## Reverse Logistics Management in Business

The rapid growth of population across the globe and accelerated technology development have been accompanied by an increase in production and consumption of fast-moving consumption products. The massive production required increased quantities of raw materials consumption. The matter required organizations to implement strategies that deal with resources efficiently and effectively within their supply chain management (SCM) activities and to consider the impact on environmental sustainability. The global policies encourage manufacturing firms to produce environmentally-friendly products through the adoption of reengineering and innovative technology management. Thus, industrial firms have implemented strategies of product recovery and zero-waste supply chains, agile and lean production. Reverse logistics refers to activities that are associated with the collection, recovery, or disposal products either directly or indirectly. The following section investigates the issue of RL, its related capabilities, factors impacting it, models of RL processes, automating the RL processes, and the guiding rules of RL in the USA.

The resource-based theory argues that the resources and capabilities of the firm identify its performance and contribute to the development of a sustainable competitive advantage. This influences firms to develop reverse logistics (RL) capabilities to reduce costs and maximize the value they offer to customers. Reverse logistics could be defined as the planning, implementation, and control processes that ensure efficient and cost-effective raw materials flow, inventory, finished products, and their relevant information collected from the point of sale to the point of production to recapturing value or disposal of the product RL could take place for many reasons, including defect products, product recall, disposal, end of life return, service return, warranty return, and use return. Accordingly, RL manages the flow of products or recycled products that starts from the consumer and ends at the supplier aiming at value creation, environmental protection, and cost minimization (Ref-A1B2C3). The adoption of RL contributes to the minimizing pollution through the reduction of the burden of load of end-of-life products (EOL) on the environment.

RL capabilities are the internal organizational capabilities and processes that a firm develops to ensure the effective implementation of its RL activities. RL capabilities consist of two categories; information management capabilities and products or services capabilities. The information management capabilities for RL utilize information systems and knowledge of products and markets. It should be considered that the return of products is usually unpredictable and requires special knowledge. Moreover, the combination of information of RL and forward logistics is challenging because product demand data could be coded according to different standards. Firms that developed over time and build logistics capabilities, including planning and controlling, agility, and lean production can find difficulties to transfer products into RL. Some factors that limit the process of RL capabilities are represented in poor integration of processes and activities, lack of infrastructure, and absence of RL in strategic planning (Ref-AB1CD2). Despite this, it is important for firms to have a secure RL plan to avoid extended lead times, avoid customer dissatisfaction, and increased costs of transportation and warehousing.

According to Antonyová, et al. (Ref-A1B2C3), there are factors that directly impact the RL's successful application in firms. First, the strategic factors include environmental aspects, customer service, cost reduction, quality improvement, and legislative issues. Second, the operational factors, represented in recycling managing supply, remanufacturing, cost-benefit analysis, warehousing, packaging, and transportation. Every organization should identify its strategic and operational factors based on its materials, production process, and packaging that ensures the protection of products during the transportation process.

There are key trends in the RL development required to create a sustainable production cycle for further social development. According to Antonyová, et al. (Ref-D4E5F6), these trends are developed by economic conditions and government regulations. These trends include a suitable material settlement with the recycling functions before starting the production process. Also, reuse of components that are incorporated into the production process, development of new products processes based on advanced technology to use the recycled materials, and investment in developing RL distribution channels. In addition, organization of logistics programs for sustainability purposes, increasing products responsibility across the product life cycle, focusing on green supply chain management, remanufacturing parts of the machines, packaging materials, and reusable materials renovation technology, cooperation with the retail chains to collect materials for recycling purposes and maintain safety measures in transporting dangerous materials.

Implementing an RL system requires the establishment of a legal environment and limitations, like the maximum allowed emissions for specific transportation methods. Moreover, the public policy of the country influences the RL process by setting rules and regulations to organize RL. It is important to note that modern companies establish direct links to the environment to build their corporate brand. Therefore, building the model of the RL processes could be implemented based on various methods. The optimization model under the conditions of a stochastic environment could be applied for the chains of the RL. Moreover, the genetic algorithm is another method that minimizes the shipping costs and the fixed opening cost According to Antonyová, et al. (Ref-J7X8A2). It considers locations, capacities of the recovering facilities, and possible transportation channels.

A third method of implementing the RL system is the quantitative model of Fleischmann that considers the type of items that could be bottles or pallets, spare parts, and machine parts, or consumer goods, like copiers or washing machines. Accordingly, the RL channel is based on the flow of items from the produces, distributer, to the end-user. A fourth model of RL establishes causal relationships between energy consumption, pollutant emissions, and the economic growth of the country (Ref-AB1CD2). This model is highly applicable in small and medium enterprises, where the RL system represents a direct part of the manufacturing process, where the logistics systems are built in-house.

