

Analysis of Green Supply Chain Management Practices in Automotive Industry Based on Green SCOR MODEL

TRONNEBATI Imane and JAWAB Fouad
Technologies and Industrial Services Laboratory
Higher school of technology,
Sidi Mohamed Ben Abdellah University,
Fez - Morocco

Imane.tronnebati@usmba.ac.ma

Fouad.jawab@usmba.ac.ma

Abstract

The automotive industry is a growing sector that not only provides great benefits but also causes environmental problems.

In recent years, there has been a growing interest in developing this profitable industry without harming the environment. Green supply chain management (GSCM) Minimizing the harmful environmental effects of the supply chain and improves the main effectiveness of automotive manufacturing industry. Based on the literature review of green supply chain management for automotive industry, this paper analyzes the GSCM practices in automotive manufacturing industry Based on the Green Supply Chain Operations Reference Model (Green SCOR Model) which divided on three level.

According to the result of the analysis, the connections between nine GSCM practices and the five process of Green SCOR MODEL are proposed. Through applying, the proposed green practices based on the Green SCOR MODEL companies can accomplish profit and market share goals by decreasing environmental repercussions and increasing green efficiency.

Keywords

Green supply chain management; practices; automotive industry; Green SCOR Model; manufacturing.

1. Introduction

The automotive industry is becoming highly competitive, because of the changing nature of products, the variety of models, and client demands(El Farouk Imane and Fouad, 2017; Ibn El Farouk et al., 2020). In the other hand Environmental challenges have intertwined with all areas of long-term economic productivity, while in this recent years, the concept of environmental protection has received considerable attention. Incorporating green practices into Supply Chain Management (SCM) to achieve economic, environmental and social performance(Jawab and EL MOKADDEM, 2018) is a subject that has become a hot topic in academic literature. This enthusiasm reflects a growing concern for the environment and the attempts by governments and organizations around the world to reduce environmental issues according to (Jawab and Arif, 2015). Moreover, supply chain management is a concept that has been used to describe materials planning and control, information flows and logistics activities both outside and inside of an organization (JAWAB and Bouami, 2004). It also aims to add value to the global logistics chain by enhancing management capabilities and processes, increasing profitability through efficiencies and maintaining customer satisfaction (Arif et al., 2020; Jawab et al., 2006).In this context our paper will study green supply chain management practices based on green SCOR MODEL.

This paper has organized as follows: the generality of automobile industry has represented in section 2. The GSCM has defined in section 3 while the study of GSCM practices for automobile industry based on Green SCOR MODEL has presented in section 4. Finally, the conclusion of our paper offered in Section 5.

2. Generality of automotive industry

Over the last few decades, automobile technology has progressed at a rapid pace. From the first car ever invented using steam to today's wide array of technologies, Transportation has categorized as a necessity and has seen a shift in recent years from a focus on environmental impact of various modes and mediums of mobility(Ibn El Farouk et al., 2020).

The automotive industry included a diverse range of companies and organizations involved in the design, development, production, marketing, and sale of automobiles. In terms of revenue, it is one of the world's largest industries. The automotive industry is an example of a challenging sector that has advanced well beyond the Henry Ford's method of scale economies, standardization, and manufacturer-led innovation. Today, the average mass-produced car receives minor design updates every year or semi-annual basis, and new model introductions every few years (Delic and Eysers, 2020; Moufad and Jawab, 2020).

3. Generality and definition of SCM

The SCM is managing and planning all activities. Starting with sourcing and procurement, to manufacturing and distributing”(el Farouk and Jawab, 2020; Imane et al., 2020) SCM attempts to improve the global logistics chain by utilizing management tools and methodologies, creating value, increasing productivity through efficiency, and satisfying customers(Tronnebati and Jawab, 2020).

