A Conceptual Framework for Reverse Logistics Performance and Innovation

Ganesh Kumar R[#1], Ashlin Nimo J R[*2]

[#*] *School of Management, Vel Tech Rangarajan Dr Sagunthala R&D Institute of Science and Technology, Avadi, Chennai, India*

[1]ganeshkumarr7@gmail.com

[2]jrashlinnimo@gmail.com

***Abstract*— Green Supply Chain Management has been receiving a lot of attention in recent times. Attention on Reverse Logistics (RL) area has also been steadily growing. Reverse Logistics involves reduce-reuse-recycle as well as redesign, remanufacture, etc. It is a closed loop of the Supply Chain for value creation. Many authors discuss that Reverse Logistics can result in savings for an organization. Some authors also analyse where the resources in Reverse Logistics could be committed to achieve good Reverse Logistics Performance. The Automotive after-market in India is also in its nascent stages and has a huge scope for growth. Thus, a study in this area is definitely warranted. This paper gives a Conceptual framework for the RL Performance and Innovation in Automotive after-market with an emerging economy backdrop. The authors of this paper find fewer papers in these areas and this paper aims to fill this gap.**

Keywords: *Green Supply Chain Management, Reverse Logistics, Task Environment, Reverse Logistics Performance, Reverse Logistics Innovation*

1. Introduction

In recent times, there has been a considerable amount of research on Sustainable and Green Supply Chain Management. In General, the effect of Greenhouse gases (GHGs) on the atmosphere and Climate Change, have been receiving a lot of attention in recent times. The operations of the Supply Chains result in a considerable Ecological Footprint (EF). Ecological Footprint (EF) of an entity is the amount of resources consumed by the entity as against the ability of the earth to regenerate the resources [1]. The Ecological Footprint (EF) analysis was used in 1992 by Dr. William Rees and Mathis Wackernagel for the first time [2]. Domestic Material Consumption (DMC) is the amount of materials consumed by an economy for production excluding the amount of materials exported to other countries [3]. The DMC is an indicator that is measured at the national level. One feels that the materials consumed can be studied even at a micro level, i.e. an organizational level or even at the Supply Chain level. These two indicators highlight the amount of natural resources consumed by an entity, i.e. an organization or a Supply Chain.

The competition today, is at the Supply-Chain level as indicated by Chopra et al [4], since the price, attributes and all the characteristics of a product in the market depend on the entire supply chain rather than an individual player in the supply-chain. Hence the study of Green Supply Chain Management becomes essential. This paper proposes a framework for the study of Reverse Logistics (RL) Performance and Innovation in the Automobile after-market in India. Reverse Logistics (RL) is one of the activities in Green Supply Chain Management that is recently steadily growing in interest.

Green Supply Chain Management includes activities like using Green Policies in the organization, Green Collaboration and effective information-sharing with the stakeholders, mentoring the suppliers on Green Operations, Green Packaging, Reverse Logistics, Environmental Management Systems (EMS), using efficient modes of transportation, etc.

Having Green Policies in the organization ensures that the green goals receive support by the management for implementation by the subordinates. Green collaboration and effective information-sharing with the stakeholders helps in building a positive image and goodwill about the organization apart from achieving the obvious sustainability objectives [5]. Mentoring the suppliers on Green programmes is another step that helps in guiding the suppliers by the lead player in the supply chain in achieving sustainability goals apart from improving the collaboration between the players in the supply chain [6]. Green Packaging can be very useful in reducing the wastage during packaging and also in the reduction of harmful substances during packaging [7]. Many organizations with an EMS like ISO 14001 are viewed in a positive light by all the stakeholders of the organization [8]. Efficient modes of transportation like using road transport when high responsiveness is not a criterion can help achieve sustainability goals.

International Journal of Supply Chain Management
IJSCM, ISSN: 2050-7399 (Online), 2051-3771 (Print)

Reverse Logistics, the focus of this paper, is an area where the authors feel, has huge scope for improvement to achieve green goals in a supply chain. Reverse Logistics refers to the movement of returned inventory (finished and unfinished) in the reverse direction and movement of information in a supply chain i.e. a closed-loop of the supply chain. Apart from helping in implementing the reduce-reuse-recycle principle, it also acts as a feedback from the customers on the products (finished or unfinished), including the sustainability aspects of the products. Many industries are using Reverse Logistics (RL) activities to generate value for their firms including aircrafts, ships, automobiles, iron and steel, electronics, chemicals, etc. [9].

Reverse Logistics (RL) can also result in a significant amount of savings for an organization [10]. The automotive after-market in India is still in its nascent stage of growth and is largely fragmented, even though it shows a huge potential for future [11]. Thus, a study in this area is certainly warranted. The automotive after-market consists of such things as after-market sales of parts and services. It also includes reusing parts which have been used and disposed of. This paper consists of a discussion on the Reverse Logistics (RL) Concept and an extensive review of the literature on Reverse Logistics and then goes on to provide a Conceptual framework based on the study done by the authors.

