Reverse Logistics: Application Fields and Benefits

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Abstract:

Reverse logistics has recently become an important part of the world economy and a means of improving the likelihood of success in complex supply chain management. Moroccan firms do not seem to be fully aware of its potential to significantly impact firms' performance in various ways which explains the low adoption of reverse logistics on the projects of supply chain management .However, in some cases, the implementation of reverse logistics practices emanates from corporate initiatives, but for some industrial corporates legal is out of obligation. Our paper aims at identifying the application fields of reverse logistics and shedding light on its advantages on firms 'performance. The emphasis is on the preconditions for successful reverse logistics which are is business process management and implementation of a robust traceability system. This paper examines how under conditions of reverse flow management, firms develop effective reverse logistics systems leading to an increase in their outcome, transparency and reputation in consequence. Our foremost goal is to identify the crucial role of reverse logistics in firms 'development and sustainability.

Keywords: Reverse logistics, supply chain management, sustainable performance, eco-conception, eco-sourcing, eco-manufacturing and eco-logistics

I. Introduction

Reverse logistics (RL) has become a crucial practice to implement on supply chain management projects because of its dramatic effect inter alia on firms 'outcomes (Becerra et al., 2021). Reverse logistics is of tremendous importance for the firms 'reverse flow management and more for complying with the legal instructions aiming at protecting the environment, ensuring effective and efficient use of resources and waste management especially hazardous waste (Gómez-Maturano and Sanchez-Lara, 2022). However, reverse logistics isn't linked only to reverse flow management, but it should be integrated upstream of the business activities to reach the objectives for which businesses implement reverse logistics practices. Reverse logistics is in general related to product recall while non-conformity reaches the final client or to those functions aiming at managing corporate hazardous waste that is seen as harmful to the environment (Pamal R. Nanayakkara, et al., 2022). In fact, reverse logistics goes beyond those areas. To ensure an effective implementation of RL practices, it should be closely and rigorously placed and monitored at every stage of the product development from the conception phase to the end of the product life-cycle.

Firms should use appropriate IT tools and techniques for effective reverse logistics implementation and monitoring. The use of relevant software applications, in particular those aiming at improving product traceability in all its stages of development, is required. Such information availability is merely in line with the traceability system requirement (Agrawal, Singh, 2019).

The first part of this paper aims at analyzing the areas of RL, with a focus on the question of RL implementation motives. is it part of the corporate initiative or the legacy obligation? (Matthew Wilson, Sean Goffnett, 2022). The second part is dedicated to the analysis of the impact of RL implementation on firms ' performance, especially financial and environmental performance.

II.Application fields and preconditions for reverse logistics implementation

Reverse logistics refers to the management of all operations linked to forward and backward movement. It consists of the management at the early stage of the product design, the raw material selection, planning the steps of the product conception and manufacturing, also the management of the reverse flow of unwanted, defective, damaged or used products (Mahir Haq et al., 2023). For older definitions, the focus was on the management of the reverse flow of used products, which revolves around the movement of goods from their point of consumption to the point of origin, as for the planning of the remanufacturing and refurbishing activities (Roger et al., 2002). To Stock, Greis & Kasarda, 1998; cited in Ernest Mugoni , B. Nyagadza, P. K. Hove, 2023, reverse logistics consists of the complete logistics cycle system that encompasses the forward supply chain of commodity sales and leads to profit and cost optimization. The focus is on the legal requirements, which are on the benefit of environment protection and impliedly on cost optimization, this result comes from the efficient resources reuse, recycling of unqualified products and packaging, minimizing pollution and sustaining human and environmental development. In order to achieve firms 'goals from the implementtation of reverse logistics operations, as Matthew Wilson, Sean Goffnett, 2022 argues, it is necessary to integrate some practices at the early stage of the processs so as to facilitate the monitoring and management of the reverse flow. Industrial firms should develop a specific conception and sourcing strategy to reduce the processing time and provide users with responsible gestures at all stages of product development. This also applies to the sourcing policy which occupies a considerable place in the reverse logistics operations. For instance, the selection of environmentally friendly and safe raw materials requires low processing time and generate less waste in consequence which consequently allows asmooth running of reverse flow, particularly those related to used, damaged, unwanted or defective products. Rodrigo Cimas da Silva et al., focus on the analysis of solid waste management mostly in the pharmaceutical industry which is the most regulated in the world because of the use of harmful substances in their production process (Xu and Yanbin, 2022). Firms operating in the pharmaceutical industry must comply with the environmental legislation not only in the process of production but also in handling waste neutralization and destruction in a safe way to prevent environmental disasters (human, animal, ecology and environment concerns) Sivaramanan, 2013; Kubra Sar, Pezhman Ghadimi, 2023).

