

# The Role of Supply Chain Integration on Green Practices and Performance in a Supply Chain Context: A Conceptual Approach to Future Research

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**Abstract**— The purpose of this paper is to investigate the current research relationship between green supply chain management practices, supply chain integration and the manufacturing firm's performances in Malaysia. Also, to improve the conceptual knowledge by compare and contrast the relationship between each dimension. The study thoroughly analyzes, reviews and explains each dimension in detail and their relationships from various previous literature perspectives. The paper is one of the first to identify and discuss conceptually the use of green supply chain management practices and supply chain integration in measuring the manufacturing performance in a single setting in a developing country.

**Keywords**— *Green Supply Chain Management Practices, Supply Chain Integration, Manufacturing Firm's Performance*

## 1. Introduction

Greater technical and institutional influences have stimulated organizations into investing in green policies within their firms [27]. In the past two decades, the supply chain and issues related to the environment in the context of green supply chain management (GSCM) have developed as a key approach through which the competitive edge and general performance of a manufacturing firm and its supply chain can be enhanced [63] It is known how influential an industry's manufacturing sector towards the country's economy. One of the requirements for a company to go global (such as to European countries) is by implementing a

green practice into their operations. Moreover, GSCM aims to maximize overall environmental profit by adopting a life cycle approach through product design, material selection, manufacturing, and sales and recovery, and therefore helps the firm to realize its sustainable development and improvement [43].

Nowadays, the demand of firms' ability to meet an environmental friendly structure is essential if firm's wishing to be part of the global business world. In addition to concerns of policy and competitiveness, green management can be implemented in an organization using various different methods. An enterprise can create a greener supply chain by incorporating modularity within the design of the product, ensuring that the materials used are more environmentally beneficial, and improving a product's capability to be recycled [32]. [58] agree that it is possible for organizations to create greener supply chains and consequently cater to the varying demands which arise from handling customers, suppliers and internal operations. Moreover, as a rising concept in the contemporary philosophy of environmental management which applies to the supply chain as a whole, GSCM is a comparatively futuristic management practice which firms can adopt in the effort to better their environmental performance [9].

## 2. Manufacturing Firm's Performance

In addition to the agricultural field, the manufacturing sector is one of the most crucial components in the Malaysian economy. This is due to the fact that civilization relies greatly on industrial products in order to preserve a particular standard of living [36]. The depletion of resources and spread

of environmental emissions are among the consequences of corporations involved in manufacturing [16]. Other than that, foreigner considers Malaysia's industry as one of the top country to invest on thus, it deems as a high yield investment opportunity. [13] pointed out that green manufacturing places an emphasis upon government policies regarding the environment, environmental impact, environmental regulations on national and global levels, competitive pressures, and environmentalism, as well as activism on the part of stakeholders. All this makes green manufacturing very different from traditional manufacturing practices. Proper environmental regulations or standards can trigger green innovations that actually decrease cost, increase productivity, or make companies more competitive.

Most previous research relates manufacturing performance with the standard financial and non-financial performance. The process of assessing a firm's performance typically places focus upon financial benchmarks, including investments and profits. However, scholars assert that concentrating purely on financial barometers fosters short-term thinking within the organization. Nevertheless, four elements are established as markers of an organization's performance, namely cost, delivery, quality and flexibility. Cost is crucial to manufacturing organizations, even if it is not the most important indicator. A firm's costs manifest through labor and general productivity, direct material expenses, inventory level and capacity utilization [12].

