmentally sound manner and there is a general lack of legislation or enforcement surrounding it.

A study from Laurence et al. (2011) and Hanafi et al. (2011) conclude that there is a growing interest in RL in some cities of Indonesia. In 2007, electronics manufacturers have produced more than 3 billion units of household appliances and IT equipment, while the annual consumption of television reaches up to 4.3 million units, refrigerators at 2.1 millions, air conditioning and washing machines at 900,000 units, respectively (Hanafi et al., 2011). The great consumption of new technologies has caused the highest utilisation rate of the technological devices and, thus, generating a huge quantity of e-waste at the end of use.

In Indonesia, the management of electronic waste still has not received sufficient attention (Hanafi et al., 2011; Kristina et al., 2011). People still do not know how to manage electronic waste. For some types of products such as computers and mobile phones are still able to be sold to a second hand goods market. However, for some goods, the end of his life ended in a barn or stall scavengers. The collection of used electronic items or electronic waste, or better known as e-waste in Indonesia is still mostly done by the informal sectors. Management and processing are done by the informal sector is also still very traditional and are likely to jeopardise the health and safety of the environment. From observations made known that the population was still hesitant to do recycling. To perform the direct management of electronic waste required large cost and RLs actors more complex. Some regulations do not support the RL implementation.

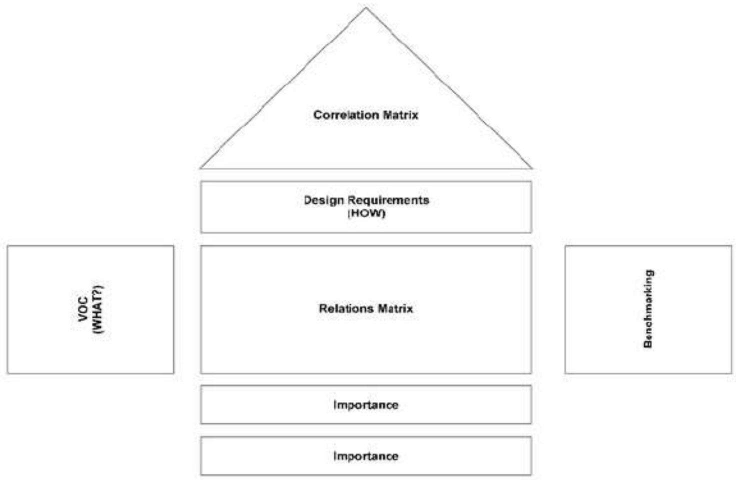
Therefore, a thorough research on RL is of importance. However, only few researchers in Indonesia have explored this research area because many do not understanding the RL concepts and mechanism. Yet, in reality, they already implement the RL. At this time, RL becomes a more common practice as, for instance, RL is technically used to anticipate the limitations of natural resources, to fulfil the global regulation, to solve the waste problems and to increase the customer satisfaction and loyalty. However, there are no empirical studies concerning RL practice and the VOC. Legislation and directives have also been launched by the Indonesian Government; yet, the RL implementation is still very poor. Many companies have not yet decided to emphasise RL as a strategic variable.

5 Method

The purpose of this study is to design the HRL. The HRL helps in defining the customer requirements (RLs application) by translating them into company technical response priorities (HOWs). The design of HRL was derived from the QFD methods. The QFD methodology was adopted from the development of a series of matrices called 'House of quality' or HOQ (shown in Figure 2).