Figure 1 below describes the stages part of product development and moves according to the forward and backward moves. Some specific activities are related to the reverse logistics of decision-making after product use, the question is to decide on product remanufacturing, refurbishing and recyclability; if the product isn't recyclable, regarding the level of its harmfulness, it will be subject to disposal, destruction or landfill. The first thing to identify is how to recapture value. For example; for some specific electronic products, firms can extract some substances or spare parts that can be used to repair defective products. The stages to follow in case of rework, remanufacturing and refurbishing should also be clearly defined. At this stage, the used products get a new life and might be distributed to specific clients (Bhatia et al., 2020).

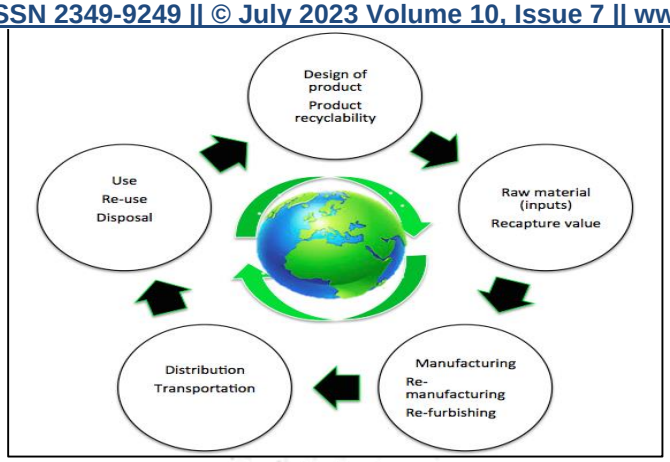

Figure 1: Product life cycle incorporating reverse logistics practices

For this, firms should carry out a complete supply chain, which encompasses forward and backward product movement. Surely by now reverse logistics practices should be included in the early stage of product development. The application fields of reverse logistics practices are displayed in Figure 2 below.

