Managing Complex Supply Chains: Lessons from Military Logistics

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***Abstract*— The prerogative of modern life is the door-step delivery of the desired products within days or a few hours of placing the order with the vendor/s. This necessitates the creation, maintenance and management of an efficient network of people and processes for production and timely delivery of the product in demand – a robust supply chain. The article is a comprehensive approach towards modern supply chain management. The purpose of this article is to illustrate the complexities faced by commercial organization in managing their supply chains, especially the ones that are spread across the globe. This article explains how the commercial world can learn from the military the ways to handle their supply chains effectively even in disruptive situations such as diseases and natural disasters in order to ensure non disruption of operations. Supply chains being lifeline of any business it pays to learn from those who are the best in managing supply chains under dire circumstances. Though blindly copying and trying to replicate supply chain management (SCM) practices adopted by the military may prove futile, a modified version to suit company-specific needs will make important differences in the efficiency of commercial operation of enterprises. We scrutinized an assortment of secondary sources including peer reviewed journal, magazines, online publications, books and newspapers to arrive at this conclusion.**

***Keywords*—** *Supply Chain, Supply Chain Management, SCM, supply, military supply chain, supply management, Supply chain security, Military logistics.*

1. Introduction

Business environments are competitive and hence businesses are always trying to please customers better in order to retain old ones and to attract new ones. This is what results is performance stability, business growth and expansion. Every business wants to serve its customers well which makes it imperative for businesses to make efficient monitoring and management of supply chain a strategic priority. In the modern world where the supply chains are spread across countries, recent turn of events including COVID-19 pandemic and Russia's was with Ukraine have highlighted the need for organizational agility and operational excellence in terms of supply chain management to keep the business running even in dire situations. This is where organizations can use a few lessons from the military as far as managing supply chains, especially in times of emergency or contingency, is concerned [1]. Disruptions in Supply Chain activities resulting from unforeseen or unanticipated natural calamities or man-made disasters (for instance, fires, floods, tsunamis, earthquakes, equipment breakdowns, cyber-attacks, terrorism and economic crises) can and do impact the performance of Supply Chains negatively [2].

When it comes to management of their supply line, military operations have always demonstrated a sense of urgency, an attribute that has been, more often than not, absent in commercial operations [1], while natural disasters and pandemics such as Corona in 2020 highlighted the need for flexibility of operations and contingency planning as key components of strategy to build resilience [3].

Big and significant emerging economies, such as, India and China, experience a range of complexities - from creation and expansion of markets (where the major section of the population comprises of people with significantly low purchasing power) to integration of suppliers who are low cost but primarily very petite and usually belong to the unorganized sector [4]. For commercial enterprises that covet carrying out

significant portion of their businesses in such markets, these complexities need to be identified, comprehended and then surmounted. A major hurdle is comprehending the associations between the society and markets. This would make it imperative for a firm to develop a novel business model which can help it grow in such circumstances [5]. The purpose of this study is to understand what business enterprises could learn from the military to effectively manage complex supply chains.

2. Literature Review

The research objective of this study was designed to scrutinize the management of complex supply chains by commercial enterprises and the lessons they could learn from the military and apply in their business world for the efficient management of their specific supply chains. Supply chain refers to the interconnected journey undertaken by raw materials, components, and goods prior to their production and sale to final consumers. It, therefore, consists of every single one of the raw materials and parts that go into the manufacturing of a product and its distribution up the chain for sale to the ultimate consumers. In simple terms, supply chain refers to a network comprising of people and firms that work together in producing a product or service and delivering the same to the customers [6]. The supply chain lays out all aspects of the production process, including the activities involved at each stage, information that is being communicated, natural resources that are transformed into useful materials, human resources, and other components that go into the finished product or service [7]. It involves producers, vendors, warehouses, transportation companies, distribution centers, and retailers [6]. Each stage of a supply chain is essentially a different industry, for example, raw material extraction and manufacturing. The supply chain enables a company to understand others that are involved in each of the stages, and thereby provides some insights on the attractiveness or competitiveness in industries the company might want to enter in the future [7]