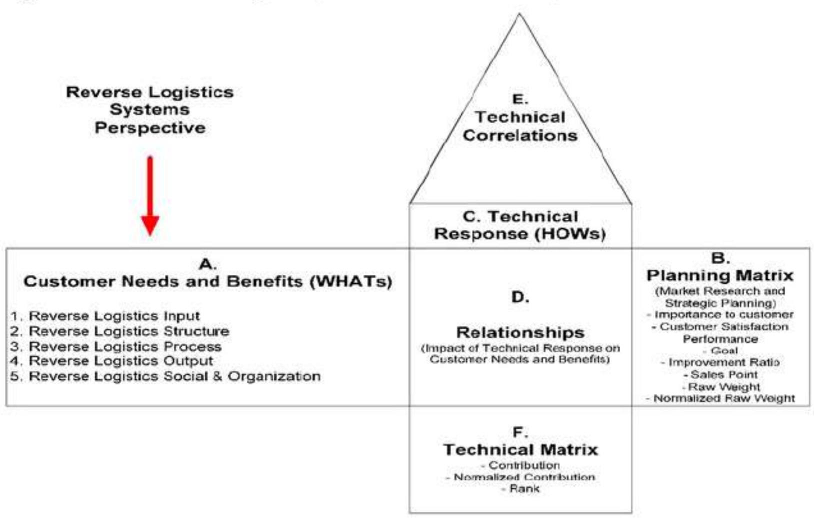
Figure 3 shows the HRL design. HRL will cover all RL perspective, starting from RL inputs, RL process, RL structure, RL outputs and RL organisation into WHATs Matrix. Based on HOQ methods, HRL imitates the step in HOQ. The steps are customer needs, planning matrix, technical response, relationships, technical correlations, and technical matrix. Planning matrix will be divided into eight sections, i.e., importance to customer, customer satisfaction performance, goal, improvement ratio, sales point, raw weight and normalised raw weight. On the other side, technical matrix is also divided into three sections, such as contribution, normalised contribution and rank.

Figure 2 House of quality



Source: Bernal et al. (2009)

Figure 3 House of reverse logistics (see online version for colours)



The object of this research for a preliminary investigation is PCB Company. PCB Company is a consumers' electronic industry. PCB produces goods such as audio cassette tape, colour TV, air conditioning, washing machine, TV rack, CD replication services, and plastic injection services. The VOC is captured in primary and secondary data. Direct discussion, interviews, surveys, and Forum Group Discussion (FGD) are the sampling techniques used for collecting the primary data. Meanwhile, the secondary data are obtained from customer complaint data, warranty product data, specification product data, and product return report.

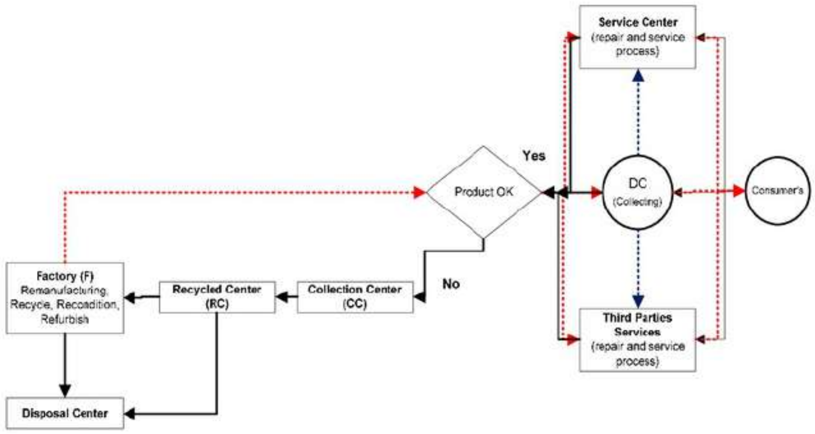
To carry out the research, the researcher uses questionnaires to collect some data. The respondents of this research are service centres (SC) who keep some data, such as customer complaints and product return report. There are two kinds of SC: Indonesian Repair Center (PRI) and Authorised Service Center (ASC). ASC is the third party service. The questionnaire is distributed over seven places in East Java Province which have the highest number of complaint data. The highest number of the record comes from Surabaya (PRI-Surabaya), Gresik (ASC-UD.Duta Bina Teknik), Malang (ASC-Windra Service), Mojokerto (ASC-Mandiri Service), Krian (ASC-Adhi Citra Elektronik), Pasuruan (ASC-NR Electronics), and Surabaya (ASC-Yohasa Service). After collecting some data from the SC, the researcher begins to arrange the Matrix of What's. To arrange the Matrix of What's, the researcher needs customer complaint data and the Indonesian as well as global regulations. The next step is arranging technical response. Technical response must fit with the company's strategy (modal, resources, machine) and regulations. The data must pass the validity and reliability tests. After passing the statistical tests, the HRL mechanism is carried out in the same manner as the HOQ mechanism.

6 Findings

In order to measure whether or not the HRL can answer the customer needs, we analyse the related literature, results of the survey, the secondary data, and the data from deep interview for finding the customer needs' characteristics (Matrix of What's). The object of this research is PCB Company. PCB Company is said to have fanatic consumers in Indonesia. However, in the last five years, PCB Company has received a great deal of complaints from its consumers. Some of the complaints are firstly consumers find it difficult to search the location of the service centre. Secondly, the warranty mechanism and policies are different within each service centre, and the service itself takes too long time. Thirdly, there is a limited information on the technology management as a tool to communicate between consumers and companies.

