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'Rising on a Reverse Route' – Can Reverse Logistics Influence Perceived Customer Value in Sri Lanka's Mobile Phone Industry

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Abstract

Main objective of the study was to examine the nature of the relationship between reverse logistics efforts of the smart phone industry and its impact on perceived customer value in Sri Lanka. The research design was based on positivism ontology with a deductive approach; a conceptual framework was derived through literature review which comprised of two dimensions namely, reverse logistics and perceived customer value. Hypotheses were developed consequently to confirm correlation among the main dimensions. Findings of the study concluded that the main form of reverse logistics activities practiced in the industry were repairing and refurbishing, while recycling and remanufacturing were recorded less than 10% of the total reverse logistics efforts. It was also evident that there is a strong relationship between some reverse logistic activities and the perceived customer value. Broad scope of the study was the main limitation; as mobile penetration rate is considerably high in Sri Lanka. Therefore, resource constraints, particularly, time and financial resources, restricted examining the objective island wide. The study, nonetheless, validated a conceptual framework on reverse logistics and customer satisfaction. In addition, the research findings diagnosed the critical success factors pertaining to reverse logistics in the context of the mobile industry in Sri Lanka.

Introduction

Global mobile phone penetration was projected to reach 70% in 2019, making this industry the fastest growing and one of the largest in the world. Concurrently, China alone has had more than 1.2 billion mobile users while India was expected to hit 1 billion in 2019. Statistics show that the mobile phone penetration in the European region remains the highest surpassing North America by a higher margin. However, the Asia Pacific region has recorded the highest number of mobile users in 2017 with an estimation of 2.9 billion users (Statista, 2018).

According to GSM Association (2016), more than 1.9 billion people are now actively using mobile money services, while the number of users from developing countries continue to increase. Many non-banking and underbanked population from these developing countries are currently using financial platforms in their day to day life, moving towards improved financial markets and economic conditions. The report further points out that the total value addition from mobile ecosystem was US$ 3.1 trillion in 2015. The industry attractiveness also appears to be high as the net investment in this sector is on a growing trend with US$ 900 expected to flow in 2020 (GSM Association, 2016). Despite the larger market size and increasing investments, phone industry has reached its maturity. According to International Data Corporation, the reduction in growth rate was expected to be 3.1% in 2016 from 10.5% in 2015, thus, a significant sharp decline in the sales value of mobile phones.

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Further, GSM Association (2016) claims that traditional logistic methods will be replaced by a new online based channelling system, paving the way to create high levels of competition among the original equipment manufacturers.

Moreover, it claims that due to market saturation and the increased bargaining power of customers, the competitiveness of the industry would also increase (International Data Corporation, 2016). Similar concepts were shared by Xinyun, Yongkang, Muyuan, and Xiwei (2017), where they argued that industry competitive levels are increasing despite the growth potential; hence, the customer satisfaction would be a challenging aspect to accomplish. An industrial research asserts that over 1.2 billion phones were sold every year. In year 2010, rate of return of phones was approximately 8% or 96 million phones. Average market value of these phones ranged from 35% - 75% of the original value. If the original value of a phone is US$150, the average resellable value of defective phones would be around US$82.5. Furthermore, this study explains that for a million returned phones, reclaimable metal value would yield US$2.8 million (Greve & Davis, 2012). Thus, it can be reasoned that the phone industry product returns represent a high percentage of the original manufactured value. Moreover, the recycle efforts of 'Original Equipment Manufacturers' are high due to the high scrap value of phones.

A research finding explains that perception meltdown of Nokia brand in smart phone industry among the high tech users had an irrevocable impact on their brand name, and set forth the success of Apple brand that was praised by the same community (McCray, Gonzalez, & Darling, 2011). Liu, Li, and Qiu (2011) were of the view that, the product colour features and functionality play a critical role in satisfying mobile phone customers. Moreover, it was revealed in a similar study that perception is one of the main reasons of customer satisfaction in the mobile phone industry. However, the products attributes and its functionality are said to have a major impact on creating a positive brand perception in the minds of the consumers. Kotler & Armstrong have identified that quality attributes will create a positive perception on the consumers' mind which will be transformed into a purchase decision (Armstrong, Kotler, Buchwitz, Trifts, & Gaudet, 2016). According to Mohd Suki and Mohd Suki (2007), the light features of the phone, particularly, the quality of photographs and sound will be a determinant factor for brand perception. Findings of another study on reverse logistics revealed that the perception of customers on product attributes will increase the purchase behaviour of consumers (Miao, Xu, Zhang, & Jiang, 2014). Hence, empirical evidence has indicated that customer perception on mobile and smart phones bears a greater impact on revenue in this industry.

