The Impact of Technology and Strategic Planning on Logistics and Supply Chain Management

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Abstract

The purpose of this research is to identify the content and the impact of technology and strategic planning on Logistics Management and Supply Chain Management. Globalization, changing economic environment and customers' demands and the ever increasing competition in the market emerged the need for new manufacturing technologies and business processes. These changes constantly confront the practice of logistic with new challenges. These are premised on the relevance of global perspective on business operations as it is evident on contemporary introduction to a major and minor text on managerial issues which highlights the new challenges and risks of the globalizing world economy. The demand for sustainable logistic and supply chain processes poses enormous challenges in terms of technology integration, the development of new business models, cultural change and job qualification, and as such requires a real paradigm shift. This paper sees the evolution of globalization and technological innovation from corporate activities which have to cope with influence as well as the opportunities that emanate from it. The study focused on the implications for logistics and supply chain management and specially consider the impact. Mention is made of Information and technology, Inventory, Overview and concepts, Transportation and conveying, Logistics flow, Facility location, Customer service, and Performance measurement and concluding recommendations.

Keywords*: Management; Logistics; Technological Innovation; Transportation; Supply Chain*

1. Introduction and Overview

Since the emergence of the "Scientific Management" movement, initiated by Taylor (1911) which probably started the recognition of "Management" as a scientific discipline, managers have witnessed a period of change unparalleled in the history of the world in terms of advances in engineering and technology, globalization of markets, and stabilization or turbulence of world economies. With the increasing number of world-class domestic and foreign competitors, organizations have had to improve and integrate their internal and external processes rapidly in order to stay competitive.

Hence, Globerson and Wolbrum (2014) maintained that the body of knowledge included in "Management" has been drastically changed since its initiation. Its original emphasis was at first on developing areas such as "method improvement," "work measurement" and "wage incentives".

Later it expended into other areas such as "industrial psychology," "quality" and "marketing". The dynamic nature of the body of knowledge of each discipline is such that it expands over time, into new areas. Some of those areas develop later to an extent that they become academic disciplines by themselves. For example, "Industrial Engineering" was once an area within the "Management" discipline, but it grew into its own discipline. Or "Project Management" was an area within "Industrial Engineering" and also became a separate discipline.

Consequently, Tien, Anh, and Thuc (2019) observed that in 1960s and 1970s, companies started developing detailed market strategies focused on creating and capturing customer loyalty. Organizations also realized that strong engineering, design, and manufacturing functions were necessary to support these market requirements. Design engineers had to be able to translate customer needs into product and service specifications, which then had to be massively produced at a high level of quality and sold in a wide scale at a reasonable cost. As the demand for new products escalated in the 1980s, manufacturing organizations were required to become increasingly flexible and responsive to modify existing products and business processes or to develop new ones in order to meet ever-increasing customer needs. In the 1990s, as internal manufacturing capabilities improved, managers realized that material and service inputs from suppliers had a major impact on their organizations' ability to meet customer needs. This led to an increased focus on the supply base and the organization's sourcing strategy. Later on, managers also realized that producing a quality product was not enough. Getting the products to customers when, where, how, and in the quantity that they wanted, in a cost-effective manner, constituted an entirely new type of challenge. The logistics renaissance has been now a really rising trend, spawning a whole set of time-reducing information technologies and logistics networks aimed at meeting these challenges. These are the reasons why companies have to not only strengthen themselves but also take care and pay attention to the partners on their supply and demand side, considering themselves not as a central player but a part of the interrelated network, a linkage of the whole, global value chain.