2. Reverse Logistics: Concept

Consider the following diagram (Fig. 1) which shows the Reverse Logistics flow along with the forward flow in the supply-chain.

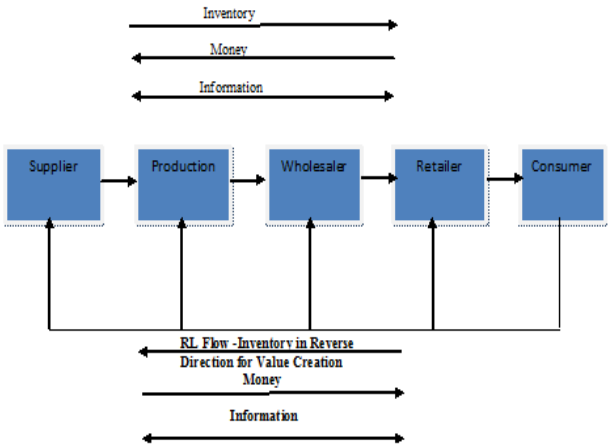

Fig.1 (idea partly adapted from [12], [13].)

The extensive study of the RL literature made the authors to arrive at such a flow diagram as shown in Fig.1. In the figure, the RL flow of inventory along with the forward flow is shown. The RL flow is used at various stages in the supply chain to reengineer, remanufacture, reuse or even recycle the products and create value. This results in minimizing consumption of resources, while at the same time reducing wastages and discharge of harmful substances into the environment. Also shown is the money-flow from Supplier towards the Customer which indicates the amount obtained on returned goods. Information flow as in the forward part of the supply-chain occurs in both directions. The RL flow is also referred to as a Closed-loop Supply Chain.

In the Control Systems Engineering literature, Closed-loop chains are referred to as a feedback. A feedback performs the function of giving part of the output back to the input as a signal to correct the error in the system. Similar to the above function, a Closed-loop Supply Chain can give valuable information regarding the sustainability of the final product back to the Suppliers at each stage. Additionally, it also has its main function which helps in value creation as we have observed in the diagram.

3. Literature Review:

This paper provides a chronological review of Reverse Logistics (RL) literature. The count of studies in this area seems to have picked up a great deal from the 1980s onwards. Kelle and Silver [14] study the case of reusable cans and develop four procedures for forecasting the demand of the reusable cans. Purohit [15] develops a model to study the relationship of prices between new car models in the primary market and used car models in the secondary market. Fuller et al [16] discuss how Reverse Logistics (RL) helps in customer retention and customer satisfaction. Purohit and Staelin [17] discuss the problem of a competition that could arise between two supposedly non-competing distribution channels of a durable product. Porter and der Linde [18] in their paper express the view that environmental regulations do not necessarily inhibit competitiveness. The role of organizations in ecological sustainable development and effects of ecological sustainable development on organizations are discussed by Shrivastava [19]. Newman and Hanna [20] in their paper claim through surveys that operational excellence and environmental management have a synergistic effect on each other. Hess and Mayhew [21] in their paper explain and predict returns through a hazard model. Mok et al [22] discuss the disassembly mechanisms in used automobiles in their paper. Ruwaard et al [23] compare the traditional supply chain flows and the Reverse Logistics (RL) flows. Dowlatshahi [9] describes insights for successful

Reverse Logistics (RL) implementation in organizations from a few available case studies in the literature. Ferrer and Whybark [24] propose a system for Reverse Logistics (RL) using Materials Requirements Planning (MRP) which is already used by several organizations for the forward supply chain. Meade and Sarkis [25] present a decision-making framework for selection of third-party logistics providers for Reverse Logistics (RL). Murphy and Poist [26] compare US and non-US firms on Environmental Logistics through an empirical study. Choi et al [27] study the returns policy in the presence of an e-marketplace. Yalabik et al [28] discuss the logistics and marketing efforts in returns systems. Daugherty et al [29] discuss the relationship between Reverse Logistics (RL) Resource Commitment, IT capabilities and Reverse Logistics (RL) Performance in the Automotive after-market in the US. Galbreth and Blackburn [30] explain the importance of sorting policy for remanufacturing firms. Morana and Seuring [31] claim that the transaction costs should be low for acquiring end-of-life products through their paper. Neto et al [32] use a special technique to achieve the twin objectives of Profit Maximization and Sustainability in logistics networks in the European pulp and paper industry. Liang et al [33] take up the pricing problems in remanufacturing of core products. Pishvaee et al [34] develop a new memetic bi-objective algorithm for closed loop supply chains logistics networks. Barker and Zabinsky [35] develop a multi-criteria model for decision-making using AHP for Reverse Logistics (RL). Huang et al [36] study the relationship between Task Environment, Resource Commitment and Reverse Logistics (RL) Performance in the Taiwanese '3C' industry. Kannan et al [37] discuss a Reverse Logistics (RL) network design model based on carbon footprint. Dekker et al [38] present quantitative models for closed-loop supply chains in their book. Abdulrahman et al [39] analyze the barriers in implementation of Reverse Logistics (RL) in the Chinese manufacturing industry. Kim et al [40] use a capacitated vehicle-routing problem (VRP) for reverse logistics of food wastes. Agrawal et al [41] provide a literature review in the area of reverse logistics and provide future directions for research. Bouzon et al [42] analyse the reverse logistics barriers in the Brazilian electrical-electronics equipment industry using fuzzy Delphi method and AHP. Guo et al [43] study the different supply chain contracts and channel leaderships and identify the research gap in the area of reverse logistics. Han and Trimi [44] use fuzzy TOPSIS method to study performance evaluation of reverse logistics for social commerce platforms. Wang et al [45] use MCDM method to analyse collection modes in Reverse Logistics.