Significance of the Study

Logistic activities represent 7% -10% of the United States economy. However, the total cost of reverse logistics was around US$35 billion (Rogers, Tibben-Lembke, & University of Nevada, 1999). Further, this research claims that the figures cannot be derived precisely, as companies do not prefer to divulge their cost of failure (Rogers et al., 1999). While product quality and attributes are considered as the key reasons, many phone manufacturers attempt to maintain these qualitative aspects with high after sale services, and efficient reverse logistics practices. Casper and Sundin (2018) claim that aftermarket repair services are provided by most phone manufacturers. Also, supply chain management systems of these manufacturers are designed to incorporate such reverse logistic activities into their respective processes. According to Li, Wang, He, Che, and Ma (2012), efficient reverse logistic practices would reduce the total cost, minimise cycle time, and maximise customer satisfaction. Despite these efforts, the smart phone industry remains to be a business with high defect rates. Industrial research acknowledges that 'iPhone 4' reported an initial rejection rate of 2.1% without counting accidental malfunctions which represent 75% of product failures during the first 12 months. Overall, smart phone failure rate is an average of 16.9% of total products (SquareTrade, 2010). A logistic company in Canada discloses that a smartphone has the highest rate of return among the fast moving electrical items. Based on their data, more than 18 million smart phones were returned in year <mention year>. In addition, the source claims that phones being returned was an additional burden on the supply chain system of those companies (Abbey, Meloy, & Blackburn, 2015). Therefore, it can be argued that due to high rate of return, importance on efficient reverse logistics practices has increased in the smart phone industry. Further, many research findings claimed that, customer perceived value has a direct impact on customer satisfaction and repurchase intention of products. Thus, it is important to identify the relationship between effectiveness of reverse logistics and the perceived customer value.

The main objective of this study is to identify the reverse logistic practices adopted by the smartphone industry in Sri Lanka. Much of the literature review above has focussed on the distinct aspects of reverse logistic practices, addressing these separately. However, according to available information, no quantitative studies were conducted in Sri Lanka combining the critical success factors impacting customer perceived value. Therefore, it is vital to contribute to this empirical lacuna in literature, pertaining to this subject. This is the first study of its kind, to quantitatively measure the effectiveness of reverse logistic practices embraced by the smartphone industry and its impact on perceived customer value in Sri Lanka.

The study is organised as follows. Section 2 devoted to the literature review while Section 3 presents data and methodology. Section 4 assesses the empirical hypotheses, test results and discussion. The final section presents the concluding remarks.

Literature Review

Zuluaga and Pablo (2005) defined the concept of reverse logistics as the process of planning, implementing and controlling the transfer of information and products, from the point of consumption to the point of origin. Another industry analysis explains that the average reverse logistic cost of a manufacturer is between 9%-15% of the total revenue (Greve & Davis, 2012).

Reverse Logistics and Forward Logistics

Among the several strategies adopted in the field of logistic management, reverse logistics and forward logistics are the main strategies that are practiced by many companies. Reverse logistics defer from the forward logistic practices in various ways. One of the dissimilarities is that forward logistics entail a push strategy, while reverse logistics focus on both, the push and pull strategies. Additionally, the forward logistic system would only pay concern to the end consumer, while reverse logistics highlight about the suppliers and intermediaries simultaneously. Further, one of the main success factors for reverse logistics is 'Design For Disassembly', where the product design process have taken into consideration the possible repair or replacement (Zuluaga & Pablo, 2005). Previous research conducted on the phone industry disclosed that 'Design for Disassembly' can be effectively applied to reduce the defect rate, usage of durable material, and adoption of a proper QR coding system for product components (Long et al., 2016). Hence, it can be argued that 'Design for Disassembly' can improve the efficiency of reverse logistics practices (explained in detail under 2.3).