Figure 4 explains the reverse flow of PCB Company. Starting from customers as end users, the products will return to the three alternative places such as distribution centres (DC), SC and third party services (3PL). If the condition of the product can be repaired by the service centre or third parties services, the product will be sent directly to the customers. However, if the product is hardly repaired, all the products must be collected in the collection centres (CC). After collecting the products, the CC will distribute the products to the recycle centres (RC). The process in the RC is to disassembly the products. Finally, if the components remain in a good condition after the disassembling process, they will be distributed to the Factory (F). Yet, if the parts are not in good condition, i.e., malfunctioning products, they will be distributed to disposal centres (DC).

Figure 4 Reverse flow of PCB Company (see online version for colours)



After conducting a series of brainstorming sessions (RL expert, company, consumers, government), the researcher finds out the 16th most important criteria that would influence the satisfaction of customers of RL implementation (Table 1). The next step is to the design the technical response in order to answer the customer needs. The creation of the technical response is based on the company's capability modal, Indonesian government regulation, global regulation, worker skills, and company strategy as listed in Table 2.

Table 1 Final List of customer needs for RL implementation

RL inputs	New, used products (parts) or recycled material	A1
	Outsourcing reverse logistics activities	A2
RL structure	Locating facilities for returned used products	B1
	Integrated of collection, inspection and consolidation of used products	B2
	Integration manufacturing and remanufacturing	B3
RL process	Disassembly mechanism	C1
	Reverse logistics information technology management	C2
	Handling heterogeneous parts for production	C3
	A scheduling arrivals mechanism for new modules, storing, or disposing	C4
	Repair and after-sales service	C5
RL outputs	Pricing the remanufactured product	D1
	Customer retention and satisfaction	D2
	Enhanced service quality	D3
RL organisation and social	Company strategic and policy (include organisational slack)	E1
	Marketing interfaces and leasing	E2
	The return policy	E3

Table 2 Technical response

Regulation and support systems
Technology supports
Establish and collaborate the reverse logistics support systems (collection centre, recycle centre, disposal centre)
3PL integration and mechanism
Balancing the forward and reverse logistics systems
Production, planning and inventory control (PPIC) system for virgin material and secondary material
Product design and structure
Managing communication along supply chain actors
Design the integrated management information systems along supply chain actors
Inventory control strategy
Warranty product policy
The location and number of service centre
Optimum selling price for remanufactured products
Enhance customer service quality
Design the information technology for better customer relations
Standardisation of service mechanism
Good management for RL labour skills (upgrade knowledge)
Remanufactured product marketing systems
Product design adaptation from customer characteristics

The questionnaires are divided into three sections, namely, importance, satisfaction and expectation consumers in RL implementation. Tables 3 and 4 present the result of the validity and reliability tests. Validity refers to how well a test measures what it is purported to measure. Reliability is the degree to which an assessment tool produces stable and consistent results. Based on Table 3, the validity test showed that r calculation is higher than r table (0.4555) with DF = 15 and the level of confidence is 95% (probability 0.05). According to these results, three questionnaires (importance, satisfaction and expectation) were found acceptable.

On other hand, Tavakol and Dennick (2011) explain about the acceptable values of alpha, ranging from 0.70 to 0.95. Nunnally (1978) recommends that instruments used in basic research have reliability of about 0.70 or better. This is a key element for evaluating the quality of the overall score. Cronbach's alpha is one of the most widely-used measures of internal consistency. Table 4 show the value of Cronbach's alpha is 0.885. According to these results, the questionnaire result is reliable.

Figure 5 shows the correlation between customer requirements and technical response. The relation matrix is filled with the number of consumer complaints. Meanwhile, to fill the relationship matrix, the researcher needs to investigate the relationship between customer needs and technical responses. The scoring scales are shown in Table 5.

