

## A LITERATURE REVIEW ON CLOSED-LOOP SUPPLY CHAIN

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### ***Abstract***

In accordance with modern environmental, legal, social and economic factors, this has attracted a large number of academics and industry workers to attend to matters relating to the reverse supply chain and the closed-loop supply chain. This interest has been reflected in the vast number of publications published in scientific journals in recent years. As a result of the limited presence of some natural resources in the supply chain as part of the physical supply in the chain, companies turned to recycling, turning to the concept and using it to their advantage in order to determine the costs of purchasing raw materials and recycling in such a way as to allow purchase at the lowest price while avoiding waste of financial resources. The idea of a closed-loop supply chain (CLSC) revolves around restoring resources from customers, remanufacturing them and then re-marketing them. The current study recommends highlighting the social aspect of clients and the role of this concept in the realization of green practices. Therefore, a comprehensive review of past literature with up-to-date and evolving papers is vital to frame this concept from the past to the present, and to highlight future trends. The aim of this paper is to review papers recently published in the reverse supply chain with reverse loops in scientific journals. Similarly, this will include models of closed-loop supply chains, factors affecting closed-loop supply chains, and their types.

**Keywords:** closed-loop supply chain, environmental management, sustainability, biomarkers, operation programs and sustainability

## 1. INTRODUCTION

The CLSC concept is a traditional supply chain management with a forward-facing trend, starting with suppliers through supply chain loops and distribution channels to customers. In addition, the concept also includes reverse supply chain management from the consumer to the company, and factories try to retrieve their products back from the market in case the product does not meet the needs of the customer or does not sell on the market, and the company tries to repair or remake them again. The CLSC concept has always contributed to reducing the waste rates of manufactured products.

A green supply chain is a supply chain in which environmental considerations are addressed during its design. For example, new raw materials would have higher prices if the manufacturing process had lower energy consumption. Recycled materials will have a lower purchase price while processed with higher energy consumption. Implementing sustainable supply chain management is a key factor that pressures organizations to reduce their negative environmental impacts and increases social and economic benefits (Soleimani et al., 2017; Gupta, 2018).

In addition, the life cycle of many products in the market has become short due to the technological development of some industries (Kazemi et al., 2019), which has forced companies to manufacture modern products continuously and rapidly to put them on the market, adding to the importance of the CLSC concept of how to retrieve expired products and how to dispose them, as well as introducing new products to the market (Masi et al., 2018). To implement these practices, the CLSC concept was adopted by supply chain associations (Panda et al., 2017), through which some basic considerations of interest to any company (environmental consideration and collective consideration) that can be achieved through CLSC have been incorporated, which also provides benefits such as saving in spent natural energies, saving in costs and improving the public image of the company in society (Mangla et al., 2018). CLSC is a framework through which certain activities are conducted and controlled to ensure increased long-term profitability of a company because of the cost savings incurred by companies following this concept (Amin & Zhang, 2013). It includes all forward supply chain practices (Paksoy et al., 2011), the most distinctive of which are the recycling practices, the basic strategy for restoring the product from the market and re-rotating it (Abdallah et al., 2012). For example, Xerox succeeded in saving about 40% to 65% in assembly costs from recycling printers, and the same approach became true for other companies such as HP and Kodak, where they focused on recycling the components of the product, which greatly benefited from cost saving.

There are some factors that may affect some companies in the application of the CLSC concept, represented in the limited financial resources that allow the company to conduct reassembling and recycling within the company (Farrokh et al., 2018). There must also be full coordination between distribution outlets and clients with the company and service providers to facilitate the recovery of products back to the company (De Angelis et al., 2018). Over time, many legislations and environmental constraints have emerged that can affect companies in their normal operation, giving

rise to the CLSC concept, which in turn has given rise to standardized strategies that can be implemented in how to handle products or materials that have been recovered from the market to the company.

A supply chain is a structured process that works to ensure goods flow from suppliers to producing companies and then distributors until they reach the customer, while dealing with another group of companies that provide services that support the company's supply chain performance, while paying attention to practices that work to ensure that the product is recovered from the market until it reaches the producer again to close the whole loop in supply chain management (Konyalıoğlu & Beriketli, 2020).

To ensure market continuity, companies may need to solve problems efficiently and ensure that production resources' availability is not hampered, which gives them continuity in the market competition. One of the problems of companies is to reduce costs, which can be achieved significantly by restoring unwanted products in the market and by trying to recycle them. This saves the company a lot of costs, as well as reducing the depletion of natural energies used in manufacturing, such as petroleum materials and their derivatives. Interest has therefore increased significantly towards sustainable supply chain management, and a culture of sustainable supply chain management has begun to be spread within companies to ensure that the flow of goods is sustained, enhancing productivity and reducing natural threats due to resource scarcity (Durakbasa & Gençylmaz, 2020).

