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Green Initiatives in Supply Chain Management Drives Enterprises' Competitiveness and Sustainability

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Abstract

The advent of supply chain management (SCM) strategy over the past four decades coupled with innovations in technology has revolutionised management of enterprises tremendously. The SCM strategy has enhanced supplier-customer collaboration and integration in the delivery of product/service to ultimate customers, while the enabling role of technology speeds up the information and product flow. The effectiveness and efficiency emanating from supply chain management is a manifestation of enterprises' inclusive concern of value-creation from economic, environmental and social attributes, also referred as triple-bottom line (TBL). Such enterprises are streamlined as they utilise resources sparingly and produced less waste. Hence, they are lean, resilient and possess capacity to withstand disruptions. These qualities are derived from green initiatives and render these enterprises' competitiveness and sustainability. This is change management through which conventional supply chain management transforms into green supply chain management (GSCM) by refocusing value-creation in embracing the triple-bottom line that drives the competitiveness and sustainability of enterprises.

Keywords: competitiveness, green initiatives, GSCM, SCM, sustainability, triple-bottom line

1. Introduction: The advent of supply chain management and innovations in technology

The enterprises have gone through tremendous transformation in the last four decades from the emergence of supply chain management (SCM) strategy and intensification of technology application [1]. The last few decades have seen the emergence of the global value chains (GVCs) from global manufacturing facilities that produce and supply products for the global markets [2]. Aligned with these occurrences are innovations in information technology that has continued to speed up information and products flow along the supply chain network. The conventional supply chain management thrives via enhanced communication that drive supplier-customer relationship through increased cooperation, coordination, collaboration and integration ([3], p. 49). Cooperation entails working together of supply chain partners, while coordination is an improved working relationship among the supply chain partners.

Supply chain collaboration (SCC) is “the establishment of working relationship of an enterprise with a supplier organisation, whereby two organisations act as one” ([4], p. 171). This relates to supplier-customer relationship and other stakeholders in the supply network ([3], p. 47). described SCC as “a relationship between supply chain partners developed over time”. Hence, time is of essence for the existence of enterprises in SCC, which depicts their sustainability.

Supply chain integration (SCI) is “the alignment and interlinking of business processes” [5]. The integration process is information technology (IT) driven via four intangible variables: coordination, cooperation, information sharing and information visibility, which are enablers of supply chain [6]. The SCI along supply chain network includes increased communication within firms and across teams, functions, processes and external firms over time and is technology driven ([7], p. 152). The supply chain network incorporates the forward flow from supply side to the demand side and vice versa for the backward flow or reverse logistics. In the fast moving consumer goods (FMCGs) supply chain, the collaborative planning, forecasting and replenishment (CPFR) of inventory in the retail chain outlets elaborates the role of SCI ([4], p.172). The CPFR is a technology driven process between the retailers, distribution centres and suppliers that ensures timeous and continuity of inventory supply. The availability of inventory when needed is a competitive advantage that drives sustainability of the retail enterprises for ensuring continuous trading.

The FMCGs industry’s adoption of technology has transformed their distribution channels to include Omni-channel which is also a part of green initiatives as it increases sales through a streamlined online process [8]. “Omni-channel is a direct to consumer (D2C) business model where all sales channels: online, mobile, telephone, mail-order, self-service and physical retail establishments are aligned to provide to provide integrated service to consumers” ([9], p. 118). This unique role of technology drive competitiveness and sustainability of enterprises as the response time to customers is shortened translating into increased turnover and continuity in operations [10].

Technology is an enabler of supply chain management as it integrates the supply chain partners for faster transactions and provides visibility of processes at various stages in the supply chain ([11], pp. 38–59). The global implementation of the fourth industrial revolution (4IR) is hoped to speed up SCM processes, render them agile, focused and more sustainable [12]. At the moment, computers are used in most enterprises to connect with the world wide web for internet access. Some of the technology application in supply chain comprises the following:

Electronic data interchange (EDI): A computer to computer exchange of business documents such as purchase orders, order status enquiries, reports, promotion announcements, shipping and billing notices ([3], 232).