It has been discussed that the Reverse Logistics consists of closing the loop of the supply Chain. Papers have been focusing on the supply-chain in the forward direction. Thus, one finds that the Reverse Logistics area has received more attention only in the recent years. Even though good amount of work can be found in this area in recent years, one finds fewer good conceptual papers for building theory in this area. Also, very little work seems to have been done on the Automotive after-market area which seems to hold a huge scope for growth and even smaller amount of work seems to have been done in this area with an emerging economy backdrop. This paper attempts to fill these gaps.

4. Methodology:

Interpretive field research generally refers to the qualitative studies or studies in which some inference is made from certain experiences in the field [46]. Survey Research refers to a kind of deductive research in which hypotheses are put forward, a sample of respondents is selected from the population, questionnaires are prepared to test the hypotheses on the sample and analyses of the observations collected from the questionnaires are done. The results obtained are generalized for the population. Survey Research is a quantitative research technique [47].

Conceptual Research on its own can help in theory building and managerial practice [48], [49]. Conceptual Research involves presenting propositions based on which Conceptual frameworks are built. This paper tries to build the premises for the propositions presented, from a few papers and presents the propositions which result in the formation of a conceptual framework. This Conceptual framework can be empirically tested and as mentioned earlier can help in sound managerial practice. This paper provides a conceptual model for managerial practice in Reverse Logistics Performance for the automobile after-market in India.

The literature review for this paper was done with several hours of reading over a period of 8 months and database searches from EBSCO and SCOPUS with keywords like "Task Environment", "Reverse Logistics Resource Commitment", "Reverse Logistics Performance" and "Reverse Logistics Innovation". The Conceptual framework resulting from this paper was validated by presenting it to 20 executives experienced in the Reverse Logistics area in the Automobile after-market industry in different cities in India.

5. Theory and propositions:

Stakeholders are the entities that interact with an organization and are involved in decision-making and also in setting and attainment of goals in the organization. Stakeholders of an organization are the Suppliers, Customers, Employees, Shareholders, Competitors and Government. Huang et al [36] in their paper call the stakeholders as "Task Environment". The Stakeholders help in commitment of resources for the performance of tasks in an organization. Their paper thus tests empirically and claims that the Task Environment directly influences Resource Commitment. The industry that their paper studies, is the '3C' industry (computer, communication and consumer electronics industry) in Taiwan. But the authors of this paper extend the relationship to all the industries as one feels that the ideas of Stakeholders, Task Environment and Resource Commitment are clearly valid for all the industries where Reverse Logistics (RL) activities are involved, and thus also extend it to the automobile after-market in India.

Daugherty et al [29] discuss where the Resources for Reverse Logistics (RL) activities in an organization should be committed. They try to answer the question: Given the managers have some amounts of Resources at their Reverse Logistics (RL) tasks, which area is a good allocation? Their paper claims and proves empirically that Resource Commitment to Reverse Logistics programmes has a direct positive impact on Information Technology (IT) capabilities.

Improvement in Information Technology (IT) capabilities results in a distinct competitive advantage for the firms. Timely availability of information through ERP, EDI, RFID, etc. has resulted in a huge boost to the performance in recent times in organizations. Organizations like Wal-Mart have benefited in a big way by investments in such IT capabilities. The Reverse Supply-Chain activities are also benefited by the IT capabilities (Daugherty et al., 2005). Thus, as the paper points out investment in IT capabilities has a direct positive impact on Economic Performance in Reverse Logistics.