Returns of clients is also a very large part of the threats that companies face, especially in highly competitive markets, and the cost of returns is a significantly borne by the companies (Diabat & Govindan, 2011). That cost could be assessed to reach thousands of dollars per store, so there was a need to use closed supply chain management methods to decide how best to deal with returns and reduce costs (Jayant et al., 2012; Beamon, 1999). Therefore, companies are required to design CLSC closed-loop supply chains and define their practices and policies when designing their traditional forward supply chain (Seuring, 2004). The closed supply chain is therefore an effective approach to sustainable supply chain management (Solvang et al., 2007). Companies implementing sustainability practices will benefit greatly from the use of their operations financially and administratively. Although there is considerable academic effort in sustainability management research and green supply chain management, there is some shortcoming in the literature on CLSCs and their association with sustainable activities (Seuring, 2004). Practices that manage the reverse logistics system are still under continuous development (Savaskan et al., 2004). It should be noted that there are few attempts to carry out CLSC-specific research, and this study is designed to integrate some of the previous literature in order to come up with some information aimed at the concept of CLSC dimensions and to reveal the latest information in the same field after analyzing previous studies to reach the most up-to-date trends in the field (Shaharudin & Zailani, 2012). This research intends to examine previous CLSC-related research from the literature during the period 1999-2021 to understand changes in the closed supply chain during that period. The research consists of four basic sections: an introduction to the

concept and origin of CLSC, a presentation of previous studies related to the CLSC area, research methodology and finally the findings of the study.

Accordingly, the present paper aims to answer the following questions:

RQ1: What are the benefits of applying the concept of closed-cycle supply chain management?

RQ2: What are the types of closed-cycle supply chain management practices?

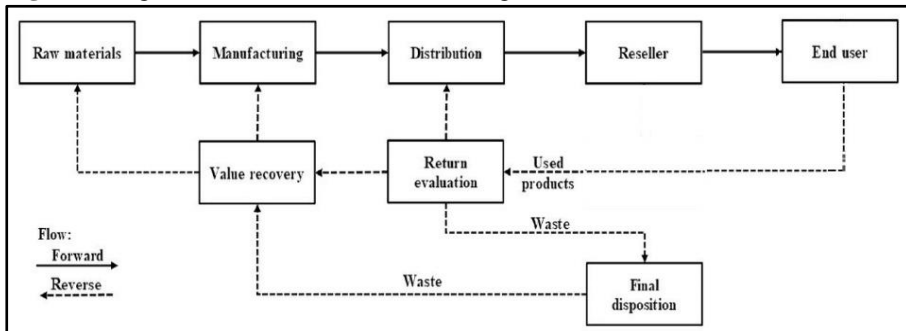
RQ3: What are the challenges that companies face in applying the concept of closed-cycle supply chain management?

## **2. LITERATURE REVIEW**

### **2.1. Logistics, SCM, and Reverse Logistics**

According to the Council of Supply Chain Management Professionals (CSCMP 2019), logistics is known as a part of an organization's business that deals with the process of efficiently planning, implementing, and controlling the flow and storage of products as well as the services and associated information, covering from the point of origin to the point of consumption in order to meet consumer requirements, including suppliers, manufacturers, transport companies, warehouses, retailers, and customers (Chopra & Meindl, 2010). Logistics is highly associated with the supply chain management (SCM) concept, which comprises the planning and managing of all activities related to the supply, procurement, transformation, and administration of the logistics system, in addition to managing the logistics system, coordination, and collaboration with the business (chain) partners (Simchi-Levi et al., 2014). Another concept is reverse logistics (RL), opposed to forward logistics, which begins with end-users of the logistics chain in order to collect or return used products or returned products without use or defects to some part of the supply chain, from decisions that may involve recycling, remanufacturing, repair, or final disposal (Govindan et al. 2015). A generic supply chain with forwarding and backward supply flow is shown in Figure 1; the solid lines refer to the forward logistical flows, and the dashed lines represent the reverse flows. The closed-loop supply chain (CLSC) simultaneously considers an integrated process of forwarding and reverse flows (Oliveira & Machado, 2021).