GSCM is a method of incorporating environmental concerns into the supply chain management process, beginning with product design and continuing via product procurement and selection, manufacturing processes, final product delivery, and life cycle management (Tronnebati and Jawab, 2020). To make the supply chain effective and ensure sustainable productivity increased cooperation between collaborating enterprises GSCM have called. Individual firms, as well as the management of the global supply chain, must link environmental economic and social objectives into performance criteria (el Farouk and Jawab, 2020).

4. GSCM practices for automobile industry based on Green SCOR MODEL

4.1 Green SCOR MODEL

The SCOR model (Supply-Chain Operation Reference-model) is the creation of The Supply-Chain Council (SCC) is an independent, non-profit global organization whose membership is accessible to all enterprises and organizations interested in adopting and advancing the state-of-the-art in supply-chain management systems and techniques (Jawab et al., 2016).is a supply chain management standard reference model that covers industries. he SCOR model is a oneof-a-kind framework that connects business processes, metrics, best practices, and technology elements into a single structure (Imane et al., 2013) to help firms in communicating precisely with their partners about supply chain issues, objectively assessing supply chain performance, and determining the goal of supply chain improvement (Qianhan et al., n.d.).

The Green SCOR model incorporates environmental considerations into the supply chain analysis tool. Humans can alter their process connections with the assistance of the developed model, adding standard environmental friendly guidelines from the first supplier to the final customer, and optimizing their final operational aim. The Green SCOR Model is composed of three levels. The first is the top level (process types), it represents the core management processes and the metrics and measures corresponding to the management processes. The second one is the configuration level, which companies describe their operational strategy in detail. The third level is the Process elements level, which contains additional details of the second level.

4.2 Specific structure of Green SCOR MODEL levels for automotive industry

The construction of an automotive manufacturing supply chain model based on the SCOR model allows organizations at each location of the supply chain to comprehend the operating mechanism. Performance indicators have inserted into the model to offer a foundation for supply chain improvement and to enable businesses to gather enough data to support their decision-making. Moreover, the supply chain model creates an operating procedure utilizing standard vocabulary and symbols to ensure that all businesses and divisions of functions can interact smoothly.

Figure 1 shows the Automotive Industry Green Supply Chain Model that consists of suppliers, manufacturers, customers, and recycle centers, according to the particularities of the automotive supply chain. To begin, automobile manufacturers select environmentally friendly suppliers and use environmentally friendly resources to achieve clean production. The constructed automobiles have then delivered to customers via green transportation and a variety of

green marketing initiatives. The flow of information and logistics have accompanied by the procedure. Finally, the recycle center collects post-consumer waste or residual vehicles, which put into the reverse logistics channel back to manufacturers and suppliers to complete the reuse process. All of the processes have designed to improve supply chain efficiency while maximizing resource consumption and minimizing environmental impact.

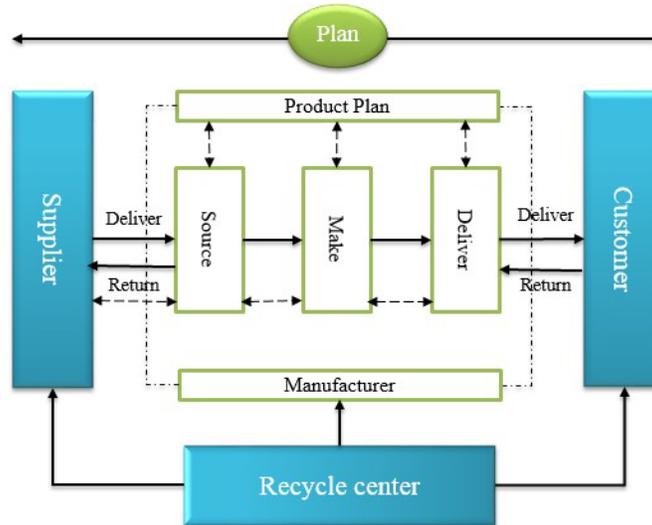


Figure 1. Green supply chain model for automobile industry

4.2.1 The first level structure for automobile industry

The first level of green SCOR model for automobile industry composed of five processes: green plan, green source, green make, green distribution and green return.