Barcode: A series of alternating bars and spaces printed or stamped on parts, containers, or labels representing encoded information that can be read by electronic readers. It is used for timely and accurate input to a computer system ([4], p. 12).

Radio frequency identification (RFID): A WI-FI-enabled radio frequency identification tags to allow tracing of items in real time.

Warehouse management systems (WMS): A software control system that improves product movement and storage operations through efficient management of information and completion of distribution tasks [13].

Transport management systems (TMS): A computer application system that is designed for the management of transportation using modules that focus on specific functions such as intermodal transportation, fleet service management, load planning and optimisation among others ([4], p. 181).

Global positioning systems (GPS): It is used for tracking vehicles such as the delivery trucks ([4], 72).

2. Competitiveness and sustainability in enterprises

The provisions of customer satisfaction, building conducive working environment with stakeholders and profitability underpins the essence of any business. Enterprises endeavour to provide quality products/services to the end customers in the most ethical ways that guarantee business continuity and environmental compliance, that culminated to competitiveness and sustainability. These dependent variables are achieved when enterprises strive to optimise returns with minimum resources, while focusing on economic, social and environmental attributes ([14], p. 9).

3. Global competitiveness

The world has traded from as early as the Middle Ages when people moved between countries in search of scarce commodities which were exchanged through barter trade [15]. With improved infrastructure powered by innovations in technology globalisation has hiked the global trade due to enhanced connectivity among nations, becoming popularly referred as a global village. The economic theories attest to the global trade and commerce as indicated by some old and new economic theories. The Adam Smith's "Theory of Absolute Advantage" is still valid in its reference that "countries would trade better if they traded commodities that had an economic or cost advantage for one or more products they produced" ([9], p. 29). Another economic theory, "Factor Endowment Theory" postulates that nations have a competitive advantage in producing one or more products when they possess one or more factors of production: land, labour, capital and entrepreneurship [16].

These are the parameters upon which global value chain and globalisation has developed. Global enterprises strive to be competitive by being low cost producers or supplementing through import or outsourcing from other low cost producers such as China [17]. These economic principles, social and environmental attributes are the underlying objectives of GSCM and portrays the enterprises' competitiveness and sustainability.

4. Competitiveness

The competitiveness of supply chain is informed by Porter's strategies of cost and differentiation for distinguishing between conventional supply chain and green supply chain management. The GSCM is technology driven and aims for higher productivity, efficiency and capacity utilisation. It also aims for lower cost for facilities, materials and labour and effective distribution channels ([18], pp. 455–468).

Porter [19] (2008) described that value chain should display total value through value activities. The value activities were referred as physical and technologically distinct activities a firm perform as in the use of green initiatives such as application of technology, optimised transportation and emphasis on corporate social responsibility (CSR) among others. [20] described most industries including FMCGs, has five activities which act as the pillars of competitive advantage. They comprise of:

Inbound logistics: the activities associated with the supply of raw materials to the manufacturing enterprise. Also included are material handling, warehousing, inventory control, vehicle scheduling and returns to the suppliers.

Operations: It deals with the transformation of inputs (raw materials) into final products. The activities include production process, packaging, assembly, equipment maintenance, testing and printing.

Outbound logistics: These are activities associated with collecting, sorting and physical distribution of products to the buyers or customers, distribution centres (DCs), material handling, delivery vehicle operations, order processing and scheduling.

Sales and marketing: These are the activities such as selling to customers, quoting, pricing, advertising, promotion, channel selection and channel relations.

Service: This includes service provisions, maintaining value of products including installations, repair, training, part supply and product adjustment.

5. Sustainability

Sustainability is described as factors which enable enterprises to withstand, maintain or prolong existence ([21], p. 44). These factors include the choice of renewable energy and the use of renewable raw materials that has minimal carbon emissions. Renewable energy is produced from natural sources such as solar, wind, hydro power and bio-diesel which has minimal carbon emissions. The renewable raw materials are those which produce products which at the end of life can be recycled or remanufactured into new products. Mitigating damage to the environment by reducing carbon emissions through logistics roles in sourcing, transportation and warehousing are green initiatives which render enterprises sustainable ([14], p. 11). This entails sourcing from suppliers who use renewable raw materials, practice ethical labour standards and use transportation that minimise carbon emissions ([22], p. 25).