A major change in logistics took place when the concept of Supply Chain Management was introduced. The Supply Chain Council at The Ohio State University argued that Supply Chain Management is more comprehensive than Logistics, encompassing the management of multiple business processes (including logistics processes) and involves frequent information updating among supply chain members for effective SCM (Cooper, Lambert and Pagh, 1997; Globerson and Wolbrum, 2014). Their model suggests that Supply Chain Management involves the management of eight business processes; two of which, Customer Relationship Management (CRM) and Supplier Relationship Management (SRM), form critical links across the supply chain. The other six processes (Customer service management, Demand management, Order fulfillment, Manufacturing, Flow management, product development and commercialization, and Returns management) are coordinated through SRM and CRM. Supply Chain Management is defined by CSCMP as "an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across

marketing, sales, product design, finance, and information technology. Using the above definitions, it becomes clear that Supply Chain Management has a broader perspective and it requires overall managerial efforts throughout all organizational functions, of the organizations involved. Therefore, a course that covers Supply Chain Management should first cover logistics management subjects, followed by other subjects of which a few are from other managerial disciplines, such as marketing and finance. There is ambiguity concerning the boundaries of Supply Chain Management due to the parts of the supply chain that are external to logistics management, since it deals with integration of activities of different functional departments among all companies that play a part in the supply chain (Arlbjom and Halldorsson, 2002; Van Hoek, 2001; Globerson and Wolbrum, 2014).

2. Literature and Conceptualization —Logistics and Supply Chain Management

In a time of accelerating competitive pressures, a global playing field and rising customer expectations, companies are faced with a constant quest to streamline their flow of goods and services and to create an effective means to gain efficiencies and eliminate non-value added steps in this environment with the focus on logistics and supply chain management (L&SCM) (Manuj and Mentzer 2008; Wagner and Bode 2008; Miller and de Mata 2008; Schoenherr, 2009).

According to Tien, Anh, and Thuc (2019), supply chain revolution and a related logistical renaissance are two massive shifts in the expectation and practice concerning the performance of business operations. They are highly interrelated, but are significantly different aspects of the contemporary strategic thinking. Globerson and Wolbrum (2014) affirmed that although logistics management is a part of Supply Chain Management, it was not always so since Supply Chain Management was introduced into the logistics life cycle only in a late stage, as described by the following paragraphs, describing its historical development. The roots of logistics thought originated around farm-to-market economics, and was first documented around the early 1900s. A review of the development of logistics can be found in Kent and Flint (1997). The evolution of logistics thought appears to fall into the following seven eras as revealed by Globerson and Wolbrum (2014).

i. Era 1: Farm to market, starting around 1900's, in whichthe main focus was on transportation and distribution.
ii. Era 2: Military and business, starting during the Second World War. Needs generated by the war gave a push to the development of functions such as transportation, warehousing, inventory and physical distribution.
iii. Era 3: Integration of functions, started around 1960, focusing on the total system's performance, rather than on performance of individual functions. Logistics started to be taught as an area.
iv. Era 4: Customer focus, starting around 1970, where customer service was regarded as the primary focus of the company.

v. Era 5: Logistics strategy, starting during the 1980s, where it has been considered as a critical component in the company's strategy. Emerging concepts are such as Supply Chain Management, environmental logistics, reverse logistics, and a heightened awareness of globalization. Information technology as well as strategy concepts have had a significant influence.

vi. Era 6: Integrated Supply Chain Management, starting during the 1990s, where logistics processes are extended to the companies involved across the supply chains. It requires greater involvement with many functional areas within the organizations involved

vii. Era 7: International Supply Chain Management, starting around 2000, where the chain crosses countries' borders, mostly due to the existence of very effective information technologies.

Supply chain (sometimes called the value chain or demand chain) consists of firms collaborating to leverage strategic positioning and to improve overall operating efficiency. For each firm involved, the supply chain relationship reflects strategic choice. A supply chain strategy is a kind of channel arrangement based on acknowledged dependency and relationship management. Supply chain operations require managerial processes that span across functional areas within individual firms and link trading partners and customers across organizational boundaries. Supply chain management is defined as the integration of activities along the supply chain linking customer orders, distributor orders, inventorial orders, manufacturer orders, supplier orders and ultimately related cash flows.