- a) Green plan: Assess supply resources, aggregate and prioritize demand requirements to create a complete green supply chain and integrated plan that can better serve the green purchasing, manufacturing, distribution, and recycling activities.
- b) Green source: In this step, purchasing green materials from selected green suppliers should be completed. Formulating a delivery timetable, delivering items, and inspecting goods are all part of the enforcement process.
- c) Green make: Request and receive green materials; manufacture and test green products; green packaging, green warehouse, and/or green distribute products, automotive should be produced under the guideline of an environmentally friendly notion. Formulating a production schedule and, more particularly, implementing a manufacturing plan are among the subjects addressed.
- d) Green distribution: Implement order management processes, including order, storage, and transportation (from consultation, quotation, delivery, and mode selection through warehouse management, receiving, and sort of goods).
- e) Green return: Raw materials and client returns are both part of this process, with defective or remaining products being returned to suppliers. And manufacturers are supplied key parts that are recyclable for reuse. It achieves both material recycling and product waste disposal.

Figure 2 shows the structure of the first layer of Green SCOR Model. (GPI-Green Planning, GPu-Green Purchase, GM-Green Manufacture, GD-Green Distribution, GR-Green Return.)

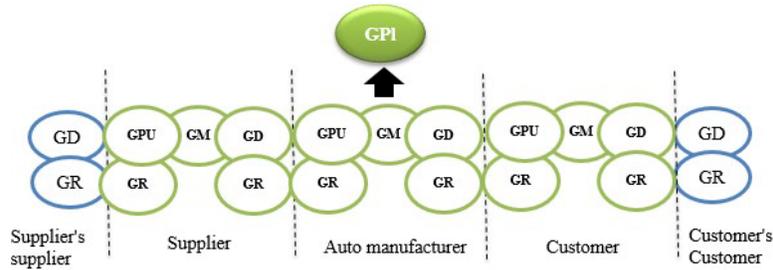


Figure 2. Structure of the first level for Green SCOR Model

4.2.2 The second level structure for automobile industry

The second level is the configuration level of the Green SCOR Model for automobile manufacturing. Manufacturing firms can use the Green SCOR Model to configure elements into a green supply chain entity, which can identify the green supply chain of any product, any production type, and then design the entire supply green chain of manufacturing firms. The second level consists of four steps: determining the scope of the automobile company's organization, identifying the flow relationship among material flow, fund flow, and information flow in each supply chain entity, and marking the reality distribution of green supply chain. Then choose a consistent process for constructing the specific green supply chain.

The figure of the second level of automotive manufacturer supply chain have provided below (figure 3), based on the characteristics of the automobile manufacturing industry.

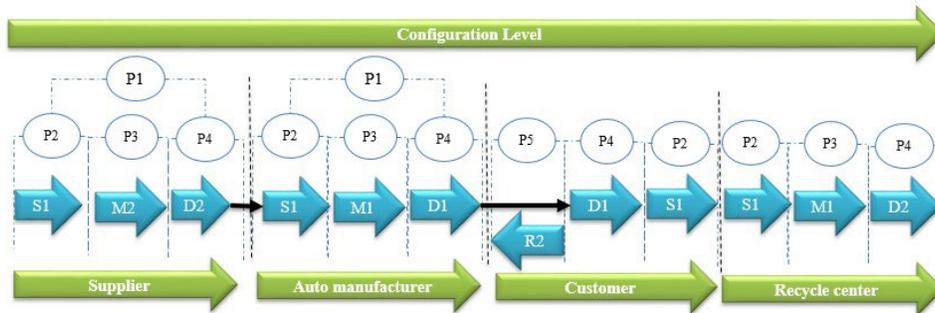


Figure 3. Second level of Green SCOR MODEL

a) Suppliers: Supply Chain Planning (P1), Source Planning (P2), Make Planning (P3), and Deliver Planning (P4). They get their goods from a company called Source Stocked Product (S1). When they receive procurement orders as Make-to-Order (M2) for the auto manufacturer, they begin to build their products. Then, as Deliver Make-to-Order Product, suppliers deliver their items to the automaker (D2).