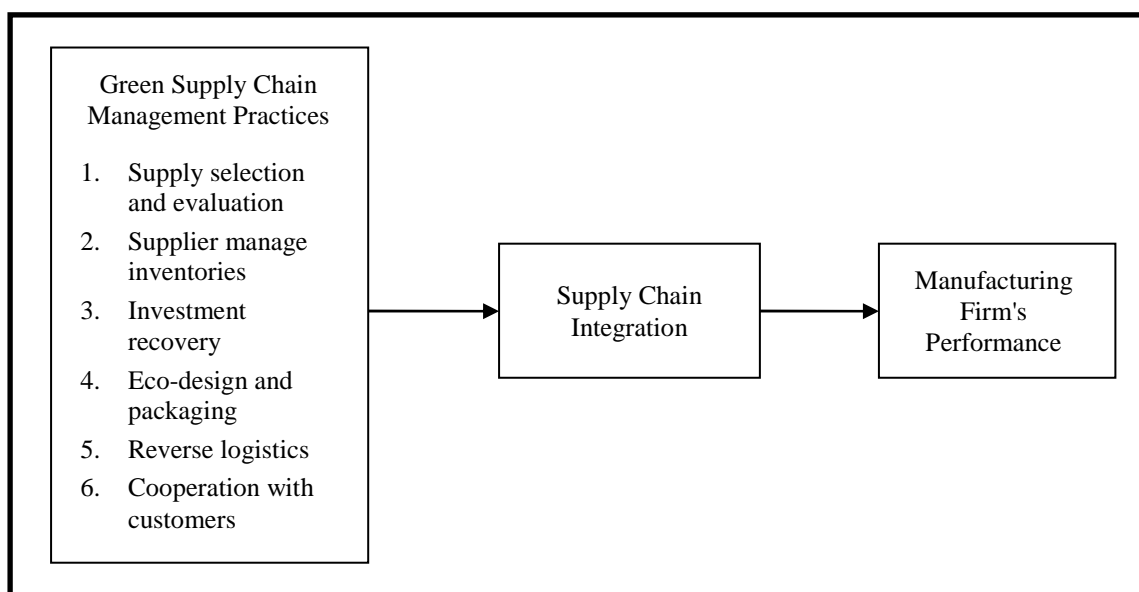
[24] highlights the fact that Malaysia has taken only a few decades to evolve into a manufacturing-based economy from its roots as an agricultural nation, achieving this feat through increased rates of trade between the manufacturing sector and other countries. From his study, the Malaysian firms may recognize the importance of GSCM practices adoption, but have lagged in the implementation of its practices. Recently,

concern for the environment has lead manufacturing industries to take a proactive role in the development of cleaner manufacturing processes and the design of recyclable products [23]. As a result, many manufacturing firms have taken the initiative to apply GSCM practices to cater to customers' desire for environmentally sustainable goods and services, produced through green methods, and in line with environmental regulations laid down by the government [19].

### 3. Supply Chain Management (SCM)

Supply chain management is the increasingly popular terminology used to describe the purchasing purposes. The term SCM was originally introduced by consultants in the early 1980s. However, it is stated by [45], which suggests that SCM includes all the activities associated with the flow and transformation of goods, from raw material suppliers to end consumers. It also encompasses all information flows up and down the supply chain.

SCM is define as the flow of materials, information, money and services from raw material suppliers through factories and warehouses to the end customers [45]. It also involves creating and handling a set of processes which are value-adding and consistent throughout organizational borders in order to cater to the customer's true needs [17]. [25] concur that it is the co-ordination and management of a complex network of activities involved in delivering a finished product to the end-user or customer. Supply chains endeavour to sustain environmental sustainability and internal health through the ability to rectify issues on its own, using knowledge collected from the external environment [49]. Hence, both internal and external factor are important to form an environmental sustainability through supply chain.



**Figure 1.** The proposed framework case study

SCM has been increasingly recognized as a manufacturing model which enhances the competitiveness of a firm, and has established itself as a growing field in business studies within academia, as well as a valid method of developing a competitive edge in worldwide trade. [10] posits that the theory of SCM plays a part in clarifying the control of the flow of information and materials, in addition to the logistics-related tasks in the inter-organizational and intra-organizational contexts. [52], concur that the supply chain is a set of business entities that directly involves in the upstream or downstream flows of products, services, and information from a source to a customer. This definition sets the consumer at the end of the supply chain and reflects a linear production paradigm that assumes constant inputs of natural resources and an unlimited capacity to assimilate waste [1].

#### 4. Supply Chain Integration (SCI)

Supply chain integration is a concept which has been championed as an essential element in enhancing performance and establishing value within SCM [35]. Researchers and practitioners both view integration as the basis of well-applied SCM, which requires the consolidation of various procedures including sourcing, manufacturing and distribution [48]. Some authors have envisaged integration as the coordination of functional activities [41], others view integration as communication [3]. Although most managers have realized the critical importance of SCI, in reality, few companies have truly adopted and disseminated a formal SCM definition; and even fewer have meticulously mapped out their supply chains so that they know who their suppliers' suppliers or customers' customers really are [17].