Logistics means the art of calculation and reasoning, in contrast to supply chain management, it is the work required to move and to position inventory throughout a supply chain. As such, logistics is a subset of and occurs within the broader framework of a supply chain. Categorically, Tien, Anh, and Thuc (2019) posited the global historical development of logistics to emerge from more than 5000 years, both in economics and military art and science, is the origin of supply chain management which has been known and become popular for several decades only. The most well-known logistics achievements in ancient time are the pyramids in Egypt and the Great Wall in China, to name a few. Logistics is the process that generates value by timing and repositioning inventory; it is the combination of firm’s orders management, its inventory, transportation and civil aviation development policy, warehousing, materials management and handling, and packaging as integrated throughout a facility network (PAUL, 2014; 2019; 2021; 2024; 2025). Integrated logistics serves to link and synchronize the overall supply chain as one giant continuous process and it is essential for effective supply chain connectivity. While the purpose of logistical work has remained essentially the same over decades, the way the work is performed continues to change radically in parallel with technology development and management innovation. As Lambert, Stock and Ellram (1998) noted, the 5 Right conception logistics is the process of delivery the right product to the right place at the right time under the right condition and cost for the right customer. According to Christopher (1998) logistics is a process of strategic management of purchasing, transporting, storing materials, spare parts and semi-finished products, products and proper information flow in a company and its distribution channels to optimize profit now and in the future through carrying out all the orders at lowest cost and as fast as possible. According to

Simchi-Levi (2000) logistics system (network, chain) is a group of applied approaches linking suppliers, producers, warehouses, shopping outlets in an effective way for the purpose that goods and services are to be produced (delivered) and distributed in right quantity, right place, at right time in order to minimize cost in the whole system in a response to the needs of customers in terms of their expected level of service.

Logistics management, as has been defined by CLM (Council of Logistics Management), refers to the process of planning, implementing and controlling the efficient, effective flow and storage of goods, services and related information from the point of origin to the point of consumption for the purpose of conforming to the customer requirements and expectations.

Most of the authors see logistics as the design and operation of the physical, managerial, and informational systems needed to allow goods and services to overcome time and space. Logistics entails planning and controlling of all factors that will have an impact on getting the correct product where it needs to go, on time, and cost-effectively. Superior logistical performance is a primary area in which organizations participating in an integrated supply chain management initiative can make themselves significant improvements. Logistical management is vital not only to manufacturing and assembly industries but also to retailing, transport, and other distribution or service-oriented industries. Owing to intensive competition in global markets, logistical management is considered an important source of competitive advantage. A study done by Council Logistics Management found that world-class firms are more apt to exploit logistics as a core competency than their less advanced competitors in less developed countries. This logic can certainly be extended to all the inter-organizational, cross-boundary and global supply chains. For instance, professional and strongly competitive German logistics service providers such as DB Schenker, Dachser, Yusen, Ziegler, APL, CEVA, DHL, Kuehne and Nagel are the powerful engines supporting German industry, export, growth and prosperity of German global corporations and Germany as an economic powerhouse in general. This Council Logistics Management study has identified what logistics firms can do to achieve world-class status. Key focus areas as Tien, Anh, and Thuc (2019) identified include:

i. Positioning concerning the selection of strategic approaches to guide logistics operations.
ii. Integration of internal logistical operating excellence and development of solid supply chain relationships.
iii. The agility with respect to relevancy, accommodation, and flexibility.
iv. Measurement of internal and external performance.