b) Manufacturer: P1 is for Supply Chain Planning, P2 is for Source Planning, P3 is for Make Planning, and P4 is for Deliver Planning (P4). The automaker obtains its materials as a Source Make-to-Order Product (S2). It produces goods as Make-to-Stock (M1) and then distributes stocked products to customers as Deliver Stocked Product (D1). c) Customers: P2: Plan Source, P4: Plan Deliver, and P5: Plan Return (P5).

Product from a Stocked Source (S1). End-users will deliver products to a recycle center as Deliver Stocked Product (D1) when they reach the end of their useful life (D1). In the event that some products have major flaws, such as Plan, Return Defective Product, some products may be returned (R1).

c) Recycle center: Source planning (P2), Make planning (P3), Deliver planning (P4).

The recycle center collects end-of-life products from customers as Source Stocked Products (S1) and then dismantles, classifies, and recycles them as Make-to-Stock (M1). In reality, there is no component or material reuse back to the

original suppliers. The recycle center will provide the recycled materials or components as receiving suppliers' procurement orders as Deliver Make-to-Order Product (D2) if the to-be condition exists (D2).

4.2.3 The third level structure for automobile industry

The third level is the process decomposition, dissecting each green connection and inventing better procedures for automobile manufacturing companies, which may be used to change manufacturing firms' operation plans and establish their competitiveness in target markets. This level provides details for each process type in the second level. Its specific contents include process component definitions, input and output information for each process element, performance evaluation for each process element, and the system's best capacity.

4.3 GSCM practices and Green SCOR MODEL for automobile industry

After analyzing the three levels of the Green SCOR model for automotive manufacturing companies, we can deduce the connections between GSCM practices and the Green SCOR MODEL for the automobile industry.

The GSCM practices is represented basing on the five process of Green SCOR model, in order to incorporates environmental considerations into the five process of SCOR Model, companies can use this GSCM practices us the figure 4 show:

- For Green Plan : **“Eco Design practice”**, which consists of reducing the negative environmental effects over its entire life cycle, ecological risk management, product protection, pollution control, resource conservation and waste management (Ali et al., 2019; Vanalle et al., 2017)
- For Green Source: **“Green purchasing”** discusses issues such as reusability, recycling, waste reduction, environmentally friendly products, substitution and hazardous material minimization. Companies are increasingly regulating suppliers environmental protection performance to ensure that the products they buy are environmentally friendly (Ali et al., 2019; Mathivathanan et al., 2018)
- For Green Make : **“Sustainable product design”** that reflects the degree which companies are incorporating sustainability guidelines into product design, such as reduction, reuse, recycle and/or recovery (Mathivathanan et al., 2018; Paulraj et al., 2017). **“Sustainable process design”** is a metric that measures how environmentally friendly companies design their processes (Paulraj et al., 2017).
- For Green Deliver : **“Green Logistics”** reflects moving equipment across the SC in an eco-friendly manner, including the use of environmentally friendly transportation and distribution, reverse logistics (i.e., remanufacturing, recycling and reusing of parts or products (Ali et al., 2019; Li et al., 2019)). **“Green packaging”** presents the use of simple packaging, chemical stability, avoidance of superfluous packaging, receive side, reduced polystyrene volumes, easy disassembly and usage of simpler packaging materials (Gopal and Thakkar, 2016).
- For Green Return: **“Reverse logistics”** is required to allow the transportation of returned products backwards to reduce waste, increase cost savings and therefore improve competitiveness (Abbas and Farooque, 2020; Mathivathanan et al., 2018).
- Connections between supplier and auto manufacturer: **“Supplier environmental collaboration”** extends to more collaborative programs, such as supplier education and support, they are being expanded in order to enhance suppliers sustainability impact to produce green products and technologies (El Farouk Imane and Fouad, 2017; Ibn El Farouk et al., 2020; Mathivathanan et al., 2018)
- Connections between auto manufacturer and customer **“Customer environmental collaboration”**, customer education and service are examples of collaborative initiatives that seek to increase consumers sustainability impact in order to create green goods and educate about everyone's activities for setting sustainable performance objectives (Mathivathanan et al., 2018; Vanalle et al., 2017). The aim is understanding customers environmental requirements and encouraging cross-industry collaboration to produce environmentally friendly solutions (Laguir et al., 2020,).