Table 3 Validity test results

Service centre	'Importance' questionnaire			'Satisfaction' questionnaire			'Expectation' questionnaire		
	Corrected item-total correlation	*r-table*	*Explanation*	*Corrected item-total correlation*	*r-table*	*Explanation*	*Corrected item-total correlation*	*r-table*	*Explanation*
1	.712	0.4555	Valid	.712	0.4555	Valid	.795	0.4555	Valid
2	.672	0.4555	Valid	.672	0.4555	Valid	.483	0.4555	Valid
3	.749	0.4555	Valid	.749	0.4555	Valid	.578	0.4555	Valid
4	.633	0.4555	Valid	.633	0.4555	Valid	.741	0.4555	Valid
5	.748	0.4555	Valid	.748	0.4555	Valid	.726	0.4555	Valid
6	.570	0.4555	Valid	.570	0.4555	Valid	.515	0.4555	Valid
7	.743	0.4555	Valid	.743	0.4555	Valid	.483	0.4555	Valid

Figure 5 House of reverse logistics

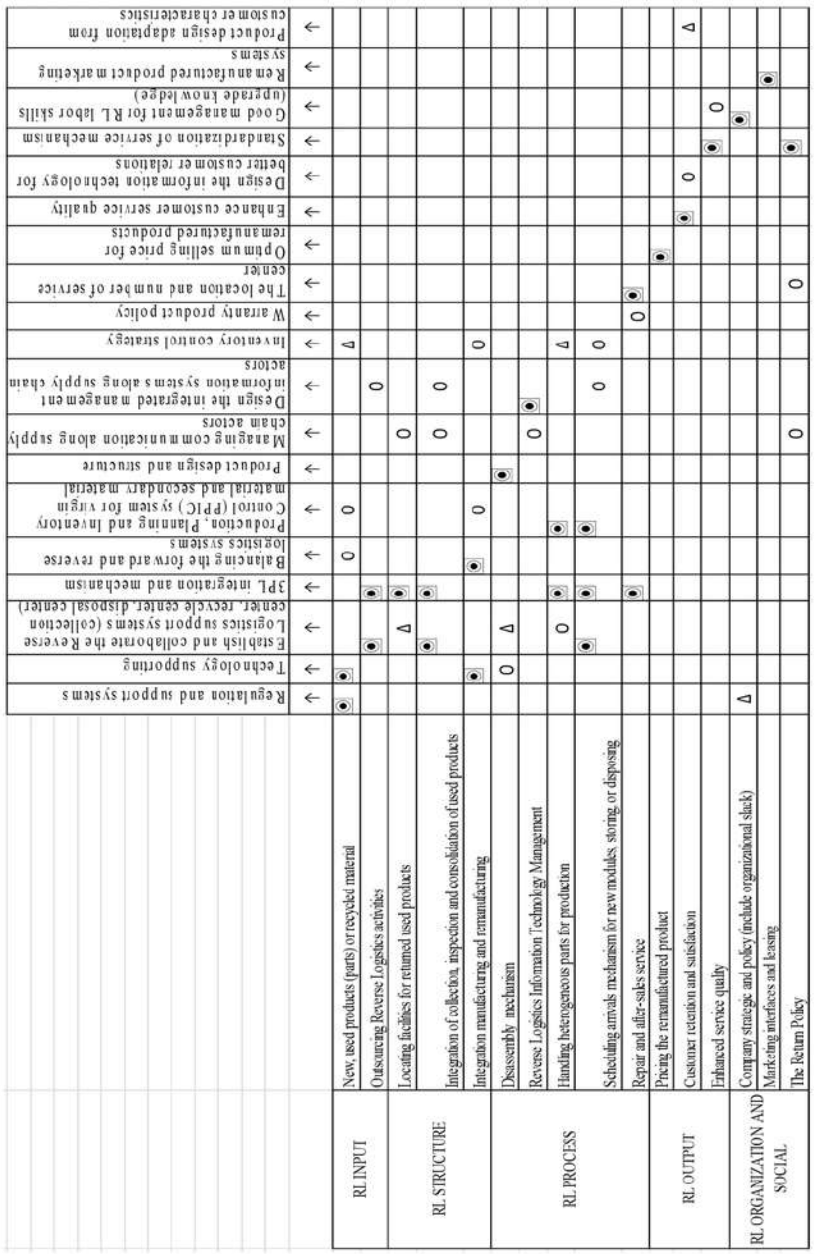


Table 4 Reliability test results

No.	*'Importance' questionnaire*		
	Cronbach's alpha based on standardised items	*Cronbach's alpha*	*Explanation*
1	.891	0.6	Reliable
No.	*'Satisfaction' questionnaire*		
	Cronbach's alpha based on standardised items	*Cronbach's alpha*	*Explanation*
1	.891	0.6	Reliable
No.	*'Expectation' questionnaire*		
	Cronbach's alpha based on standardised items	*Cronbach's alpha*	*Explanation*
1	.851	0.6	Reliable