Integrated supply chain management will only increase the importance of logistics activities. Supply chain management allows supply chain members to optimize their logistics performance at the inter-organizational level. This means integrated management of the movement (the flow) of materials, spare parts, semi-products or finished products first from the supplier to the next links across the supply chain to the end customer. This represents a major departure from current logistics practices and concepts of many traditional companies, often characterized by independent efforts with limited mutual coordination between organizations. Logistics professionals will

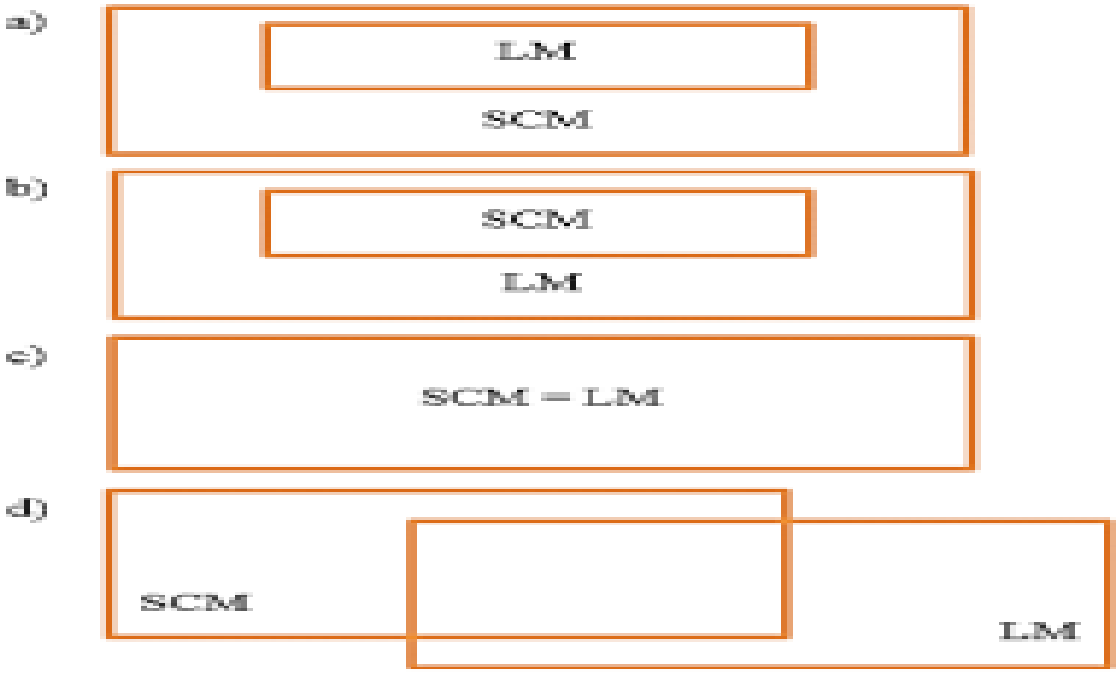
continue to be challenged to manage the movement of products across the supply chain in a timely and cost-effective manner that meets customers' service requirements. Meeting this challenge requires a logistics strategy that encompasses the entire supply chain. This overall strategy will be the primary driver for the specific logistics strategy within each of the supply chain member organizations. Distribution networks, transportation modes, carrier surveillance, inventory management, warehousing, order processing, and other related activities need to be addressed. The scope of the logistics strategy is now the entire supply chain, not just each individual unit in the chain. It will no longer be desirable or sensible for each of the supply chain member organizations to manage its logistics activities independently.

As said before, supply chain management is a new concept of management that has gained its popularity since 1980 and the logistics management has been perceived as organization's traditional business or non-business activity since ancient time. Analyzing definitions and essence of both logistics management and supply chain management leads us to many schools of thought related to the issue on relationship between those fields as presented in the following figure 1:

i. Logistics management is a part of supply chain management
ii. Supply chain management is a part of logistics management
iii. Supply chain management is strongly and strictly identified with logistics management and vice versa d) Supply chain management and logistics management have something in common and something of their own

Tien, Anh, and Thuc (2019) believed that logistics management is part of the supply chain management and supply chain management encompasses all logistics activities of the firms, their partners they cooperate with, the synergy effect of those activities and more.