A supply chain is different from a value chain that involves every individual step that is taken for the creation of a marketable product [8]. The value creation process includes, besides physical components, a number of different value-adding activities which can be categorized as part of the “knowledge economy”. These include such elements as innovation, conceptualization, design, development, marketing, and sales. All of these value creating activities lead to the manufacturing of a product that is ready for consumption [9]. Supply chain, therefore, encompasses the entire processes that spans over a wide array of activities. including procurement, storage, manufacturing, transportation, and vending of the physical products and services [10]. A superior supply chain is one of the key factors driving operational efficiency and hence commercial success. A resilient supply chain is a comparatively novel concept and is defined as the adaptive capacity of the supply chain to be ready for unforeseen occurrences, act in response to disruptions, and recuperate from them through the maintenance of operational continuity at the required level of connectedness and control over structure and function [2, p. 925].

2.2 Understanding Supply Chain Management (SCM)

The Council of Supply Chain Management Professionals (CSCMP) has defined Supply chain management as the organization and management of every activity involved in procurement and sourcing, production processes, and all activities related to logistics management, such as collaboration and coordination with suppliers, intermediaries, third-party service providers, and consumers [11]. The importance of supply chain management has been growing over the years in competitive world of business. Supply Chain Management is more inclined towards being a holistic approach to management of the process of logistics and includes various different aspects including information flow and technology..

2.3 Evolution of Supply Chain & SCM

There are several factors that have been involved in driving the evolution of supply chain management. These factors include technological developments and innovations, modifications in customer expectations, and the increasingly dynamic global business scenario that warranted the enhancement of operational efficiencies of the organizations in order to be able to compete in the modern market arena [12]. Thanks to Globalization, modern value chains are now spread across the globe and are being redesigned or restructured by increasing demand and new industry know-hows in the emerging economies as also by the wave of innovative technologies [13]. It is imperative for modern firms to act promptly and adequately in response to such different external shocks as the resources depletion, stringent regulations, growing demand in terms of quantity and quality of goods and services, responsiveness, customization, and

decreased costs [14]. At the same time, because of the rising awareness of the necessity and significance of environmental protection among the general public [15], issues pertaining to environment and climate change have also become a demanding issue for organizations concerned with management of supply chain [11]. The 1990s witnessed the introduction of enterprise resource planning or ERP systems which was a noteworthy development and a defining moment in the timeline of evolution of supply chain management. These systems made it possible for the commercial enterprises to put all of their business functions, including supply chain management, together into one single platform. This resulted in easier management of inventory, tracking of shipments, and better coordination among suppliers and manufacturers [12].

Over the last 4 decades, the just-in-time or JIT model of inventory management and delivery of final products has been helpful for commercial enterprises. Companies that accepted and implemented this model have been able to operate lean supply chains due to the fact that they were able to consistently predict demand and supply in a reliable manner [1]. However, the emergence of e-commerce resulted in disruption as it resulted in significant alteration in consumer expectations relating to the time of delivery of products and services that exerted a lot of pressure on JIT supply lines. The problem was aggravated by the COVID-19 pandemic. With the rapid development of ICT and internet becoming more predominant, businesses have started to look at the potential of e-commerce and online markets. This was the key driver behind the rapid development of such new supply chain models, as drop-shipping and direct-to-consumer shipping, that depend heavily on real-time data and analytics for the management of logistics and inventory [12].

However, businesses still do not have the same kind of urgency that drives military missions. Nevertheless, commercial enterprises that intend to remain not just operational but also commercially viable during times of turmoil and disorder can learn a lot from the military supply chain model that can offer valuable guidance [1].