Recent studies have taken to viewing SCI as being a construct with multiple dimensions [eg. 8,35,53] as opposed to having a singular dimension [30]. Research has determined that customer integration, supplier integration and internal integration are three main forms of SCI (eg. 5,18,53,61). Customer integration and supplier integration can also be categorized together as external integration [60].

Internal integration can be defined as "the degree to which a manufacturer structures its own organizational strategies, practices and processes into collaborative, synchronized processes, in order to fulfil its customers' requirements and efficiently interact with its suppliers" [18]. In order to achieve this level of integration, activities in all organizational departments must function holistically. An excellent level of internal integration in a supply chain will be reflected in the form of exemplary customer service and organizational performance [61]. On the other hand, customer integration necessitates strong interaction between manufacturers and customers, which allows for the creation of positive feelings among each other, enhances the precision of shared information and improves the effectiveness of various procedures [18,46]. More accurate information about customer demands and preferences, as well as frequent information updating, can speed up the product design process, improve production planning, reduce inventory

obsolescence, and ensure that the manufacturer is more efficient and responsive to its customers' needs and, thus, gains a higher market share [44]. While, supplier integration involves core competencies related to coordination with critical suppliers [18]. [18] also state that it facilitates the mutual exchange of information, which improves the understanding and anticipation of the manufacturer's needs.

The effects of SCI on firm performance have received considerable attention from scholars and practitioners [46]. The extant literature on SCI is largely driven by the typical view that a greater level of integration leads to better firm performance [7,40]. An organization need to have strong upstream and downstream integration of their elaborate network of business relationships [47]. With the growth of the firm, SCI practices begin to place more emphasis on customers demand for services and goods that are not environmentally detrimental. As a result, management will take steps to encourage coordination and integration of GSCM practices across their supply chains. There are three categories within the study of performance regarding SCI, namely the connections between external SCI and performance, internal SCI and performance, or both external and internal SCI in relation to performance [64].

#### 5. Green Supply Chain Management (GSCM) Practices

The definition of GSCM is the integration of environmental issues into SCM. [23] lays out the terminology typically used in these contexts, including green supply [6], green supply chain [42], environmental supply chain management [38], environmental purchasing [19], green supply chain management [63], green value chain [11], green supply chain practices [23], and green purchasing [14]. GSCM incorporates the role of the purchasing function in processes ranging from recycling and reuse, material substitution and reduction of waste [9]. However, more broadly, operations, marketing and logistics have been integrated into the GSCM framework [42]. It is because an organization can receive more than a few benefits by greening their supply chain.

Existing research highlights the fact that GSCM practices are highly progressive in developed countries, including Germany, Japan and various North European nations [20]. On the other hand, GSCM still exists in its infant stages both academically and practically in Malaysia, which is still a developing nation. The Malaysia Productivity Corporation (MPC) elaborates that Malaysia has incorporated the Sustainable Green Practice as an initiative (Environmental Quality Act 1974) in the Malaysia Plans. Among the encouraged practices include the stimulation of both supply and demand for environmentally conscious services and products. Consequently, green practice will help manufacturers and supplier contribute to global environment protection by promoting eco-conscious in their activities towards the general public (consumers). Also, as a more systematic and integrated strategy, GSCM has established itself as a key tool in enabling firms to create "win-win" practices which lead to greater ecological efficiency and

reduced environmental damage and risks, whereby the firm can successfully reach market share aims and profits [39].

GSCM includes every stage of SCM which must adhere to regulations for environmental protection [62], and can be grouped into two forms of practices: intra-organizational and inter-organizational. [52] defines "environmental supply chain management" as the integration, on a management level, of all flow of information and material across the supply chain, all of which function to cater to customer demand for green services and goods created through green manufacturing. Furthermore, SCI stands for the co-operation of supply chain members in both intra- and inter-organizational processes [18]. In other words, GSCM and SCI can be merge and known as the green supply chain integration (GSCI). GSCI is defined as "the collaboration of a firm with its supply chain partners to manage both intra- and inter-organizational environmental practices" and could be divided into internal and external integration [54].

### 5.1 Supplier Manage Inventory

Several industrial firms take steps to contract their raw material suppliers as managers of the organization's inventory. This is due to the fact that suppliers may have better experience with management, and in order to reduce risks [51]. Manufacturing firms which employ the use of chemicals in their GSCM processes and services can be taken as an example. The firm's GSCM tasks can be highlighted using two aspects, namely the entrustment of the organization's inventory management to the suppliers, and the provision of services for the management of inventory for clients [31].