Figure 1: Supply Chain Management and Logistics Management

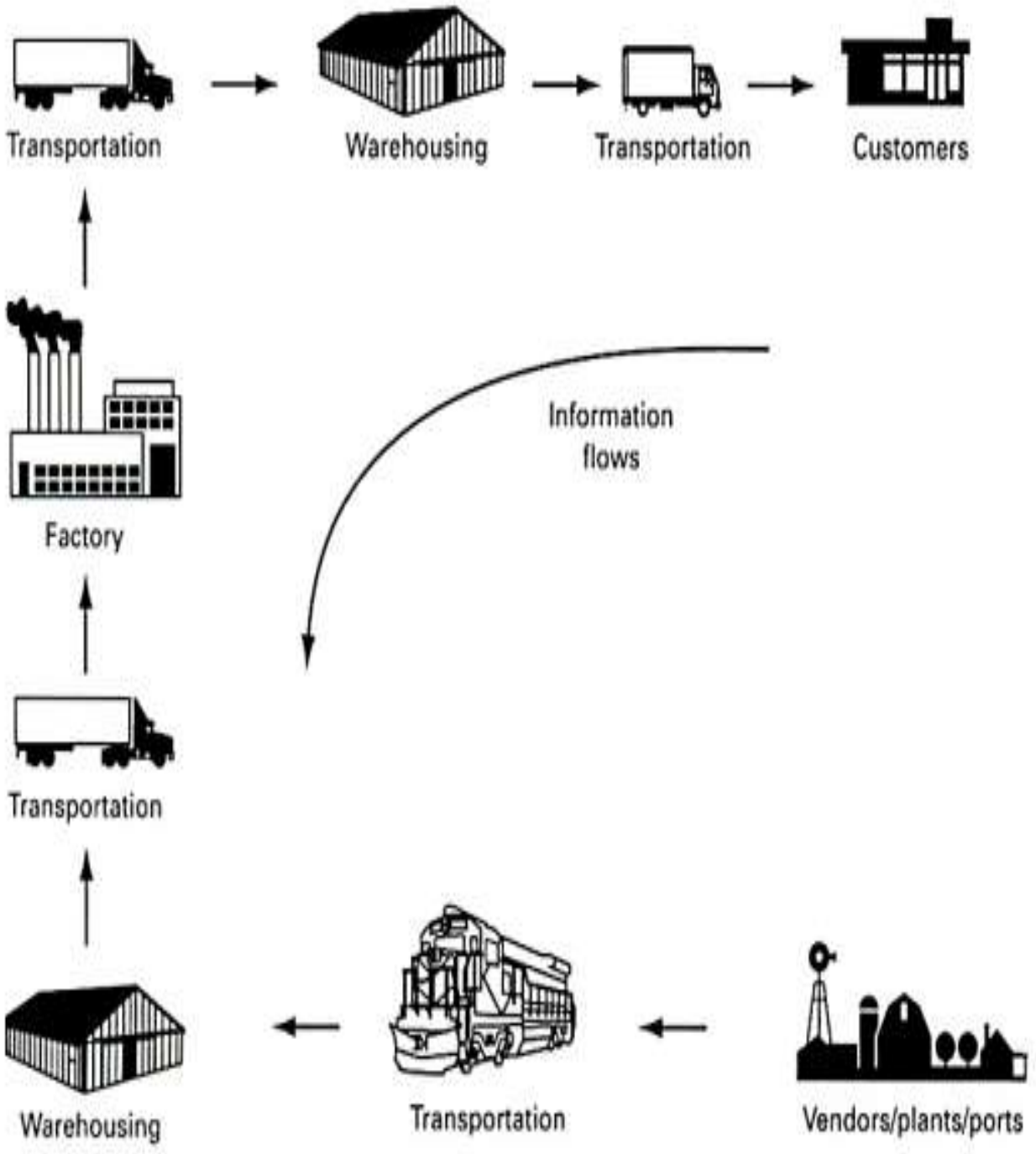


Source: Tien, Anh, and Thuc (2019).