Return Lead-Time Management

Panova and Hilletofth (2018) explained that a reverse logistic system of a company should be designed to minimise lead time of their re-production process by standardising the production tasks and reducing the skill requirement of the process. Lieckens and Vandaele (2007) argue that increase in lead time of reverse logistics process would increase uncertainty of the process. Research findings further prove that the product lead time is a direct function of efficiency in a given process. Moreover, in a research on manufacture, it is argued that the lead time on reverse logistics would increase consumer lead time and estimated pipeline time, thus, resulting in an increase in the total cost (Cannella, Bruccoleri, & Framinan, 2016). Findings of another study indicated that supply chains of production oriented businesses are directly influenced by the return lead time. In addition, it proved that reverse logistic lead time would have a direct impact on the environmental cost (Bogataj & Grubbström, 2013). Literature implies that lead time of reverse logistics would directly influence efficiency of the reverse logistic system.

Design for Disassembly

Design for disassembly is a strategy used by specialists in lifecycle engineering. Moreover, research data prove that this tactic can mainly be used in the recycle process of electronic savvy products. This would enhance the serviceability of these products, and the end of lifecycle objectives, such as recycling and reuse (Desai & Mital, 2003). However, Sodhi & Knight are of the view that longer the disassembly process takes, lesser the profits. Further, the study highlights the importance of involving in bulk recycling to realise the maximum potential from such recycling practices (Sodhi & Knight, 1998). According to Güngör (2006), the design for disassembly practices allow the products to be more maintenance friendly and easy to recycle. Additionally, the report highlights the importance of carrying disassembling in a nondestructive manner, while saving cost and minimising the environmental impact. Much of the literature suggests that the remanufacturing and recycling process can be enhanced and made efficient, with proper utility of design for disassembly practices.

Infrastructure and Top Management Commitment for Reverse Logistics

A Chinese study claims that lack of infrastructure is one of the main barriers in reverse logistics efforts of the Chinese manufacturing sector. Further, the report claims that lack of investment on recycling techniques, non-availability of cost effective methods in China are the main causes of this issue (Abdulrahman, Gunasekaran, & Subramanian, 2014). Assavapokee and Wongthatsanekorn (2012) explained that product recovery system should render support from all logistic resources and supply chains of the organisation. Moreover, the study reveals that government exerting pressure on waste management has increased the significance of effective product recovery systems. Furthermore, the study identified statistical coexistence among the infrastructure availability and the efficiency of product recovery process of the organisations. In a study conducted in Brazil, it was identified that most regions of the developing world suffer from the condition of "deficient logistic infrastructure"; hence, the efficient use of infrastructure is far from reality. Consequently, the efforts on recycling and remanufacturing tend to be significantly hampered, undervalued and underperformed. The study further reveals that the problem is partially due to manufacturers resistance towards improving the proper product recovery system (Bouzon, Govindan, Rodriguez, & Campos, 2016). However, Lukinskiy, Panova, and Soletskiy (2016) argue that by improving IT infrastructure recycling efforts, product recovery process can be enhanced. Furthermore, the study reveals that this improvement will realize about benefits like reduction in remanufacturing time and the lead time, along with the reduction of total cost in the remanufacturing process.

Hazen, Cegielski, and Hanna (2011) opined that committed management practices would increase the information and knowledge flow to various parties in the organisation. Thus, such a setting would help improve the controllability through goal setting and motivation. Another related study on electrical battery manufacturing industry reveals that the top management focus and commitment can be attracted towards reverse logistic management, by creating an accurate reporting system. This study explains that with amalgamation of the balance scorecard to improve and analyse the reverse logistic system, would also improve the overall management effort by further improving the recycling process; hence, making the process accurate (Bansia, Varkey, & Agrawal, 2014). It is evident from literature reviewed that most research findings assert on the notion that proper use of infrastructure would benefit the organisations' operational process, recycling and product recovery process; on the contrary, not having such infrastructural benefits in place was said to have a hampering impact on reverse logistics practices. Further, management attitude and commitment are said to have a positive impact on the recycling and product recovery process; these factors would improve resource allocation, information flow and guidance on achieving the reverse logistics goals. However, overall, the studies reviewed indicated a lacuna in scholarly findings, relating to infrastructure improvement and management commitment making an impact on the customer perceived value.