([17], p. 110) concurred with the definition of sustainability by [23] as “the ability to meet needs of the current supply chain members without hindering the ability to meet the needs of future generations in terms of economic, environmental and social challenges”. The enterprise’s accountability of economic, environment and social are sustainability attributes, referred to as ‘triple-bottom line’ (TBL). This happens when there is close working relationship between the enterprise, suppliers and other role players or collaboration of all the parties involved in the supply chain ([21], p. 107). The enterprise’s drive to optimise returns with minimum resources results in competitiveness and sustainability ([14], p. 9).

6. Green initiatives in supply chain management

The green initiatives in supply chain involve changes in conventional supply chain management (SCM) to green supply chain management (GSCM). ([24], p. 785) define change management as “the tools, techniques and processes that scope, resource and direct activities to implement a change”. The change from conventional supply chain comprises of initiatives that involve sharing of environmental responsibility with the value chain (VC) partners in purchasing, manufacturing, materials management, distribution and reverse logistics ([7], p. 508). Value chain incorporates primary activities that provide enabling business environment in the development of sustainable competitive advantage. The activities create customer supported value such as marketing, product design, production and delivery [25]. The American Production and Inventory Control Society (APICS) define green supply chain management as “a supply chain that considers environmental impacts on its operations and takes action along the supply chain to comply with environmental safety regulations and communicate this to customers and partners” ([4], p. 73).

The full range of activities undertaken by firms and workers to initiate and develop a product and processes through its life cycle and beyond are the framework

of a value chain. The process pattern commences with design, production, marketing, distribution and through to support provided to the final consumer ([26], pp. 129–133). ([14], p.17) expressed the principle of GSCM as the 'green initiatives' factors comprising of dematerialisation, detoxification and decarbonisation that streamline operations towards sustainability. Dematerialisation entails reducing the amount of materials or time needed to produce and deliver products/services required by the customer. Detoxification entails reduction of pollutants from hazardous materials and industrial products. Decarbonisation or de-energisation refers to mitigation of carbon emissions in an organisation by using renewable energy and utilising processes with less carbon emissions.

The sharing of environmental responsibility entails utilisation of materials, products and processes which has less carbon emissions as it exacerbates the climate change or global warming (UNFCCC 2010). Examples of GSCM applications include the use of renewable energy, bio-diesel for transportation, use of appropriate mode of transportation that reduces cost and/or emissions reduction, use of full container load both ways where applicable and others ([21], p. 111).

Essentially, the green initiatives or green supply chain management facilitate optimisation in enterprises functions, reduction of waste and cost rendering the operation competitive, profitable and ability to continue or sustainable ([25]. [9], p. 615) described GSCM as a closed-loop supply chain as it is concerned with both forward and reverse movement of products. In closed-loop supply chain, the emphasis is on reducing cost and capturing value as the ultimate goal of the manufacturer is for everything to be reused or recycled ([18], pp. 455–468).

Developing the green initiatives or GSCM requires an elaborate system factoring in all the supply chain processes. They include planning for procurement, production, packaging, product sales and marketing, logistics and product life management [18], pp. 455–468). The next stage comprises of preparation of a detailed implementation plan factoring the environmental impact, economic and social attributes which is technology driven. ([14],11) provided a GSCM system featuring supply chain network processes as follows:

Planning for procurement: planning involves training employee training in the best practices in supply chain management; involving suppliers in decision-making; developing alternatives for performance improvements and organisational alignment for continuous improvement.

Production: process design, categorising and identifying environmental impact and cost and adopting the most economical and environmental friendly process; and involving suppliers/vendors in decision-making.

Packaging: minimising resources and hazards; recycling and energy recovery; usage of reusable and recyclable packaging; waste reduction, customers' collaboration and regular audits and performance review.

Product sales and marketing: creating awareness among consumers of green products; emphasis on eco-friendly products and clear communication between suppliers and logistics providers.