SCM concerns itself with a holistic approach to the process of logistics management, and includes various different aspects, from information flow to the application of novel technology. This applied science is perhaps one of the best approaches to achieve stable results over a prolong period when compared to the military's pigeon-holed approach. Such practice is the noteworthy feature of e-commerce corporations such as Amazon, which has scaled such levels of efficiencies of supply chain management that it has become possible, in some instances, for the company to provide door-step delivery to the consumer within just an hour of placing an order by the consumer through just a click using an internet enabled smart device. It must, however, be noted that Supply Chain Management that have a higher orientation towards achieving superior efficiency will in general result in supply chains that are likely to be overly "fragile" from the angle of military applications. Hence it becomes imperative for the logistician to balance these trade-offs on a regular basis [17]

2.4 Similarities Between Military and Commercial Supply Chains

There is one thing that is common to both the military and civilian supply chains – both of them essentially incorporate information technology (IT) in their supply chain management. There exists a school of thought which argues that both these sectors must possess the same organizational talent and ability while implementing IT in their supply chain. Despite the fact that there are clearly discernible technology leaders when it comes to commercial logistics, it looks like not only military logistics but also the larger commercial logistics market has the tendency to be comparatively slow in adopting novel or emerging technologies. More often than not, in the case of the military, operational priorities other than logistics management take precedence while allocation of funds. However, in the case of trade and commerce, funding allocation is likely to be driven more by the unwillingness or lack of enthusiasm to commit hefty sums to unconfirmed, experimental or niched technology until the technology has been well proven, established and is in wide used within the industry [17].

2.5 Key Difference Between Military and Commercial Supply Chains

The very basic difference between military supply chain and commercial supply chain is that the notion of military logistics is much wider compared to business logistics. The reason is that military logistics, along with the functions of transport and storage, takes in a large number of other activities for instance medical health activities, upkeep of vital military infrastructure, transportation of particular materials and precise equipment, and also veterinary protection and activities, military logistics in humanitarian disasters, pandemics (example of using the army for civilian purposes due to the COVID-19 pandemic), etc. [18].

The performance metric of availability is used by

the military to manages its logistics. This metric is concerned with having the specific product that is needed, at the precise location where it is needed, precisely at the time of the need — for its end-customer, the soldier. On the contrary, the commercial world, takes care of its logistics management with metrics of internal performance and not from the standpoint of the final consumer. The bureaucracy of the Pentagon could certainly have the department entangled in an "anchor chain" but a closer examination, the delineation of military logistics does not look as austere as is depicted. At the same time, the perfect yet unrealistic images of the well-organized and effectual corporate supply chain and business processes also prove inadequate in practice. In real life, both worlds have the opportunity to acquire knowledge and skills from each other and learn from one another's mistakes and successes. [19].

Another very significant difference between military and commercial supply chain that amplifies the degree of complexity of the military supply chain is that other than having a forward pipeline, similar to majority of the commercial ones, it also has in place reverse and lateral pipelines [20]. Military supply chain management has to deal with a much broader array of products compared to retailers such as Amazon, Dell, Sears or Wal-Mart – each of these companies is well known for taking the subject of supply chain management to a whole other level, making it an advanced science [20].

There are several aspects in which military supply chain can resemble commercial supply chains. But in terms of adequacy, commercial supply chains severely lag behind when it comes to handling grievous operational challenges that keep appearing from time to time during military operations. For instance, both commercial and military logistic operations are prone to facing significant spikes in demand; however, such peaks can be largely anticipated (such as holidays and new product launch), unlike military [21]. In business logistics a surplus of products is considered to be a negative indicator. The same is the outlook with a shortage of products. On the contrary, in the army a surplus of resources is considered to be a form of competitive advantage over the enemy [18].

It is usual for a typical commercial logistics department to be oriented on a much narrower goal of providing support to the business operations of its particular line of commerce. It has already been mentioned that because of its focus and a working environment with better stability, commercial logistics can many a times turn out to have higher efficiency compared to the military [17]. However, whatever shortfall in efficiency that might crop up, the military logistics mare than compensates through its robustness and adaptability. Military supply chains display significant flexibility and adaptability.