Customer Expected Lead-Time

According to van Lith, Voordijk, Matos Castano, and Vos (2015) with proper communication at the sales point or service contact point, it is possible to influence customer expectation of the service. The study further reveals that any production process should be designed based on the expected lead-time from the perspective of customers, and these standards are to be communicated to the consumer directly. Moreover, the study argues that probability of acceptance is correlated with the lead time required. Another study found that the expected lead time is related to the customers' cost benefit analysis on the brand (Yulia & Olli-Pekka, 2016). Hawkins, Nissen, and Rendon (2014) argue that if the expected lead time is high, the total cost of recycling and reprocessing is also high. However, their study reveals that reducing the quality parameters would increase sales, hence, the total benefit would increase despite the rise in cost of penalty. In addition, majority of studies conducted were not related to customer expected lead time on reverse logistic practices, although findings related to cost minimisation and increase in sales were highlighted. Therefore, it can be argued that there exists a literature gap in identifying the correlation between reverse logistic practices and customer expected value. Hence, the study would focus on identifying critical insights and thus, contribute towards this research gap through research findings.

Customer Perceived Value

Customer perceived value is a unique concept to customer satisfaction, with the main difference being pre and post purchase occurrence. Satisfaction is universally agreed to occur in post-purchase and post-purchase evaluation. On the contrary, perception can take place in many stages of the purchasing cycle, including the pre-purchase stage as a result. Moreover, it can be concluded that a perception about a product would be generated without any consumption experience (Apte, Apte, & Rendon, 2011). Another related study argues that the perceived value of customers are heterogeneous and need to be addressed in crafting a better strategy (Floh, Zauner, Koller, & Rusch, 2014). A study conducted in Australia on YOU mobile phone users confirmed that perception of the mobile phone brand among peers and the public has a direct impact on their preference; thus, has influenced users' selection of mobile phone brands. Further, the study argues that this perception has a direct influence on the group behaviour (Walsh, White, Cox, & Young, 2011). Floh et al. (2014) have tested the multidimensional scale including fictional, loyal, economic, social and emotional value that are identified as components of the customer perceived value. Quality is used as a perspective to map the components of perceived value (Miao et al., 2014). According to Sweeney and Soutar (2001), a multidimensional scale is a useful tool to determine factor analysis and for an in-depth analysis. However, a narrow analysis on a concept or a behaviour pattern can be measured with a single scale or likert scale (Ranasinghe & Nawarathna 2020). This study focussing on identifying a relationship between customer perceived value and reverse logistics, eliminates the need to analyse and comprehend customer perception. Instead, the concept is applied to identify the relationship between another set of variables.

Despite many efforts to identify cost effectiveness, sales and other benefits, there is a dearth of literature that clearly link customer perception with the reverse logistic efforts of organisations. However, efficiency of reverse logistics is dependent upon the commonly discussed factors like top management commitment, infrastructure, return lead-time and design for disassembly.

Methodology

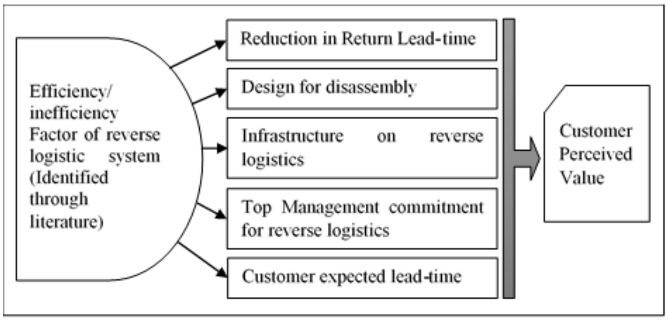
Research methodology is dependent upon both, the purpose and ontology of the research. However, positive ontology is generally associated with a quantitative approach, while data gathered would be quantifiable. Further, it enables the study to develop and measure correlation among certain variables (Wang, 2010). According to Boynton and Greenhalgh (2004), quantitative research process requires tools like survey questions would generate numerical data, where these data would be tested mathematically with hypotheses. Statistical information need to be gathered to confirm intention of the study, i.e. relationship between reverse logistics and the customer perceived value. Therefore, the study approach is qualitative, with a set of hypotheses created to identify the relationship as mentioned. In general, the process of this research would be similar to that of a positive ontology as suggested.