Logistics: rail as preferred mode of transportation and third-party logistics (3PL) recommended; logistics optimisation, use of clean fuel, optimised truck load and collecting waste; use of distribution centres (DCs) for fast moving consumer goods (FMCGs).

Product end-of-life management: product design, supply and effectiveness; reprocessing end-of-life products' materials for economic recovery.

The GSCM pursue materials and processes that minimise the impact on the environment. The main considerations are reduction in the amount of raw materials used; minimising the number of components in the product; minimising energy consumption; increasing the useful life cycle; maximising use of renewable and

recyclable materials and minimising the environmental footprint and sustainability of each [26]. Green supply chain management extends across an enterprise, its trading partners, the processes involved in purchasing, manufacturing, materials management, distribution and reverse logistics. Hence, GSCM is also describe as a closed-loop supply chain which is designed to manage both forward and backward (reverse) flows ([9], p. 64).

7. Environmental implications

Environmental concerns refer to cognition in the use of green products for protection of the environment ([21], p. 18). Environmental protection is stipulated in the biosphere rules that enterprises are required to pursue to avoid environmental degradation. The biosphere is the earth's surface and atmosphere inhabited by living things which is also the environment in which enterprises operate ([14], p. 171).

In his book on "Earth Incorporated", ([21], p. xviii) described five rules or principles of biosphere as materials parsimony, power autonomy, value cycles, sustainable product platforms and function over form.

- **"Materials parsimony:** The focus is on the need to minimise the types of materials used in products especially those which are life-friendly and economically recyclable. In implementing this rule, an enterprise would realise reduced supplier complexity, reduced production complexity, reduced toxic risk, reduced compliance costs, volume purchase discount, improved health and safety, improved work productivity, improved products attributes and improved environmental performance.
- **Power Autonomy:** To reduce energy costs with the use of renewable energy for production processes.
- **Value cycle:** Involves product recovery from recycling and remanufacturing as a value-added process.
- **Sustainable product platforms:** Benchmarking to improve product benefits in scale and scope and gain knowledge and experience by doing.
- **Function over form:** Fulfil customer functional needs in ways that sustain value cycle".

Towards a sustainable enterprise

([21], p. xviii) expressed some crucial factors pursued in realisation of a sustainable enterprise:

- Involvement of all value chain partners.
- A strategic plan to be prepared and pursued.
- Highlighting awareness of climate change (reduction of carbon emissions, energy efficiency and so on)
- Waste must be recycled, reused and reduced

- Intensify use of natural resources such as water and renewable sources of energy
- Enforce supplier ethical assessment and collaboration

These activities streamline enterprises making them to undertake only the crucial functions, minimising resources through reuse and recycling and intensify use of natural resources such as water and renewable energy that has less carbon emissions. The sharing of environmental responsibility in supply chain at every stage and process ensures minimisation of adverse impact on the environment ([7], p. 508). These are risk mitigation processes that make enterprises more sustainable and more competitive through cost saving, business differentiation and attracting more customers which are characteristics of GSCM ([22], p. 27).

8. Supply chain risk/disruption

The words risk, disruption and vulnerability describe occurrences with negative consequences and they help describe such situations in supply chain. The English dictionary define risk as the possibility of incurring misfortune or loss; disruption is an interruption of progress of something; and vulnerability means exposure to attack.

Supply chain risk “comprises of a number of events and their outcomes that could have a negative effect on the flow of goods, services, funds or information resulting in some level of quantitative or qualitative loss for the supply chain” ([27], p. 172).

Supply chain disruption are risk occurrences such as sudden fall in prices or natural disasters such as earthquakes, floods and disease pandemic ([9], p. 44).

Supply chain vulnerability describes broader perspectives of risk embraced in SCM networks involving products/services, process performance, trading relationships, currency fluctuations among others ([4], p. 172).

In supply chain management, risk refers to a particular type of hazard or threat such as technological, political, terrorism and natural disasters among others. The supply chain risk also manifests as financial loss or competitive disadvantage resulting from a failure to implement ‘best practice’ in SCM ([3], p. 308).

([7], p. 481) described the processes of supply chain risk mitigation to include the following:

“Increasing safety stock and forward buying: It calls for extra expenses, but a crucial alternative as countries have experienced in beefing up medical equipment and food supplies during 2019/2020 Covid-19 global pandemic.