2.6 Need for Supply Chain Management (SCM)

A supply chain refers to the interconnected journey undertaken by the raw materials, components, and goods before they are assembled and sold to the consumers. Supply chain has become the key factor driving the creation and maintenance of competitive advantage for any business organization [22]. The study pertaining to management of supply chains stresses on the manners in which the overall value of the firm can be maximized trough the better utilization of resources and their proper deployment across the entire firm. A supply chain, therefore, refers to the entire gamut of value-adding activities connecting the suppliers and its customers of the commercial enterprise [23]. In the area of logistics and transportation, Supply Chain Management stresses on planning logistics, movement of inventory of raw materials and inventory, and their management. With respect to the warehousing premises, Supply Chain Management focuses on the storage of raw materials, components and finished goods, order picking, and control of inventory. In the area of demand management, Supply Chain Management focuses on sensing current demand, giving shape to future demand, and forecasting of demand.

The rapid proliferation of ICT has resulted in the use of advanced analytic techniques for the extraction of valuable knowledge from big data which ultimately facilitates data-driven decision-making. Extensive application of various platforms and technologies to include OCR (optical character reader), barcodes, sensors, and the whole gamut of internet of things where all devices and sensors carry out systemic checks and reach an approximation for various types of repairs and replacements required, refilling of stocks of materials, components and finished good and ensure maintenance of adequate inventory levels to avoid supply disruptions. This helps in the integration and coordination of every linkage of the chain and is the key to efficient Supply Chain Management [24].

2.6.1 Dynamic Nature of Consumer Demand

Demand for all products is more or less dynamic and change according to the changing economic environment. Hence it becomes essential for businesses to develop the flexibility of supplying the necessary volume of products or services as and when required. In the commercial world, efficient supply chain management allows manufacturers to produce as many products as necessary in order to meet market demand. Efficient supply chain management helps retailers cut down excess inventory and bring down the cost of storing products. Supply Chain Management, therefore, entails management of costs occurring at every step of the production and delivery of final products to the ultimate consumers with the least possible delay. The discipline assumes that each one of the products that are being sold, exists due to the proper functioning of the different participants in the supply chain [25].

2.6.2 Global Operations

Today world is a global village and most large and established companies are going beyond their domestic boundaries to spread their business and cater to a broader clientele. Various regions across the earth are more suitable for producing particular goods and services than others. For instance, customer help centers have been outsourced to India or Mexico quite a few years ago [26], Latin American and the Mediterranean specialty foods are in quite high demand across the world, and information technology companies are forever in need of microelectronics from various corner of the globe to take advantage of cost differentials [27]. Going international using global supply chains have helped to facilitate entry into uncharted territories and new markets, which has helped to enable business expansion and growth and provided companies with access to novel and innovative technologies by striking partnerships with foreign firms [28].

The exponential growth of world trade and the development and expansion of new markets in Asia and in other emerging economies gave rise to new opportunities for companies to procure raw materials and other components and sell their products. However, it has also resulted in higher complexity in the management of supply chains, as the global companies now have to manage logistics across a number of countries and regions [12]. Globalization and technology have emerged as the key forces that are driving the management to bring in modifications in supply chains, and has also created a new economic environment. Technology and globalization are considered to be complementary to each other and interact significantly in order to decide a mutual destination and collectively decide the way for global supply chains to move forward [29]. Covid-19 has taught an important lesson to the corporates. The crisis created by the pandemic highlighted that supply chains form an integral part of the global marketplace and faltering of the supply chain and the resultant loss of market is damaging for a large number of industries in various different ways. In a business environment in which cost effectiveness has the supreme interest, just-in-time supply chains do not have the capacity to provide enough surplus that can result in the smooth and relentless running of these industries. These supply chains had been developing for a long time, whether it was for cheaper manufacturing or superior skills for part fabrication [27].

2.6.3 Growing Complexity

Economic systems are becoming increasingly susceptible to complications and uncertainties and supply chains are no exception. In the modern world, markets are becoming increasingly competitive and turbulent. Supply chains or SCs are growing in terms of complexity and at the same time becoming more susceptible to disruptions [30]. With the growth and expansion of businesses at a global level, supply chain management too is becoming an increasingly complex affair. This led to the development of new technologies and software that could help manage the flow of goods and information across a multitude of suppliers, manufacturers, and distributors [12].