Sampling Method & Sample Size

Sample size should be comprehensive to represent the target population of the research. Accuracy and reliability of a smaller sample size is lesser compared to that of a larger sample. Further, bigger the sample, higher the accuracy and reliability in generalising the findings on the target population (Ji et al., 2012). However, a study conducted on meta-experiment stream has discovered that many researches frequently use the sample size of 100. Purpose is to generalise a larger population despite the theoretical methods to tally the actual population with the sample size. Overall, studies have accurately proven the research objectives (Govindasamy & Kelley, 2014).

For this study, two different samples were gathered, consisting 200 customers from 30 different phone dealers and franchises in the Colombo region. Reverse logistic efficiency of each customer's corresponding franchises were mapped. Therefore, correlation was mapped with customer and the reverse logistic variables identified in the literature review, and not based on the individual service provider. As a result, two samples can have a tallying output. According to William Cochran (1953), when homogeneity of the total population is high, random sampling is user-friendly. However, when the subgroup characteristics are vivid among each other, then a clear stratum is required to collect data from those distinct groups. Further, the pilot survey conducted for 20 customers revealed that perception towards a recycled product and the expected service do not vary due to age, gender, and region of a customer. Therefore, a heterogeneous assumption can be applied to form the random sampling method for the study (Figure 1).

Figure 1: Conceptual Framework of the Study



Source: Based on Authors' observations.

This conceptual framework is tested in the study; following regression and hypothesis were tested to confirm the created conceptual framework.

$$CP_i = f\left(\overset{+}{R}_{i,}\overset{+}{D}_{i,}\overset{+}{I}_{i,}\overset{+}{T}_{i,}\overset{+}{C}_{i}\right) + \varepsilon_i = \beta_0 + \beta_r R + \beta_d D + \beta_i I + \beta_t T + \beta_c C + \varepsilon_i$$

where,

CP = Perceived customer value.
R = Reduction in return lead-time
D = Design for disassembly
I = Infrastructure on reverse logistics
T = Top management commitment for reverse logistics
C = Customer expected lead-time

The sign above the variables denotes the expected impact of the particular independent variable on the dependent variable, while other explanatory variables are held constant, and ε_i is a typical stochastic error term. Hypotheses can be summarised as follows:

Hypothesis 1: $\beta_r > 0$

There is a positive relationship between reduction in return lead time and the customer perceived value.

Hypothesis 2: $\beta_d > 0$

There is a positive relationship between design for disassembly and the customer perceived value.

Hypothesis 3: $\beta_i > 0$

There is a positive relationship between infrastructure on reverse logistics and the customer perceived value.

Hypothesis 4: $\beta_t > 0$

There is a positive relationship between top management commitment on reverse logistics and the customer perceived value.

Hypothesis 5: $\beta_c > 0$

There is a positive relationship between customer expected lead time and the customer perceived value.

Results and Discussion

Primary analysis of the study involved identifying the bivariate correlation of individual independent variable with the dependent variable. In the second step, the proven variables will be tested for regression. The estimation results are presented in Table 1.

Table 1: Correlation and regression results for coefficients for perceived customer value

	Correlation coefficients	Regression coefficients	
		Unstandardised	Standardised
Constant		0.189 [a] (0.184)	
Reduction in return lead-time	0.745[a]	0.400 [a] (0.277)	0.269 [a]
Design for disassembly	0.530[b]		
Infrastructure on reverse logistics	0.737[a]	0.523 [a] (0.375)	0.363 [a]
Top management commitment for reverse logistics	0.798[a]	0.084 [a] (0.228)	0.056 [a]
Customer expected lead-time	0.716[a]	0.412 [a] (0.241)	0.275 [a]
Coefficient of determination		0.89	
Number of observations		200	

Source: Authors' calculations.

Notes: a and b are significant at 0.01 and 0.05 levels, respectively; Data in brackets are standard error values.

Hypothesis 1: Table 1 indicates a strong relationship between reduction in lead time of recycled products and the customer perceived value. With a high significance level, the relationship can be interpreted as valid. Therefore, it can be concluded that hypothesis 1 is proven beyond reasonable doubt with statistical significance. Hence, one percent increase in the reduction in return lead-time will increase the perceived customer value by 0.26 percent, holding other variables constant.

Hypothesis 2: Although significance level is high in the relationship, Pearson correlation value is below the expected reliable level. Therefore, this variable cannot be considered as independent in this equation. Consequently, hypothesis 2, is refuted and the null hypothesis is proved.