According to [52], inventory management is one of the three principal elements of an integrated supply chain model where they manage the product and material flows. In context of supply management, logistics or even partnering, the extensive low-level data sharing that occurs with integration contributes to receive a better inventory management and improved scheduling and production planning [49]. In isolation, these activities may directly affect the design and management of forward-flow operations, and tend to require more complex inventory management and scheduling systems [59].

The majority of inventory models include three forms of stocked items which enable development and performance to be observed over time. Non-serviceable items are one such example, encompassing manufactured items, remanufactured items and items which are yet to undergo remanufacturing. Deterministic models are also available, whereby the rates of demand and return are known beforehand [26]. However, the most comprehensive view of the inventory system can be gained through stochastic models, where rates of demand and return are based on probability. In addition, with the right inventory management and having closer relationship with suppliers can guarantee a higher frequency of delivery with lower tonnage which brings a better performance [2].

*H1*: Supply chain integration mediates the relationship between supplier manage inventory and manufacturing firm's performance.

### 5.2 Supply Selection and Evaluation

Members of a supply chain must adhere to particular protocols or standards of environmental practice in order to allow for a system of practices which are congruous with environmental monitoring. As a rule, these codes or standards are incorporated in the assessment criteria and process of choosing suppliers [54].

A customer can impose specifications for parts, components or materials on its suppliers to satisfy regulations or downstream requirements [50]. An example of this is the fact that major automotive manufacturers based in America are expected to apply environmental process management in their selection of suppliers in order for the company to be viable for ISO 14000 certification. Purchasing activity can be an alternative method of supplier selection. Upstream integration allows for the manufacturer to seek out products and services which offer the best available deals on the basis of quality and price.

Therefore, green practice in supply selection and evaluation while purchasing will help manufacturers and supplier contribute to global environment protection by promoting eco-conscious in their purchasing activities. It also helps in promoting a balance environmental preservation to ensure a more sustainable development. Companies can improve performance by expanding green practice standards to their suppliers. This can be done by imposing the requirement that suppliers initiate and sustain a system of environmental management, in addition to including clauses for extensive management of chemical substances in the purchasing contract [34].

*H2*: Supply chain integration mediates the relationship between supply selection and evaluation and manufacturing firm's performance.

### 5.3 Investment Recovery

Investment recovery is an established practice in business which involves the resale of surplus inventory or material, extra capital equipment, as well as used or scrap materials [56]. [42] concur that, it requires the sale of excess inventories, scrap and used materials, and excess capital equipment. This practice is regarded as important in the developed countries [42]. In other words, it is about how to deal with surplus assets.

Firms are venturing on to integration activities, linking of suppliers, manufacturers and customers in order to obtain significant improvements in terms of cost efficiency and lead time [52].

In addition, [19] explains that one of the processes in investment recovery involves the repurposing of scrap materials, and this can cut down on the total waste content deposited in landfills. As an example, the company can clear

unused assets and decrease their inventory by recycling scrap or previously used material. This GSCM activity can be classified as an economically and environmentally beneficial practice towards firm performance [62].

*H3:* Supply chain integration mediates the relationship between investment recovery and manufacturing firm's performance.

#### 5.4 Eco-Design and Packaging

According to [56], the concept of eco-design necessitates that manufacturing firms take initiatives to create products which employ the use of recyclable or reusable components in order to cut down on the depletion of new materials. Organizations should also minimize the use of dangerous or environmentally damaging materials. [63] asserts that eco-design concepts for packaging is a part of GSCM practices, and that suppliers and firms should work together to guarantee the use of green product packaging.

Manufacturing and remanufacturing are the usual activities in the production/ internal SCM phase in order to re-design or an innovation of a new product design. Green manufacturing is a manufacturing mode designed to minimize the impact of the manufacturing process on the environment [19]. Scholars and practitioners have increasingly realized that SCI is a great innovation in SCM and a new frontier of opportunities to enhance firm performance [29,33].

Other studies have identified in an organization, there are elements of green design and packaging is included to ensuring that packaging is reusable and recyclable, minimizing waste by reducing packaging, and avoidance of hazardous material [4,28]. In addition, [55] posited that a product can have influences on the environment throughout all its lifecycle phases, and determined that evaluation of a product's lifecycle be a widely applied practice in GSCM. Thus, this attribute measures the environmental performance of a firm.