The RL is a type of returns management. It tracks returned products from their point of return by the end-user. The returned products can be repaired, resold, recycled, or it could be scrapped. The applied method of RL impacts the firm’s profit margins. The increase in sales is usually accompanied by an increase in revenues. Therefore, with the implementation of a returns management strategy, revenues could be generated. In this regard, in case the firm does not have RL capabilities, it can depend on a third-party logistics (3PL) provider to increase the RL profit margin. The 3PL provider can be a cost-saver, streamlines the process, and frees up resources that could have been allocated to the RL to be directed to implementing other business activities. This could be supported by the argument that the RL process could be time-consuming and costly for the need of assessing the returned products for damage and transport to the repair location for resale (Ref-A1B2C3). Moreover, the inefficient product return process can negatively impact customer satisfaction that can avoid purchasing products from certain brands for a bad experience.

An example of the RL facilitation method could be the software streamlines returns. It can automate the process of managing returned products from the point of product return by the customer. The software could be based on machine learning to analyze returned products, rules of return, and sales demand. The advantage of the software is that it could be tailored based on the unique business needs and enables it to meet specific challenges. Moreover, it provides an all-in-one portal for returns management, automates the tracking process, provides reports to executives accompanied with reasons for returning products, can forecast data (Ref-SG7J2K). According to Business Wire (Ref-K92Y6F), the RL software can identify whether the returned products can be stored in the warehouse for resale or should go to the manufacturing unit for re-manufacturing.

In the USA, the Resource Conservation and Recovery Act (RCRA) allows the US Environmental Protection Agency the authority to control hazardous waste from its time of production to scrappage. Therefore, it controls transportation, treatment, warehousing, and disposal of hazardous waste. The EPA sets regulations and guiding policies to ensure safe management and cleanup of waste. Also, it implements programs to encourage beneficial reuse. The RCRA represents a combination of amendments of federal solid waste (Ref-J7X2B9). It describes scribe the waste management program issued by Congress.

Hospitals, pharmacies, and other health care units should comply with the RCRA-C in managing the storage of hazardous waste and handling requirements. The responsible person for facility compliance is called the compliance officer is required to confirm that appropriate determinations of hazardous waste are made by the firm. The RCRA differentiates between pharmaceutical and non-pharmaceutical products, where the pharmaceutical products require Reverse distribution (RD) and non-pharmaceutical products require RL. RD of pharmaceuticals is regulated by the Drug Enforcement Agency (DEA) and the New York State Department of Health Bureau of Narcotics Enforcement (BNE). While RL is excluded from this regulatory oversight. A DEA registered company that receives pharmaceuticals for returning unwanted or outdated products arrange for products disposal. Most of the returned pharmaceuticals are not classified as hazardous wastes, but they can have an environmental adverse effect. The matter that requires generators of pharmaceutical wastes to implement RD to manage these materials in a proper way that guarantees no harm to the environment (Ref-A1B2C3). Therefore the process of moving the pharmaceuticals from the inventory should identify their ability of reuse, to be returned to the manufacturer, or to be disposed according to the rules.

This final rule that the EPA has established to regulate RD and policy on RL. The rule stresses the importance of cost-saving, handling pharmaceuticals hazardous waste standards to comply with healthcare sector regulations and ensure applying protective actions for human health and the environment. This final rule is more likely to increase the safety of drinking and surface water by reducing the amount of pharmaceuticals hazardous waste that enters waterways. Moreover, the US Food and Drug Administration (FDA) has agreed not to consider the nicotine replacement therapies as hazardous waste when disposed. The matter that reduces costs and saves management activities in eliminating the impact of nicotine wastes (Ref-J7X2N9). Finally, the final rule of the EPA has exempted non-prescription pharmaceuticals and unsold retail products that could be used or reused from being a solid waste that does not require RD or RL.

In conclusion, RL could take place in firms for many reasons, including defect products, product recall, disposal, end of life return, service return, warranty return, and use return. RL manages the flow of products or recycled products that starts from the consumer and ends at the supplier aiming at value creation, environmental protection, and cost minimization. Firms that developed over time and build logistics capabilities, including planning and controlling, agility, and lean production can find difficulties to transfer products into RL. Factors that limit the process of RL capabilities are represented in poor integration of processes and activities, lack of infrastructure, and absence of RL in strategic planning. There are key trends in the RL development required to create a sustainable production cycle for further social development. Building the model of the RL processes could be implemented based on various methods. Software applications can automate the process of managing returned products from the point of product return by the customer. The EPA sets regulations and guiding policies to ensure safe management and cleanup of waste according to the RCRA.