Identify backup suppliers and logistics services: Over-dependence on China as key global supplier of general goods and the slowing down of logistics activities to contain the spread of the Covid-19 pandemic.

Diversify supply base: The importance of multiple suppliers from geographically dispersed markets to minimise disruptions.

Utilise supply chain IT system: The use of information technology (IT) enhance collection and sharing of crucial information with supply chain partners.

Develop a formal risk management programme: Helps identify potential disruptions and the appropriate response”.

The supply chain risk adversely impacts on enterprises financially, reputation and customer service among others [4]. As supply chains grow to include more international suppliers and customers, the complexity of disruption increases ([7], p. 480).

The Covid-19 pandemic of 2019/2020 exposed vulnerability and rendered many global organisations vulnerable. The global FMCGs suppliers and traders that relied heavily on imports from China which has hitherto turned like global manufacturing centre had their supply chain disrupted by the pandemic [28]. The leading role of China in global supply chain was reaffirmed in a 2020 report by Deloitte Canada which referred to supply chains mostly disrupted as for those countries that had China as their tier 1 (direct) or tier 2 (secondary) supplier [29]. The tier 1 suppliers supply raw materials direct to the focal firm or manufacturer and tier 2 suppliers supply to tier 1 suppliers ([9], p. 153).

9. Green logistics management

Logistics management is a crucial component of SCM which is responsible for forward, reverse transportation and warehousing functions ([7], p. 336). Logistics management is defined as “that part of supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to point of consumption in order to meet customer requirements” ([4], 94).

The GCSM involves environmental considerations in purchasing, manufacturing, materials management, distribution and reverse logistics ([14], p. 17). Thus, green logistics management pursues green initiatives through green transportation, green warehousing and green reverse logistics to drive sustainability in the supply chain. The optimised processes in supply chain such as transportation, warehousing and information flow through technology applications streamlined enterprises into hardened status and able to withstand disruptions. These are characteristics of GRSCM [30].

The green logistics role is accomplished through logistics seven Rs (7Rs), translated as: “getting the right product to the right customer, in the right quantity, in the right condition, at the right place, at the right time, and at the right cost”. The 7Rs eliminates waste which is a prerogative of green logistics to create value for the customer and render an enterprise more sustainable [31]. Pursuing a similar trend, green reverse logistics is concerned with returned materials that undergo through processes of recycling, reusing, refurbishing and disposal in landfill, reducing environmental pollution ([21], p. 74).

10. Reverse logistics and 3Rs

Reverse logistics involves the processes of sending new or used products “back upstream” for repair, reuse, refurbishing, resale, recycling, scrap or salvage [9], p. 614). Items are usually returned to a central location for processing which involves transportation, receiving, testing, inspection and sortation for appropriate action such as repair, refurbishing or resale. The facility and related processes are provided either by the original manufacturer or a third-party logistics (3PL) company.

The philosophy of “cradle-to-cradle” describe how enterprises are able to recover resources or value from the returned or damaged products. The philosophy or protocol of cradle-to-cradle is derived from nature, whereby one creature’s waste is another’s food ([21], p. xiv). The three 3Rs of reverse logistics: return, recycle and resale generate value from the damaged products which could have ended in landfills ([14], p. 125).

The reverse logistics system transforms into green reverse logistics when the system “start focusing on reducing the environmental impact of certain modes of transportation used for returns, reducing the amount of disposed packaging

and product materials by redesigning products and processes and making use of reusable totes and pallets” ([7], p. 530). Therefore, the pursuit of reverse logistics in GSCM is a value adding process through which enterprises received resources which could have gone to waste, driving competitiveness and sustainability.

11. Lean and agile approaches

The principle of lean thinking is to improve material flow and minimise waste, while ensuring customer value delivered. Lean management was started in Western Europe after just-in-time (JIT) approach in Japan in 1950s. The two concepts mean the same as they aim to minimise space, resource and inventory in pursuit of minimising waste [21], p. 47). Waste in supply chain comprise the following:

Transportation: unscheduled transportation, double handling and unnecessary movement of fork-lift truck among others.