2.6.4 Reducing Risk of Disruption

Management of Supply Chain is highly dynamic, even when it's business as usual. A natural calamities or pandemics like the COVID19 have the potential to uncover or highlight the weakness lying latent within the supply chain of an organization. Today in the face of a global pandemic a large number of firms succumbed to the supply chain challenges that were thrown by the testing times. The pandemic brought several of even the larger companies to their knees. The businesses organizations needed to stabilize their supply chain amidst the disruption and maximize their efforts towards mitigating the threats faced by their own supply chains, more than ever [31].

Majority of the managers are aware of the fact that they need to guard their supply chains against any grave and expensive disruptions - but

compared to that only a very small number takes action. A Catch-22 situation arises as the solutions for reduction of risk have very little meaning if they are not evaluated against the impact that they would have on the cost efficiency of the organization. In order to provide protection to their supply chains against any significant disruptions, modern companies can develop resilience by way of segmentation or regionalization of supply chains, and put a constraint on the losses in performance by keeping away from excessive centralization of resources. [32].

One of the major reasons for enterprises not being able to efficiently or successfully handle the problems impending within their business operations results in a scarcity of risk management capabilities for a large number of businesses. Efficient Supply Chain Management is expected to streamlines the flow of all things including the final goods against any unexpected natural disaster [33]. Supply chain efficiency is usually directed by a company towards improving the company's financial performance and is not the same thing as development of supply chain resilience, which is usually aimed at the reduction of risk. Despite the fact that both necessitate coping with risks, intermittent risks including fluctuations in consumer demand that are inherent in the business and which managers need to deal within supply chains, makes it imperative for the companies to put a lot of emphasis on enhancing efficiency for improving the manner in which they match supply and demand; disruptive risks on the other hand makes it necessary for the companies to develop resilience in spite of the additional cost involved [32].

3. Discussion

Logistics is one of the most significant constituents of any overall organizational strategy, since each and every strategy requires a strong supply chain to be able to make it conceivable. Over the last few centuries logistics has been described to be a business process that uses resources for the production of goods and transportation of those goods to the people who actually need or use them.

There has been a significant development and evolution of supply chain throughout history from the manner in which Alexander the Great transported materials to the manner in which modern organizations of mammoth stature and the contemporary governments are carrying it out today. Nevertheless, a lot of it continues to remain the same. Logistics, till date, continues to depend on the conversion of information pertaining to the obtainability or accessibility of and demand for supplies into realistic plans of action that deliver the supplies at the precise time and to the exact location where they are required. [34]. Supplying goods or services to the consumers is the key objective for every sustainable supply chain network that consists of manufacturers, distributors, logistics firms, and a large number of other indirect agents such as banks, brokers, insurance companies, etc. [35]. Supply chain management or SCM, therefore, plays a crucial role in the military sector to ensure sustainability of any operation [36].

The inherent risks may be predictable to a certain extent and can be estimated in advance and hence it may be possible to build supply chain resilience or flexibility accordingly. However, for mammoth size unforeseen incidents such as the recent COVID-19 pandemic, it is impossible to accurately calculate or rather estimate the financial impact of supply chain disruptions beforehand. Hence the nature of planning that needs to go into building resilience for such events may be uncertain. This is where the private sector lacks when compared to the military. They have a better system of assessing unforeseen risks as the nature of risks handled by the military are so different and so wide that they can factor in catastrophe of any stature and plan supply lines in advance.

The military supply-chain can be divided into 3 separate chains, according to the military logistics experts. Chain number one has fast movements but the volume remains low. This is used to move commodities such as war rations, medicine aa also clothing. In the commercial world the equivalent of this would be Amazon, Wal-Mart or Sears. The second chain is involved in the movement of key elements such as weapons systems that need, over extended periods, regular maintenance and repair. Their commercial equivalents would be Boeing and Caterpillar. The third one is the deployment chain which is used by the military to move huge number of troops and material within a short while under challenging circumstanced. Of course, there is, no commercial equivalent to this chain [20].