Hypothesis 3: According to Table 1, when the reverse logistics system is enabled with required infrastructure system, the perceived customer value will increase. This concludes that hypothesis 3 is proven with evidence. In addition, while holding other variables constant, one percent increase in the infrastructure on reverse logistics will lead to increase the perceived customer value by 0.36 percent.

Hypothesis 4: Although significance is not high as in other two variables, there is a strong positive correlation with top management commitment and customer perceived value. In addition, significance is validated with high value, hence, proving validity of the relationship. Accordingly, hypothesis 4 is proven with statistical confidence. One percent increase in the top management commitment for reverse logistics will increase the perceived customer value by 0.26 percent, holding other variables constant.

Hypothesis 5: When expected lead times of customers are high, delays in replacing products will be tolerated. This facilitates the company to maintain a high level of customer perceived value. Hypothesis 5 is therefore proven with this statistic, that the customer expected lead-time will increase the perceived customer value by 0.27 percent.

Having estimated the model in Table 1 reveals that hypothesis 1, 3, 4, and 5 are supported and the model is confirmed with a minor amendment. However, the rejected hypothesis, namely the "Design for disassembly" remained to be a prominent factor for consideration in the production engineering community, despite the research result. When analysing the quantitative feedback provided by the respondents on the subject matter, most of the customers were not concerned about the internal process of disassembling even though they possess prior knowledge on same; especially, phones like iPhones take considerable time to disassemble against that of another budget smart phone. Customers are more concerned about the lead-time, and delivery of a mobile phone. Moreover, in future researches, prospects may be available to diagnose a relationship between lead time and the Design for dissemble. Further, according to direct agents and franchises, top management commitment is an under focussed area in reverse logistics practices. Infrastructure system is more significant (with a sensitivity of 36%) to make an impact on customer perceived value, compared to customer expected lead-time, reduction in return lead-time and top management commitment (each with a sensitivity around 26%).

Most of the 'Original Equipment Manufacturers' responses are considered to be slow paced, although with regard to local partners, the processing speed is high. Most technical experts reveal that this is due to their heavy R&D focus on quality assurance; here, R&D attempts to minimise the product failures while the technological advancement on recycling and product replacing technology is less prioritised. Further, the customer expected lead-time is also a unique variable in this study. Findings of the study depict that, higher the customer expected lead time, lower the chances for customer dissatisfaction. Allowing the businesses to increase their potential can help improve or sustain the customer perceived value. The outcomes agree with the research findings of Floh et al. (2014) and Miao et al. (2014). Moreover, in a detailed analysis on the same matter, it has been revealed that many customers who had long expected lead time were using branded phones. Most consumers justified it by relating the complexity, genuineness and the uniqueness of the product. Respondents mentioned that their tolerance level is high due to aforementioned reasons, and they expect it to be somewhat time consuming than other phone brands. However, another factor that would contribute to the "customer expected lead time" is perception on the Culprit of phone failure. If consumers believe that the phone failure is due to their misuse, the customer expected lead-time is high. Nonetheless, these qualitative facts were not included in this model to be tested statistically. Mobile phone penetration being high, and time and financial resource constraints are key limitations of this study.

Conclusion

The study was comprehensive to identify a relationship between reverse logistics and the customer perceived value, in the mobile phone industry in Sri Lanka. Further, based on data analysis, the customer perceived value is a function of main four elements of an efficient reverse logistics system, namely, Customer expected lead-time; Reduction in Return Lead-time; Infrastructure on reverse logistics; and Top Management commitment. Moreover, study has disproved Hypothesis 2 by proving the null hypothesis; most research findings are in conformity with literature findings.

Future researches on this subject can be tested to identify the impact of reverse logistics on variables and determinants influencing customer perceived value across industries. Significance of these findings can help identify critical success factors and how variables fluctuate, impacting customer perceived value. For example, this can be tested on suppliers and intermediaries involved in the backward supply chain (reverse logistics) in the production sector. It can be further extended to manufacturers of various industries, R&D etc., on economical as well as ecological aspects. Production sector players can gain better insights on formulation of strategies, operational processes, and in pricing and discount formulas (on new product models when exchanging). Findings enable for effective decision making cost benefit analysis in reducing the environmental impact and responsible waste disposal like recycling, upcycling etc. When reverse logistics facilitates reducing of production costs and increasing consumer engagement in brands, manufacturers are privy to enhance the value proposition of their business firms.

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