Table 5 Scoring scale

Score	*Symbol*	*Meaning of linkage*
9	⊙	Strong relationship
3	△	Moderate relationship
1	○	Weak relationship
0		No relationship

Table 6 shows the rank of the target where the highest ranking is a priority that must be solved by the company. Rank 1, 2 and 3 are 3PL integration and mechanism (0.20298), establishment and collaboration of the RLs support systems (collection centre, recycle centre, disposal centre) (0.11270), and standardisation of service mechanism (0.10270).

Table 6 Target to prioritise

Technical response	*Contribution*	*Normalised contribution*	*Targets*
Regulation and support systems	0.67	0.03928	10
Technology supporting	1.12	0.06572	4
Establish and collaborate the reverse logistics support systems (collection centre, recycle centre, disposal centre)	1.91	0.11270	2
3PL integration and mechanism	3.45	0.20298	1
Balancing the forward and reverse logistics systems	0.58	0.03419	11
Production, planning and inventory control (PPIC) system for virgin material and secondary material	1.10	0.06456	6
Product design and structure	0.38	0.02211	15

Table 6 Target to prioritise (continued)

Technical response	*Contribution*	*Normalised contribution*	*Targets*
Managing communication along supply chain actors	1.04	0.06131	7
Design the integrated management information systems along supply chain actors	1.11	0.06551	5
Inventory control strategy	0.36	0.02132	16
Warranty product policy	0.16	0.00958	17
The location and number of service centre	0.82	0.04812	9
Optimum selling price for remanufactured products	0.56	0.03317	12
Enhance customer service quality	0.56	0.03317	13
Design the information technology for better customer relations	0.19	0.01106	15
Standardisation of service mechanism	1.74	0.10270	3
Good management for RL labour skills (upgrade knowledge)	0.72	0.04229	8
Remanufactured product marketing systems	0.45	0.02654	14
Product design adaptation from customer characteristics	0.06	0.00369	18

7 Conclusions

A new approach based on QFD method and RL system has been developed to improve the customer satisfaction and loyalty. HRL is very useful to understand the customer needs and complaints. The complaints will give valuable information for the company on the gap that lies between customer expectation and services. Having understood the customer complaints and identifying customer emotions, the company will plan recovery strategies to maintain the customer satisfaction and loyalty. Thus, the company should realise how to understand the customer characteristics, customer expectations, customer perception and the level of customer satisfaction and loyalty. Finally, the company should adopt the technical response to construct and plan the strategic planning to solve these problems.

7.1 Managerial implications

Environmental issues are quite a concern in the last decade. Many companies demand to minimise the amount of waste. Moreover, customer satisfaction and loyalty are in need of attention as well. A company must have a good strategy and plan to achieve those goals. Based on the rank of targets, the company should have priority scales of technical responses. The result of this research is the well-established 3rd parties' services integration and mechanism. The second target is establishment and collaboration of the RL support systems (collection centre, recycle centre, disposal centre). The standardisation of service mechanism is also needed to give standardisation policies for all SC. The proposed HRL allows decision makers or practitioners to make decision about customer complaint for RL implementation in their organisations. This study also gives guidelines on how to provide the criteria of customer complaints and how to choose the right technical response to solve the problems. The evaluation of company strategies is needed to minimising the complaints. Finally, the company should not ignore all complaints from customers. Good maintenance of the complaints will give positive feedback to the company.

7.2 Limitations and future research

Finally, it is necessary to present both the limitations and the opportunities for future research. HRL uses the RL attribute as customer requirements which are put in the Matrix of WHATs. To create the Customer Needs, the researcher interviews the customers to understand what they need. Consequently, if HRL is to be applied in other line businesses, i.e., paper industry, textile industry, metal industry, etc., the customer need characteristics may be different. This paper present five RL perspectives and 16 assessment categories. The RL perspectives and assessment categories can be change, if the RL problems more complex. Future studies should investigate the influence of global and local regulation of RLs implementation on measures of company performance. Finally, maintaining a positive company image, or meeting consumer expectations, their actions will ultimately lead to the business sustainability and produce competitive advantage.

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