3.2 What Businesses Can Learn from the Military

The U.S. military forces stationed almost all across the globe. This makes it essential to have a strong supply chain management in place for providing

not only the equipment, but also the resources and supplies of the troops that are necessary for the fulfillment of their missions. As with every function in the military, tough leaders are required to cope with the complexities of the global military supply chains. During the COVID-19 pandemic the interconnected supply chains that were spread across the globe, were significantly disrupted. The event besides highlighting the inflexibility of the supply chains to handle such unforeseen disruptions, further highlighted the need for effective leaders who have the ability to adapt quickly to rapidly altering circumstances and have problem-solving capacity and temperament that would be useful during times of uncertainty [37].

Besides strong leadership, there are various other aspects of a military supply chain that can prove to be helpful for planning and managing commercial supply chain. These aspects have been discussed below point wise.

3.2.1 Defining the Supply Chain Clearly at the Onset

It is imperative that the supply chain is defined clearly and accurately at the onset. Any supply chain can be defined using only 4 types of entities: 1) Products; 2) Facilities; 3) Vehicles; and 4) Routes. Various combinations of these 4 entities can be used to fabricate any model of a supply chain anywhere in the world. These models can then be used an input to run in simulations in order to generate various results and see how well they perform under various stressed circumstances. [37].

The civilian sectors must be able to define their own unique requirements in terms of supply chains. Every industry, every commercial entity is unique in itself and the respective supply chains that they have in place are supposed to be in line with their broader commercial goal and organizational objective. Clearly defining the supply chain will also help to identify the weaknesses that may exist within the system, thus creating the scope for improvement and most importantly highlighting the areas that need to be improved in order to ensure higher efficiency of the supply chain.

3.2.2 Being Mission-critical About the Supply Chain

The military considers the mission as the sole purpose that has to be achieved at all cost and hence focuses all resources on achieving the goal [38]. For enterprises, this goal is delivering products or services demanded by customers, as and when needed. Unless they are able to achieve this, they will lose out customers to their competitors. Modern consumers' temperaments have changed. They no longer have the patience to handle delays and would quickly switchover to a competitor that can serve better. Businesses hence need to turn mission critical and the same applies to supply chain management as the key to supplying the desired product at a time and place and in the desired form, needs efficient functioning of the supply chain. It requires streamlined process management to keep pace with the rapidly evolving global market and to maximize productivity

3.2.3 Threat Identification & Analysis

The military uses experts to identify direct threats that helps in contingency planning. The identification of threats that will have direct impact on the supply chain and hence the performance of the company in advance helps to remain prepared. The identification and assessment of the risk beforehand helps to put together a quick response team just like the military does. While risk assessment the military always analyses both short and long-term effects. The commercial enterprises should incorporate this while planning for unforeseen events. An example might include how supplier stability can affect the company's supply chain in the next six months, next year and next five years [31].

3.2.4 Involving Employees in the Planning Phase

The military emphasizes on planning in advance. It also understands that every situation will not impact everyone in a similar manner. Some will be more impacted than the others. Hence while making the plan for increasing preparedness during contingent times, the army involves all those departments that would be impacted by the contingency for planning is being undertaken. The corporate world can learn from this exercise too.

While planning for guarding the supply chain in the future against any unforeseen event, involving those employees whose core roles are likely to be significantly affected by the pressures exerted on the supply chain makes available important insights that are quite frequently overlooked by the executives while creating the plan. This process also opens itself to positive, hands-on, solution-

based problem-solving, and presents an organization with an augmented decision-making timeline allowed by the company's leadership, having provided the desired data that must be had prior to the actual occurrence of the anticipated threats [31].

It is also extremely important to get the leadership involved in the process of planning of the supply chain. Supply chain is typically the headache of the middle management. Like the military where the senior leadership usually keeps a close watch on the supply chain, it is essential in the commercial sector as well that the senior managers be involved in the supply chain management as it helps to streamline the organizational policies so as to impart the highest possible level of efficiency to the management of supply chain [1].