**Figure 1.** A generic model of direct/reverse logistics



Source: Oliveira & Machado (2021)

## 2.2. Closed-Loop Supply Chain

The supply chain is a bunch of exercises that incorporate buying, producing, coordination, appropriation, and advertising that play out the capacity of conveying worth to the end client (Paksoy et al., 2011). Green financial aspects have been filling in the previous twenty years in a heap of various fields. In that capacity, there have been a lot of examinations in the fields associated with supply chains and coordination. Various trendy expressions have been utilized, for example, Green Supply Chain Management (SCM), Closed-Loop Supply Chain Management (CLSCM), Reverse Supply Chain Management (RSCM), Reverse Logistics (RL), Sustainable Supply Chains (SSC), Sustainable Transport and so forth (Aleš Groznik & Jure Erjavec). CLSCM, RSCM, and GrSCM issues included are more unpredictable and need more endeavours to control forward and inverse coordinates at the same time thinking about the ecological effects. SCM has “made associations consider closing the supply chain loop” to accomplish harm to the ecosystem fabricating the upper hand and higher benefits (Kumar & Kumar, 2013).

According to Guan et al. (2020), the concept of CLSCM is implemented in many countries and companies. In terms of waste recycling, improvement of environmental protection, recycling e-waste, reduction of usage of certain hazardous substances, sustainability, and circular economy matters. In general, CLSC can be seen as the traditional forward supply chain but supplemented by reverse operations for recovered products that are reprocessed and ultimately re-enter the forward supply chain (Stindt & Sahamie, 2014). Now, meeting the legal and regulatory requirements and economic reasons is the strong driving force that practitioners take CLSC into consideration in order to dispose of their end-of-life products. The CLSC is not a mere a method for minimizing costs, but rather it is a way to gradually create more revenue opportunities for producers (Peng et al., 2020). Stindt & Sahamie (2014) noted that the central decision within a CLSC strategy is about the aspired level of recovery or the recovery option. This recovery option determines the amount of value that is recovered from the reprocessed product, which can be one of six different options described in the academic literature: repair, reuse, refurbishing, retrieval,

remanufacturing, and recycling. However, the uncertainties pose a serious challenge to the planning and actual operation of reverse activities, compared to the traditional forward supply chain. These uncertainties occur regarding the amount and quality of the available secondary feedstock. Further stochastic impacts are the reprocessing time and the effective yield, as well as the common uncertainty regarding the final customer demand for the reprocessed products.

CLSCM organizations may grow financially and ecologically supportable of mechanical framework (Braz et al., 2018). The recoverable item climate that GrSCM is making “is a closed-loop system incorporating traditional logistics forward streams with coordination channels turned around” (Ferdows, 2018).

### **2.3. Factors Affecting Closed-Loop Supply Chain**

The closed-loop supply chain (CLSC) expects firms to be engaged with item recreation subsequent to gathering centres (we will utilize centres, utilized items, and item returns reciprocally) from shoppers. Item remaking requests inventory network accomplices to be occupied with reusing, renovating/reconditioning, and remanufacturing of items offered to the commercial centre (Gaur et al., 2016). Generally, 130,000 organizations across the US are occupied with item remaking, producing yearly deals surpassing \$300.

According to Shekarian (2020), turnaround coordination exercises start with securing centres. Accordingly, centre obtaining gets quite possibly the most basic strides in overseeing CLSC. Be that as it may, centre procurement is likewise one of the significant boundaries for effective item remaking (Kannan et al., 2010) because of vulnerabilities related to timing, amount, and nature of centres. One of the techniques to diminish such vulnerabilities is offering monetary motivators to customers for bringing cores back. Caterpillar Inc. guarantees the quality and nature of the centres by receiving a store discount strategy (Wei et al., 2015). In addition, CLSC writing proposes that purchasers are normally not roused to return their items back to firms if there should be an occurrence of absence of motivations and data of company’s reclaim strategy (Morana & Seuring, 2007).

### **2.4. Evolution of Closed-Loop Supply Chain**

Uncertainties in securing and handling the market, and different phases of the closed-loop supply chain have extraordinarily added to the intricacy of remanufacturing and have diminished interaction productivity, hindering the supportable improvement of businesses and the circular economy. As of late, an expanding number of studies have been conducted that emphasize the uncertainty examination of closed-loop supply chain. Under the ebb and flow centre around the “green, low-carbon, and feasible” industry, a closed-loop supply chain (CLSC) has progressively pulled in research interest from various researchers (Mohammed et al., 2017; Ma & Li, 2018; Asim et al., 2019). As a significant method of understanding a circular economy and manageability, CLSC can limit asset input, squander

discharges, and energy spillage through a durable plan, support, fix, reuse, remanufacturing, revamping, and reusing (Peng et al., 2020).