*H4:* Supply chain integration mediates the relationship between eco-design and packaging and manufacturing firm's performance.

#### 5.5 Reverse Logistics

In the Ninth Malaysian Plan and the Third Industrial Master Plan (IMP3), the logistics sector has been identified as one of the strategic sectors for Malaysia to attain global competitiveness. Reverse logistics is generally defined as the process of returning faulty goods from customers to the suppliers or any other company acting as an agent to reverse logistics [15]. The process of managing returned goods can decrease resource costs. Many products experience damages in transit, and as such costs can be saved through the enhancement of the manufacturing and transportation processes. Reverse logistics carries many different definitions. Historically, used materials or goods have been retrieved and repurposed for different functions [37].

In SCI, there is a term for logistics. It is known as logistical integration, which widely studied under a number of different labels such as vertical co-ordination, supply management, or partnership [35]. There are several aspects that can be considered which assessing this form of integration, including both informational and delivery aspects, much of the literature has emphasized the notion of information flow between organizations in the supply chain as the main enabler of delivery integration.

Networks of reverse logistics carry several traits in common with regards to postponement and speculation, the uncertainty of supply, returns disposition decisions and the coordination requisites of two markets [57]. There is an emphasis on closed-loop systems which have the objective to remanufacture, recycle and reuse materials [21]. [15] explains that reverse logistics is the foundation of post-operational practices, which enables a firm to partake in value-adding activities and reduce damaging effects on their environmental performance.

*H5:* Supply chain integration mediates the relationship between reverse logistics and manufacturing firm's performance.

#### 5.6 Cooperation with Customers

Cooperation with customers' demands collaboration with customers, enabling the creation of clean manufacturing processes which result in products which are environmentally sustainable and boast the use of green packaging [62]. Collaboration with downstream customers yields mixed outcomes [49].

The term "supply chain integration" has been defined as the extent of commitment between suppliers and customers, while the terms "supply chain collaboration" are used to describe the elements of SCI [8]. Therefore, SCI helps firms to improve partner-related routines and processes through global and real-time collaboration [40]. As "collaboration begins with customers and extends back through the firm (...), integration is needed both internally and externally" [8].

Moreover, green alliances across the supply chain allow for a wider examination of operational performances. [19] highlights the fact that partnerships with suppliers' result in stronger delivery operations, while partnership with customers has a positive relationship with the flexibility and quality of goods. As such, an organization's performance can be strengthened through cooperative relationships with customers and suppliers.

*H6:* Supply chain integration mediates the relationship between cooperation with customers and manufacturing firm's performance.

### 6. Relationship between GSCM practices, SCI, and manufacturing firm's performance

There are three elements in SCI that can help improve manufacturing firm's performance. The three elements are also influenced by GSCM in order to create an environmental

sustainability performance in a manufacturing process. As an example, manufacturing organizations must regularly tackle the challenge of delivering goods and services on time. By integrating with their suppliers through the sharing of inventory information and orders, suppliers can aid in the preparation of timely and good quality services and materials. Upstream complications can be smoothed out through supplier integration, which involves collaborating with suppliers, communicating, and sharing details related to production schedules and inventory information. Organizations must also work together and share knowledge about manufacturing plans and insist on receiving estimates and predictions from suppliers in order to minimize the "bullwhip effect" [36]. [22] discovered that organizations with better customer service quality exhibited superior levels of SCI. With high-level supplier integration, manufacturers are more likely to be satisfied with the materials or services provided by suppliers [60]. Based on previous studies, we expect that external and internal integration leads to high green manufacturing performance.

## 7. Research Methodology

The methodology design for this study will employ quantitative method of random sampling and build a survey questionnaire based on a thorough and detailed analysis of relevant literatures. A total of 9 variables of supply chain on green practice and integration towards manufacturing have been developed; supply selection and evaluation, supplier manage inventories, investment recovery, eco-design and packaging, reverse logistic and cooperation with customers. Questionnaires are then mailed randomly to 1,000 manufacturing firms in Malaysia. The target respondent would be the manufacturing department high personnel (e.g. CEOs, managers, directors, president, and etc.).