3.2.5 Building Redundancy and Efficiency Within the Supply Chain

Just in Time or JIT model of inventory management relies on fewer suppliers to make the business more cost effective. Every supplier in the supply chain brings their own transactional cost. As the supply was predictable, there seemed to be no point in undertaking the additional expenses in trying to retain multiple suppliers or vendors just for the sake of back up.

With the passage of time, changes in business environment and increasing operational complexities have made the access to inventory more difficult, manufacturers and businesses must be able to diversify sources of supply in order to be able to minimalize the impact of any one point of failure. A significantly large, single point of failure was generated in the recent past caused by the reliance of manufacturing activities on just a few geographical regions, especially when it comes to production of a few of the critical components including computer chips.

It has become imperative for the companies to build redundancies into their supply chain so as to be able to transfer strategic execution without much effort and without putting the mission in jeopardy. Having a contingency plan in place prior to the occurrence of a supply chain failure diminishes the negative influence when any of the anticipated disruptions actually does happen. It must, however, be kept in mind that a crucial factor in this regard is that the redundancies and contingency planning need to be cost-efficient, else the additional costs would turn out to be extremely burdensome for the company and negatively impact the bottom line [1]. Efficiency takes center stage when it comes to military operations. Circumventing redundancies and fabricating contingency plans would mean putting the precise amount of effort necessary for the mission – the amount that is just adequate and not superfluous. In the instance of a bridge being blown up, the contingency plan will not make it necessary for the Army to take a detour of a hundred mile to reach where it was required to. That is not considered to be an efficient redundancy that can support the mission. As an alternative, the military would send ahead Army engineers who would reconstruct the bridge. In plain English, they have an alternative bridge supplier in place. A process that is efficient, fast and cost-effective.

It is not possible for commercial enterprises to commit unlimited resources in order to build or add redundancies in a countless manner into every supply chain. Purchase of warehouse space or storage facilities in locations or regions that are spread across geographies and are adequately large to house supplies that are adequate to meet the demand for 6 months of parts does not amount to an efficient planning for contingency. In its place, companies need to pay attention to the diversification of their sources for their vital components in order to construct a backup route. The companies must also put their efforts in identification of alternatives well in time before the need for the alternatives arise, so as to ensure that they do not assume the risk of overstocking.

3.2.6 Using Technology & Training to Build Efficiency

Logistics is one of the important components of any overall strategy, because every strategy needs a supply chain to make it possible. In the United States, various segments of the defense forces such as the Army, Navy, Air Force, Marine Corps and the National Guard have annual plans and guidelines that are decided by whatever they expect their supply chains to achieve. The defense forces also put in place uniform systems that can help manage them. In the present scenario, with the progressions in technology and the assimilation of big data, simulators are being used to impart trainings to logistics personnel and add to performance of the real supply chain [34]. Analytics, scheduling, complex problem solving,

project management – all are applied in supply chain management [39].

Information technology is perhaps one of the aspects in both the military and civilian organizations that commands a lot of significance. Due to the existence of certain key differences in the purposes of the supply chain designs in both the miliary and the commercial sectors, various organizational capabilities become essential while carrying out and adopting various strategies for information technology in military and civilian organizations. For example, the military ones deal with highly sophisticated, sensitive, and specialized weapons, as opposed to civilian organizations. A number of these armaments and weaponries need to be handled with a lot of care and must be kept secret from the general public. Such high degree of sophistication and specialization in the military hardware system brings with it a much more elevated level of proficiency in information technology as compared to most civilian organizations [31]. In the similar way the commercial sector must adopt unique technology that will help build resilience and robustness into the inventory management system. The commercial enterprises must be aware of their special needs and chose a technology that will provide the necessary competitive edge by strengthening is supply chain.