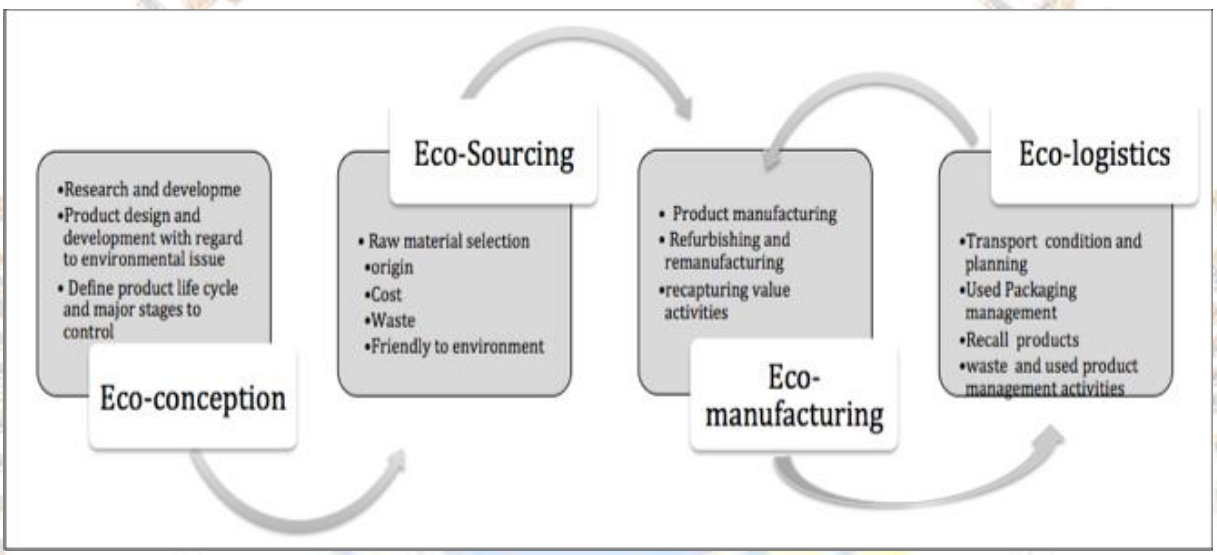

Figure 2: Reverse logistics application fields

Reverse logistics involves various milestones from the product design stage to the end of product life. Equal importance is attached to all stages and are treated in the same way. To improve the ecological quality of the product and to reach the goals for which the firm implements reverse logistics, eco-innovation is required for sustainable production and environmentally friendly delivery. The eco-conception refers to the stage of the product design, the focus on the process of creating, testing and validating prototypes, products and techniques in the attempt to find the appropriate design and techniques leading to mitigate the negative impact of the product in all its life cycle. For Preno, and Amina, 2022, 80% of a product's environmental impact is determined from its conception stage. For this, we recommend the integration of environmental concerns at the early stage of the product conception enabling firms to choose the appropriate materials and also to fix the possible part of their product to reuse and recycle. Firms should be committed to supporting R&D in improving the recyclability of their products and all of the used material contents. The second stage refers to the eco-sourcing which is to implement within the firm practices for eco-friendly sourcing or responsible sourcing. It significantly goes beyond the selection of suppliers and their location to saving transportation costs and minimising pollution. Equally important is the purchase and use of friendly raw material and energy, that might have a crucial impact on the overall reverse logistics activities concerning their impact on the environment and cost of waste processing and disposal. For eco-manufacturing, it refers to the

development of the manufacturing process, procedure and implementation of some eco-responsible gestures aiming at efficiently consuming less energy or inputs. The purpose is to wisely use the resources and production factors with less ecological damage. Firms are required to opt for environmentally responsible production. Eco-logistics refers to the management of the move of products, and the organization of good transportation taking into account the product specificities for the selection of adequate means of transport involving inter alia the delivery schedule. For efficient delivery scheduling, several IT solutions are developed to optimize vehicle itineraries and reduce energy consumption, cost and improvement in optimum loading rates for transport units (containers, trucks…) (Kubra Sar, Pezham Ghadimi, 2023). For the reverse flow organization firms should be aware of the necessity to avoid delivery trucks returning empty to their origin. It is advisable to schedule the unwanted, damaged or unsold goods picking simultaneously.

The success of the implementation of reverse logistics relies much on supply chain management, and more specifically on business process modelling and the process of decision-making (Mahin Had et al., 2023). Without this business process management firms cannot make adequate decisions regarding the fate of their products.

III.Reverse logistics impact on firms ’performance

Reverse logistics was seen as costly for firms because of the lack of information regarding its benefits. In what follows, is an outline of some of the benefits resulting from the reverse logistics, focusing mainly on those leading to firms ’financial, environmental and social performance enhancement.

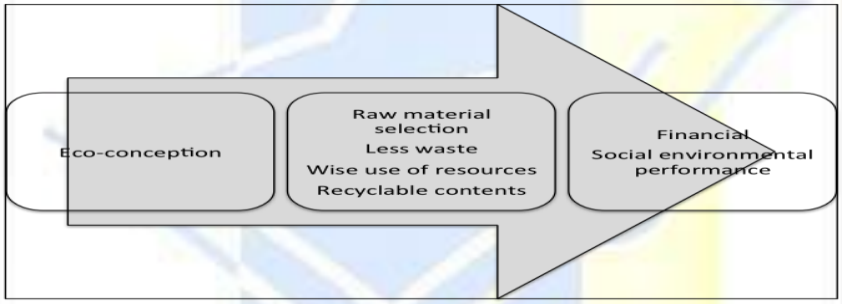

Figure 3: Eco-conception effect on firms ’performance

Implementing reverse logistics practices at the stage of product conception generates a positive impact on financial, social and environmental performance (Srivastava, 2007). At this stage, as described in Figure 3, firms develop product design according to some specific prototypes and define production resources and the responsible gestures aiming at organizing the production cycle and the possible use of specific recyclable materials and contents which come up with positive effects on firms ’sustainable performance.

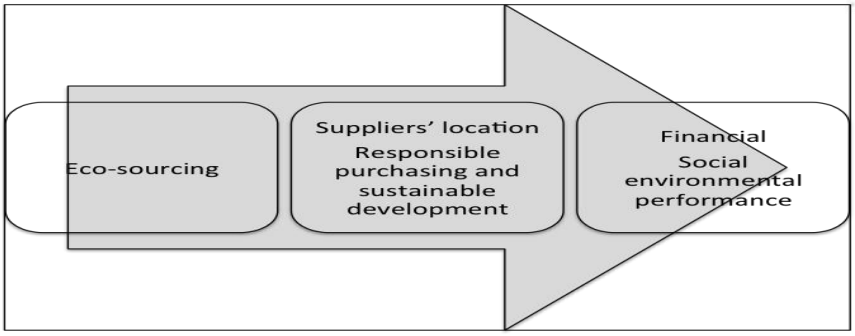

Figure 4: eco-sourcing impact on firms ’performance

The main RL practices at the eco-sourcing stage are shown in Figure 4. It is noted that at this stage firms make several decisions associated with suppliers 'notation about the required materials and raw material quality, final cost per unit including transportation costs, especially the level of the greenhouse-gases emission (Chongjie Gao, S. Wolf, S. Wang, 2021). All helps to reduce supply costs and alleviate the potential negative effect on environmental grounds. Thus, RL practices at this stage generate a positive effect on sustainable firms 'performance.