3. The Principal Roles of Supply Chain Management

The management activities that need to be coordinated within a supply chain vary significantly from firm to firm, depending obviously on particular organizational structure, management's honest differences of opinion about what constitutes logistics, and the importance of individual activities to the logistics operations. Following along the supply chain as shown in Figure 2 and noting the important activities that usually take place, according to the Council of Logistics Management these are components, or activities, as to where they are most likely to take place in the supply channel (chain). The list of them is further divided into key and support activities, along with some of the decisions associated with each of the activities (table 1).

Figure 2: Logistics Activities in Supply Chain



Source: Tien, Anh, and Thuc (2019).

Table1: Key Logistics Activities in Supply Chain

Key Activities	Decisions Associated
Customer service standards	a. Determine customer needs and wants for logistics customer service
	b. Determine customer response to service
	c. Set customer service levels
Transportation	a. Mode and transport service selection
	b. Freight consolidation
	c. Carrier routing
	d. Vehicle scheduling
	e. Equipment selection
	f. Claims processing
	g. Rate auditing
Inventory management	a. Raw materials and finished goods stocking policies
	b. Short-term sales forecasting
	c. Product mix at stocking points
	d. Number, size, and location of stocking points
	e. Just-in-time, push, and pull strategies
Information flows and order	a. Sales order-inventory interface procedures

Source: Tien, Anh, and Thuc (2019).

Key and support activities are separated because the first activities will generally take place in every logistics channel (hub), whereas the second will take place, depending on the industry or circumstance (case), within a particular firm. Regarding key activities, they either contribute most to the total cost of logistics or are essential to the effective coordination and completion of the logistics task. Tien, Anh, and Thuc (2019) identified the following key activities.

i. Customer servicing standards set the level of output and degree of readiness to which the logistics system must respond. Logistics costs increase in proportion to the level of customer service provided, such that setting the standards for service also affects the logistics costs to support that level of service. Setting very high service requirements can force logistics costs to exceedingly high levels.

ii. Transportation is primary cost-absorbing logistics activities. Experience has shown that it will represent one-half to two-thirds of total logistics costs. It is transportation that adds place value to products and services, whereas inventories add time value. Transportation is essential because no modern firm can operate without providing for the movement of its raw materials, spare parts, semi and/or finished products. This essential nature is underscored by the financial strains placed on many firms by so-called national disasters, such as a national railroad strike or independent truckers' refusal to transport goods because

of rate disputes and so on. In these circumstances, markets cannot be served, and products back up in the logistics pipeline to deteriorate or become obsolete.

iii. Inventories are essential to logistics management because it is usually not possible or practical to provide instant production or sure delivery times to customers. They serve as buffers between supply and demand so that needed product availability may be maintained for customers while providing flexibility for production and logistics to seek more efficient methods for manufacturing and distributing the products.

iv. Order processing is the final key activity. Its costs usually are minor compared to transportation or inventory maintenance costs. Nevertheless, order processing is an important element in the total time that it takes for a customer to receive goods or services. It also is the activity that triggers product movement and service delivery.

4. The Importance of technology and Logistics and Supply Chain Management to the Global Economy

The five (5) main elements of the networked production can be defined by the following (Husi, 2016; Kovács and Kot, 2016).

i. Digital workpieces – the dimensions, quality requirements and the order of technological processing is given for the digital workpieces;

ii. Intelligent machines communicate simultaneously with the production control system and the workpiece under processing, so that the machine coordinate, control and optimize itself;

iii. Vertical network connection – when processing the unique specifications given by the customer for the product to be manufactured the production control system forwards the digital workpiece created by automated rules to the equipment. The products control their own manufacturing process, since they communicate with the equipment, devices and the other workpieces about the conditions of the production;

iv. Horizontal network connection – the communication is realized not only within one factory, but also in the whole supply chain; between the suppliers, manufacturers and service providers. The main purpose is to enhance the efficiency of production and to utilize the resources in a more economical way; and

v. Smart workpieces – the product to be manufactured senses the production environment with internal sensors and controls and monitors its own production process in order to meet the production standards, since it is able to communicate with the equipment as well as the components already incorporated and to be incorporated.