## 8. Conclusion and future research direction

The current study posits that the implementation of GSCM practices would possibly need a suitable and progressive pattern of application in order to produce the related performance advantages [62]. To address this specific concern, we evaluate the mediating influences of SCI on GSCM practices and their subsequent effects on economic, environmental, and operational performance measures. The paper is one of the first to identify and discuss conceptually the use of green supply chain management practices and supply chain integration in measuring the manufacturing performance in a single setting in a developing country. In conclusion, green strategy could induce numerous benefits to an manufacturing based organization. It can help guarantee employees health with an environmental friendly surrounding. GSCM is increasingly popular as an environmental practice which enables firms to obtain economic profit while enhancing their image in relation to environmental concerns [62]. Additionally, GSCM is capable

of providing strong product scheduling which can cater to just-in-time demands without imposing excessive stress on the company's external and internal management. What is more, the result would help provide insight to Malaysia manufacturing sector on how they could improve the SCM with the adoption of green practice and integration into their manufacturing firm's performance.

This study is basically highlighting the manufacturing firms that adopts GSCM practices would achieve great firm performance. This is because of the influence of the SCI which drives from the internal integration and external integration (supplier and customer integration). The framework is adapted from the literature review of GSCM practices as the independent variable and its impact on manufacturing firm's performance (MFP) which is the dependent variable and by incorporating SCI as the mediating variable.

GSCM has evolved into a key blueprint which allows firms to gain profit and achieve market share targets through the act of reducing environmental risks and ecological damage, while also improving upon environmental efficiency [63]. A globalized economy and the conditions for sustainable development require that Malaysian manufacturers shift their priorities to the supply chain in its entirety, as opposed to implementing improvements in one plant at a time. As a result, the company's relationships with the environment and their own economic achievements can be better evaluated [63]. In addition, moderating effects of supply chain integration would turn-up in some cases with certain GSCM practices with the inclusion or exclusion of these integration might cause worse or better performance.

In relation to SCI and its mediating effects, findings reveal that the two major elements of external integration are customer integration and supplier integration. External integration promotes joint development, shared knowledge and ecological collaboration involving parties in the supply chain [54]. Moreover, in this study, it would show that internal integration is focusing on organizational learning and development and could improve green practices towards firm's performance. How well a firm is able to apply and execute supply chain practices will determine whether it is able to reap the various advantages of GSCM. Examples of these practices include abandoning the pursuit of single-function targets in favour of aims with wider scopes, stimulating the sharing of information among functional areas and successfully tackling the obstacles in integration which restrict the integration of the supply chain [39].

Based on previous research of [62], there is an empirical evidence showing the existence of mediation effects indicates the need for manufacturers to coordinate between GSCM practices and its mediator to realize their performance potential to the fullest. Therefore, the active evolution of GSCM is an important issue for implementing these practices. However, occurrence of changes is unavoidable such as government policy and supply chain partners, manufacturing enterprises can better implement their GSCM practices with adaptive evolution to the changing market

dynamics and requirements. Hence, a longitudinal study is useful to complement the current study with a focus on examining the recent situations of GSCM practices and performance as well as their structural mediating effects.

## 9. Implications

A main contribution of the current study is the development framework which outlines the limits, suppositions and existing industry requirements which are needed for the evolution of green practices within the model of SCM. Moreover, it is to provide support for an improvement and a starting point for future research of GSCM on manufacturing firm's performance in Malaysia. Not only that, but also uncovered the effect of SCI as the mediator between the relationships of GSCM and manufacturing performance.

In the practical sense, green practices allow for the more effective organization of profit earnings and the financial budget, as well as the efficient use of surplus material and extra resources. Processes related to manufacturing, such as the distribution, packaging and processing of goods can stimulate growth in the agricultural field and give rise to greater improvements through the spread of green practices. There will also be significant contributions to R&D efforts in the development of environmentally friendly designs for goods and services, which can go on to improve the organization's performance.

In the managerial implication, consecutively to improve environmental performance through GSCM practices such as supply selection, eco-design investment recovery and customer cooperation it is desirable for enterprises to implement GSCM practices with an internal and external influence. It is important that a firm which practices eco-design in its products is able to establish a system which synchronizes its design needs with its green purchasing requirements. Otherwise, the organization's environmental performance results could be undermined [60].

While to improve economic and operational performance is by building collaborative relationships with customers (customer cooperation) is a necessary ingredient for each of the GSCM practices to result in improved performance. Other than that, investment recovery is desirable for eco-design to achieve economic performance. In addition, the prospective capital gains obtained through investment recovery demand the existence of internal financial policies and internal environmental management which can create favourable conditions to enhance economic performance.

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