The Task Environment or the Stakeholders are the force that is involved in taking important decisions regarding an organization. The effect of Task Environment or Stakeholders on the Reverse Logistics activities is considered. A decision taken regarding an organization like for example to outsource a portion of the process by the management can result in improvement of economic performance of the organization. A decision taken to provide a higher dividend to the shareholders can result in the improvement of economic performance of the organization as more shareholders might invest in the shares of the organization. Thus, we arrive at our first proposition from the above discussed hypotheses.

***Proposition1*: Task Environment impacts Reverse Logistics Economic Performance.**

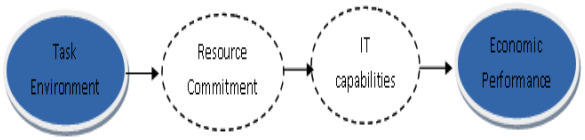

Fig. 2: Proposition1

IT Capabilities have proved a major enhancer for service quality for customers. The availability of EDI, POS, RFID, etc. have proved very useful to improve service quality [29], [50], [51]. These IT capabilities prove all the more useful in the case of Reverse Logistics where good service quality to customers is essential for handling of returns from the customer and result in the kind of Service Quality that gives satisfaction to the customers.

The Task Environment or the Stakeholders take the decisions which influence how an organization operates. These decisions have an impact on the efficiency and responsiveness of the operations and logistics. This means that they have an influence on the quality of service the customer receives. Thus, we arrive at our second proposition.

***Proposition2:* Task Environment impacts Reverse Logistics Service Quality.**

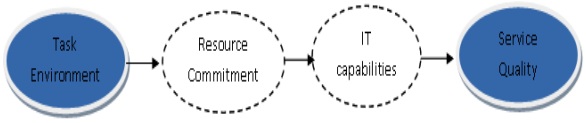

Fig. 3 Proposition2

Resource commitment for environmental management and green activities is found to enhance the reputation and goodwill of the organization in the eyes of customers as well as employees. It also promotes the adoption of cleaner technologies and hence adaptation to International and Government Environmental regulations easily [36]. Thus, the mentioned paper claims and proves empirically that Resource commitment is found to directly positively impact Environmental Performance.

Task Environment or the Stakeholders also make decisions regarding the environmental management and sustainability in an organization. A request by the shareholders for better environmental policies can result in better Environmental Performance by the organization resulting from a policy change. A decision regarding a better environmental policy could also come from the management. A better environmental policy similarly could also be a result of change in competitor's environmental policy. Thus, we arrive at our third proposition (Fig. 4).

Proposition3: **Task Environment impacts Reverse Logistics Environmental Performance.**

Fig. 4 Proposition3

The paper by Richey et al [52] extends the idea of Resource-Advantage theory to Reverse Logistics (RL) area. He claims that as more resources are committed for operations, organizations over a period of time, innovate newer processes in an attempt to produce more and utilize resources in a better way. Innovations could also result from Resource Commitment for requirements of environmental regulations of the Government or International bodies. Thus, Glenn Richey et al. (2005) claim that Reverse Logistics (RL) Resource Commitment causes Reverse Logistics (RL) Innovation.

Task Environment or the Stakeholders take the kind of decisions that support policies which result in innovations in an organization. For instance, an innovative policy adopted to replace paper work by EDI can result in better performance on all aspects. Similarly, a greener policy adopted to utilize effectively and dispose of wastes in a clean manner can improve the reputation of the organization among the public and also with the Government. Thus, we arrive at our fourth proposition.

Proposition4: **Task Environment impacts Reverse Logistics Innovation.**

Fig. 5 Proposition4

Conceptual Framework:

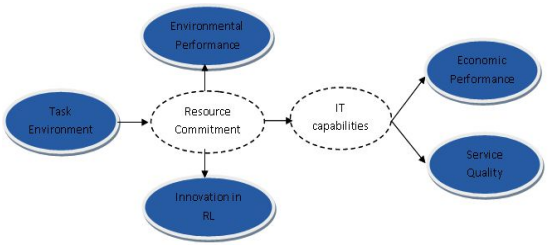

Fig. 6 Conceptual Framework

6. Implications of this paper:

While many papers discuss the impact of several factors on Reverse Logistics Performance and Innovation, few papers study the impact of the Task Environment or the Stakeholders on the Reverse Logistics Performance and Innovation. Even fewer papers present such concepts with a view to study the Automobile after-markets in an emerging economy. There are claims that this industry earns handsome profits even though the industry is largely in its beginning stage in India. Reverse Logistics in this area also has considerable potential since good returns-handling means good Service Quality and good Customer Relationship and hence improved profits. This paper gives the relationship between Task Environment and Reverse Logistics Performance namely: Economic Performance, Service Quality, Environmental Performance and Reverse Logistics Innovation.

Research could also analyze and study the activities in RL such as reduce, reuse, redesign, remanufacture, recycle, etc. separately focusing more on their individual potentials and throwing light on their capabilities and benefits.

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