As Kiessling, Harvey and Garrison (2004) asserted, the important and required evolution of the logistics boundary-spanner due to changes in the marketplace (i.e., automation and a hypercompetitive global marketplace forging strategic alliances and lean logistical value chains) has often been overlooked by many firms and consequently, these firms have lost a competitive venue. Following this therefore, the primary importance of logistics and supply chain is seen in the;

i. Provision of employment engagements and jobs opportunities. A significant proportion of people making a living and working in the industries (logistics and supply chain). Of course, with the growth of the logistics industry, it will seek more human resources and provide more employment opportunities.

ii. Acceleration of Ease of Doing Business in the world over. Otherwise, logistics are thought to have formed when the Allied nations were to supply their troops with valuable supplies and ammunition during the Second War. In those times, supply coordination was not easy, especially given that it was more a matter of life and death. Today, just about anything and everything on the market relies on transportation and inventory management services in the industry. As every sector relies on such importance of logistics, any significant loss or damage in logistics can be felt by all other branches of the industry. Business Logistics and Supply Chain Management (SCM) are relatively new terms that emerged in recent years concerning to be modern terms compared to the more traditional fields of production, marketing or finance.

iii. Global logistics plays critical role in the growth and development of world trade, and in the integration of business operations on a worldwide scale.

iv. Emergence of dynamics in multiplication and multi-dimensional global business centres. By opening new stores globally, from which to source products, by increasing the number of retailers, wholesalers, agents and distributers in the global supply chain, as well as easing global transport, these events dramatically changed the way business looked at managing its physical operations.

v. Business growth and development. The steady growth of partner sectors will only increase the logistics industry as one sector cannot function optimally, especially without logistics services. The supply chain industry primarily consists of six sectors, of which the initial four relate to modes of transport such as air, road, maritime and rail. The remaining two sectors are primarily responsible for securing the shipment to the final destination through careful coordination. Such responsible segments are storage and warehousing.

5. Concluding Remarks and Recommendations

Like Zijm and Klumpp (2016) observed, modern logistics and supply chains emerged as a result of diversification and specialization of industrial production, globally scattered availability of resources and more demanding consumer markets. Jointly with advances in freight transport and communication technologies, these developments have led to the global economy we face today. The strong growth of trade and consumption however also revealed some essential weaknesses of the system that renders current practices in the long run unsustainable—in social, environmental and economic terms (people, planet, profit). Suffice to also note that as the logistics industry is of paramount importance for an optimal working economy particularly industrialization (PAUL and Ofuebe, 2020; 2021; 2024), many recent changes have been observed in this industry (Mihajlović and Trajković, 2020). With the continued growth and development of technology, many feasible capabilities are capable of inducing automation in the industry. It is only a matter of time before the robots will be employed in such transportation services, ensuring maximum impact without

human error. Introducing online shopping is a viable solution, when it comes to the convenience of shopping from home. Internet shopping is the dominant driving force of the logistics industry as more and more customers order products online. It is recommended therefore that:

i. Future supply chains should no longer deplete scarce natural resources or contribute to climate change, should avoid environmental pollution and withstand safety and security threats, while at the same time remaining competitive and satisfying high labor quality standards.

ii. With the growth and expansion of the economic sector and the increase in population, there is a need to develop various infrastructures of the economy, which necessitates the need for an efficient and effective logistics industry to meet and facilitate needs.

iii. There should be the requirement of the application of advanced technologies to mitigate or even neutralize these negative effects, but also the development of smart business models, new job qualification standards and corresponding (lifelong) training and education programs at all levels, including artificial intelligence based learning.

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