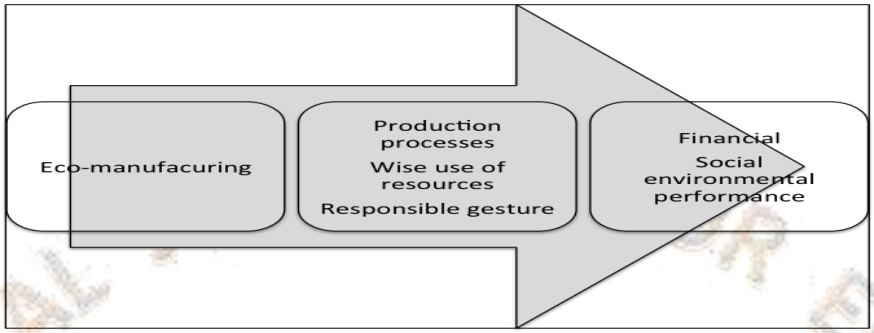

Figure 5: Eco-manufacturing effect on firms 'performance

In the same line of thought, figure 5 presents the main RL practices in the eco-manufacturing stage. This stage deals with the production process optimization and efficient use of production resources. It aims at manufacturing products through economic processes and procedures including eco-responsible gestures, all generating a positive effect on environmental performance through the wise use of resources which in turn affect positively financial performance and hence social performance. For the used product, this stage includes several activities related to remanufacturing and refurbishing damaged or used products, firms make decisions regarding repairable products (when the cost of repairs doesn't exceed product costs) that are integrated into the remanufacturing process (Gaustad et al., 2018). For the non-repairable products firms take measures to recapture value and for the non-recyclable contents will be destroyed and stored for disposal.

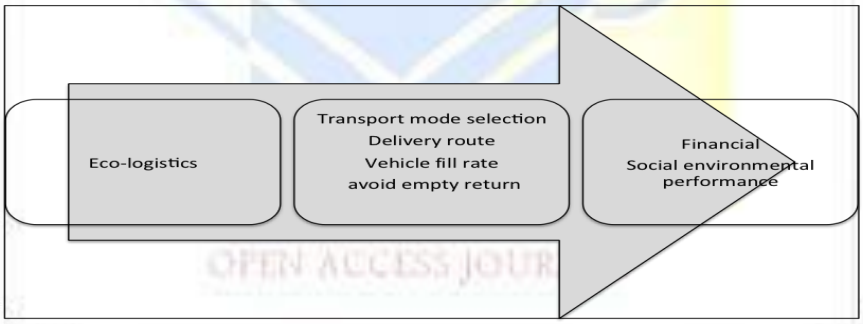

Figure 6: Eco-logistics effect on firms 'performance

For the eco-logistics main activities as displayed in Figure 6, it includes the forward and backward process. At this stage, firms decide on the appropriate transport mode regarding client location, the delivery deadline and the volume of client orders. For minimizing delivery costs and reducing air pollution, firms use specific software applications to identify the best itinerary or delivery route for minimizing energy consumption and greenhouses-gases emissions, thus, this transportation process optimization has a direct positive effect on both financial and environmental firms 'performance and indirectly positive effect on firms 'social performance (Prajapati et al., 2019). To optimize the transport circuit, firms organize the reverse flow that consists of scheduling the unsold, damaged, unwanted or defective products picking or removing from the point of consumption to the producer (Dutta et al., 2020). In this way, producers avoid empty returns and

also avoid planning special transport programs for picking products from their final destination to their origin (Kongar et al., 2015). According to this, firms mitigate transportation costs and greenhouse gases emission and therefore generate a positive effect on their sustainable performance.

IV.Conclusion

Nowadays, reverse logistics is crucial for effective supply chain management. reverse logistics implementation is in favor of the supply chain management in the form of reducing costs and expenses. Whereas, reverse flow management affects mainly the reputation of the firm and its relationship with all stakeholders mostly its relationship with its clients. Furthermore, the wise use of production resources affects the firms 'sustainability. The rational reuse of recyclable raw materials enables firms to sustain their business going and prevent the negative effect of irrational use of natural resources that might jeopardize the availability of natural resources for future generations.

The success of reverse logistics practices implementation depends to a great extent on the firm commitment and stakeholders 'awareness and involvement in the ongoing improvements and environmental issues requirements (Mahin Haq et al., 2023). To ensure that this mission is successful, quality and environmental issues must be monitored throughout all stages of production. The use of adequate IT solutions and software applications is recommended to ensure an appropriate product traceability system which is vital not only to direct supply chain management but also to reverse flow management.

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