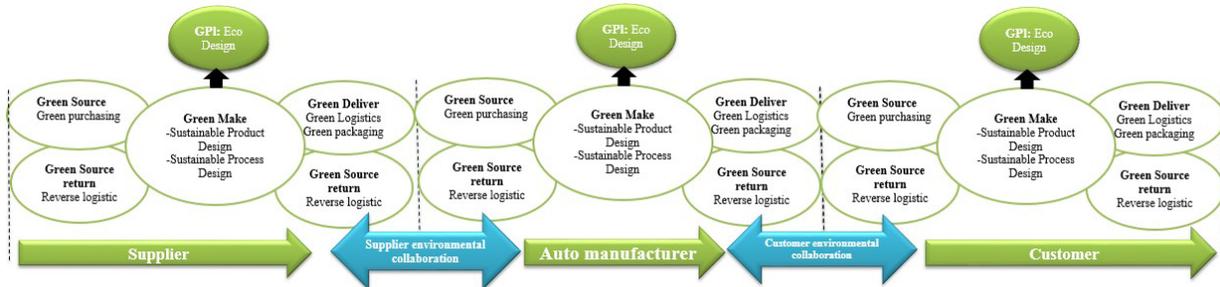


Figure 4. The connections between GSCM practices and Green SCOR model for automobile industry

5. Conclusion

Based on the literature review of green supply chain management for automotive industry, this paper analyzes the GSCM practices in automotive manufacturing industry Based on the Green Supply Chain Operations Reference Model (Green SCOR Model) which divided on three level. According to the result of the analysis, the connections between nine GSCM practices “ ECO design, Green purchasing, Reverse logistic, sustainable product design, sustainable process design, green logistic, green packaging, supplier environmental collaboration and customer environmental collaboration ” and the five process of Green SCOR MODEL “ Plan, Source, Make, Deliver and Return” are proposed. Through applying, the proposed green practices based on the Green SCOR MODEL companies can accomplish profit and market share goals by decreasing environmental repercussions and increasing green efficiency.

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Biographies

TRONNEBATI Imane is a PhD student at the Higher School of Technology at Sidi Mohamed Ben Abdellah University, Fez – Morocco. She is a mechatronic engineer graduated from faculty of science and technology of Fez. Her research interests are in green and sustainable supply chain management, supplier relationship management in the automobile industry. Her research work consists in the application and development of models, innovative methods and tools of decision in order to manage the supplier relationship and the green supply chain in automobile industry.

JAWAB Fouad is a professor at the Higher School of Technology of the Sidi Mohamed Ben Abdellah University in Fez, Morocco. He is responsible for the research team "Industrial Management and Logistics" (MILOG), vice-director of the "Industrial Technologies and Services" (IST) laboratory and former director of the laboratory "International Management, Decision Techniques and Logistics" (MIDLOG). He has directed the Department of Science and Management Techniques (STG) as well as the University Diploma of Technology (DUT) "Logistics and Transport Management (GLT)" and currently directs the Professional License "LOGISTICS".