Waiting: occurs where time is not used effectively.

Overproduction: producing in excess of the orders received add cost of warehousing awaiting new orders.

Inappropriate processing: using a large central process meant for several items to process number of items below economic level.

Unnecessary inventory: inventory resulting from overproduction that has additional cost of warehousing until orders are received.

Unnecessary motion: walking between processes unnecessarily like delivering documents to other work centres that could have been emailed.

Defects: production of products that do not meet specifications and of low quality.

The concept of agile supply chain is about having an end-customer focused supply chain as opposed to conventional supply chains which are structured around the focal firm [32]. It is essentially an approach to organising logistics capabilities around changing end-customer demands and responding timeously. In manufacturing, agility is defined as “the ability to successfully manufacture and market a broad range of low-cost, high-quality products and services with short lead times and varying volumes that provide enhanced value to customers through customisation” ([4], p. 6).

12. Supply chain resilience

Supply chain resilience is the ability of supply chain to respond to risk/disruption and recovering fast from these disruptions to return back to its original state better prepared to optimise customer service and financial stability ([33], pp. 109–122). The resiliency in supply chain was described by APICS as “the ability to return to a position of equilibrium after experiencing an event that causes operational results to deviate from expectations”. This is what happened to enterprises in the period of global Coronavirus pandemic in 2020. [34] described supply chain resilience as “the ability to exploit the disruptions as a competitive advantage to excel over the competitors through redundancy, building flexibility and changing corporate culture”.

Redundancy: Redundancy in supply chain requires holding higher level of inventory, maintaining low utilisation capacity and maintaining several suppliers that increases the operations cost. However, efficiency is achieved through utilisation of lean production processes.

Flexibility: Supply chain flexibility involves aligning procurement strategy with supplier relationship and adapting to postponement plans.

Cultural change: Stepping up communication with employees to condition them to familiarise with disruptions and be passionate about their work.

The period of supply chain disruptions in 2020 due to the global Coronavirus pandemic required resilience practice in enterprises to withstand unusual occurrence. Enterprises experienced redundancy with several employees losing jobs and bonded closely with the remaining employees most of whom worked remotely from home. As a result, flexibility ensued as enterprises repurposed and prioritised procurement of food and medical supplies as essential commodities [35].

This attribute of GSCM is lean as it is able to deliver products quickly to the end customers as it has streamlined procurement, quality and precision manufacturing, low level of inventory and use of consolidated transportation where multiple products use single shipment [36]. ([9], p. 180) describes seven types of waste that a lean supply chain controls: overproduction, delays (process and parts), transportation, over-processing, inventory levels, motion (unnecessary movement of parts in production) and making defective parts.

13. Corporate social responsibility in supply chain

Corporate social responsibility (CSR) is a practice of business ethics that required enterprises to act responsibly by observing the attributes of environment, social and economics referred to as triple-bottom line (TBL) [7]. (Wisner, Tan & Leong, 2016:106). In supply chain, emphasis is placed on ethical sourcing as it impacts on public, buying organisation and the suppliers. This is to ensure ethical processes are followed and the enterprise can express other benefits such as the environment and the community that interact together with the underlying economic benefits [37].

([22], p. 25) provided the parameters of CSR that included activities aimed at extending the outreach and existence of an enterprise as follows:

- Factoring society and community in the long-term plan.
- Controlling hazardous chemicals in products and other waste that impacted on the environment and minimised environmental pollution (air, water, soil, noise). Promotion of resource and energy saving by reusing, reducing and recycling; greenhouse gas production; waste reduction and disclosed environmental preservation activities.
- Advocated the protected computer networks against threats for information security.
- Encouraged fair trading by prohibiting corruption and bribery, abuse of superior positions and provided correct information on products/services among others.
- Provision for occupational health and safety at workplace.
- Promotion of human rights by prohibiting forced labour, inhuman treatment, child labour, discrimination and payment of appropriate wages. CSR also advocated the provision of conducive working environment, hours of work and allowing freedom of association.

These attributes drive sustainability and they also provide competitive advantage to the organisation.

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