At first, the scholarly regard for the CLSC started from public mindfulness (Dowlatshahi, 2000). From there on, governments passed enactment to permit makers to discard their finish-of-life/end-of-life items, like the “Squander Electronic and Electrical Equipment” order utilized by Besiou (Georgiadis & Besiou, 2010; Neto et al., 2010). CLSC is not a strategy for limiting expenses but instead is an approach to set out more income open doors for producers progressively. The inventory network in its traditional structure (forward store network) is a blend of cycles that meet client necessities, including every conceivable element, like providers, makers, carriers, distribution centres, retailers, and the actual clients (Govindan et al., 2020).

Then again, invert supply chains as a rule starts by gathering items utilized by end clients, which are subsequently reintegrated into the inventory network or discarded suitably (Govindan et al., 2015). Recycled materials can be gotten back to the inventory network through reuse (recycled market), fix/restoration (guaranteeing the pre-owned item quality meets new item quality), and remanufacturing (guaranteeing the pre-owned item meets similar exacting quality guidelines as another item). As per the US Reverse Logistics Executive Committee, reverse logistics (RL) is “a proficient and practical cycle from the point of utilization to arranging, execution, and control of crude materials, stock, completed items, and related interaction data to recapture the esteem or appropriately discard the objective”.

“Uncertainty” alludes to an expression that can't be straightforwardly communicated by a specific measure of data (Liao et al., 2019a). It portrays a circumstance that cannot be found out or where there are various prospects. Every conceivable state compares to a specific chance (Liao et al., 2019b). Uncertainty is an intrinsic and unavoidable trait of a CLSC. These elements increment the administration intricacy of the CLSC (Liao et al., 2018). Late investigations have shown that profound uncertainty in the inventory network frustrates the change to a CLSC (Velte & Steinhilper, 2016). Certain writing surveys on the shut circle and reasonable inventory network the executives have demonstrated the requirement for extra uncertainty components to be methodically contemplated.

To improve comprehension and the executives of the uncertainty factors in the CLSC, it is critical to sort various kinds of uncertainty and how to make up for them (Coenen et al., 2018). In any case, a few ongoing remarks propose that a couple of articles have unequivocally focused on the sorts and additionally wellsprings of different uncertainties, especially in regards to uncertainty figuring and strategies. Concerning arrangements, barely any researchers have done point-by-point insights (Govindan et al., 2015).

### **3. METHODOLOGY**

This paper presents a critical reviews regarding general analysis for the CLSC. At the micro-level, this study focuses on an analysis of the literature content. In

addition, prospects for future research are examined from the perspectives of factors, methods, and solutions, and the gaps in future research are defined, laying the foundation for follow-up research.

## **4. RESULTS**

By listing some studies of closed supply chain management (CLSCM), we found that many of the practical advantages in companies that follow closed-cycle supply chain management are recycling production wastes, which saves wasted costs, in addition to protecting the environment and society from the harms of production waste. This requires intervention by certain organizations to monitor factories and companies in production and recycling practices and to increase corporate awareness of green supply chain management practices. Applying the concept of closed-cycle supply chain management. CLSCM requires managing market-to-company returns as it is not only about production practices and manufacturing waste management, but it is also about logistics practices and returns management. Also, this concept has other forms such as repair, reuse, renovation and recycling. Company managers must also understand the uncertainties because this concept differs from that of traditional supply chains, because it manages the types of overproduction in stores and how it is managed so as to achieve the lowest possible costs.

### **4.1. Future Studies**

There are several topics on the subject of CLSCM that could be studied in the future, such as the role of closed-cycle supply chain management in reducing companies' operational costs, the role of green logistics practices in providing competitive advantages to companies, the role of CLSCM in petrochemical companies, and the role of lean production in supply chain management network practices.

### **4.2. Limitations of the Study**

The study presents previous studies on CLSCM, listing some studies from 2020 to 2021.

## **5. CONCLUSION**

CLSCM has been recognized as a methodology for improving the execution of the interaction and items as per the prerequisites of the ecological guidelines. CLSCM is the summarizing of Green Operations (Reverse Logistics), Green Design, Green Manufacturing, Waste Management, and Product Life Cycle Assessment. CLSCM accepts contemplations to natural causes just as financial matters as a goal, while



regular SCM typically focuses on financial aspects as a solitary goal. In this paper, information on different shut circle inventory networks the executives' issues enlisted in the writing has been examined. Shutting the production network gives the operational and monetary benefits for an association, and all the while, it works in the courtesy of natural manageability. CLSCM gives a serious edge and improves the monetary status of an association. Powerful execution of CLSCM prompts a decrease in squander, decrease in natural contamination, enhancement of asset usage, and decrease in costs. Planning of legitimate approaches is needed to address the distinctive natural issues for which comprehension of the means which may prompt maintainability ought to be known, and one ought to have a reasonable comprehension of the obstacles and entanglements of the framework prior to going for the execution.

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