3.2.7 Communication & Cooperation

Within the military the collaboration and cooperation between various departments are one of the key reasons for the success of any operation. On account of the broad range of logistics activities undertaken by the military, the collaboration between staff, both logistics and non-logistics, assumes a lot of importance, taking into consideration the fact that logistics activities have a solid influence on the operational role of the military. As the operating practices of the army witnessed a deterioration in the quality of performance of duties resulting from the inadequate and weak communication between various logistics and non-logistics staff, which usually results in creation of misunderstanding of and wrong or unrealistic expectations regarding the function of logistics officers, military science has been dedicated to developing the ways of refining the relations between these two branches of the army that need to cooperate intensively with the purpose of achieving an optimal result [18].

In an similar manner, various departments within an organization need to communicate effectively in order to ensure inter departmental cooperation that is necessary for the successful implementation of lean supply chain system. Even in times of grate crisis, effective communication and collaboration can quicken the pace of response to emergency situations. It is never possible to have a supply chain strategy that is completely insulated against every possible and predictable disruption. There will always be something that has not been factored in while fabricating the supply chain policy; and when that contingency actually occurs, an effective communication between various departments involved in both logistic and non-logistic managements ensures a smoother handling of even a difficult situation.

3.2.8 *The Importance of Leadership*

No literature is talking about leadership. None of the literatures discussed above have stressed on the need for strong leadership that will be necessary to not only plan the supply chain for contingent times but also handle it effectively when such times actually arrive. A far-sighted leader might not have been able to predict the arrival of COVID -like situation but will still concentrate on building a strong and resilient supply chain. As is the case with any function within the military, strong leadership are necessary for the purpose of managing the complexities of the international military supply chain. When the COVID-19 pandemic considerably disrupted the global interconnected supply chains, the outcome further pointed out the vulnerabilities that existed within the modern international supply chains. There was substantial need for leaders who could effectively and quickly adapt to rapidly changing international business circumstances and were able to take part in problem-solving during uncertain times [40]. Time, as always, was of essence. A quick response was necessary to cope with the challenges that appeared almost overnight with the stoppage of regular economic activities due to rapid spread of the disease. More than having a pre-conceived strategy in place the pandemic needed able leaders who could effectively manage the supply chains in response to unprecedented challenges emerging one after another, in quick succession. This is where the commercial world needed to take lessons from the military. The army might not be able to apprehend every situation beforehand to ensure

adequate planning but the range of situations that are considered are not only stark but are widely apart to give a broader perspective. Just like the troops follow the leader, supply chain executives needed solid direction from the leadership when things started to go haywire.

4. Commercial or Civilian Supply Chain can use the Best Practices from the Military to Enhance their SCM processes

As a result of the factors that have been mentioned below, civilian or commercial supply chains can make use of the best practices adopted by the military for the enhancement of their supply chain management process.

The military achieves its objectives, either during active operations or in peace times, by ensuring that the logistics chain is uninterrupted and fully operational. The logistics chain in the military has requirements for both onward and backward movement of troops and supplies. These supplies could range from ammunition and weapons and fresh troops getting deployed at the forward positions to rations and medical supplies and the same transportation then gets utilized for evacuation of casualty, sending back weapons which can be reused with minimal repairs to the rear headquarters. So much so, that sometimes although more far-reaching objectives can be captured due to military might; these objectives are reduced so that the supply lines are not stretched beyond their capability and the axis of maintenance is retained. This is used by the SCM to employ "Just in time" supplies which cater to immediate requirements from the market. This reduces load on the inventory and also makes the supply more efficient with minimal goods sitting in the shelves and expiring shelf life. A very dynamic SCM system would also be able to cater for backward movement of goods damaged during transportation or to even cater to other markets with increased demand due to sudden weather changes or even a festival celebration.

The Army marches on its stomach and hence cannot afford to have its logistics back up interrupted at any cost. Tanks will not move without fuel, a soldier will be no more than a pile of meat with a rifle if he does not get adequate food and on time, and a base that does not have proper electricity supply will be as good as a traditional Roman tent that will be unfit for modern warfare and will not be able to survive in the conditions of present-day warfare [18]. The contingencies which are catered for by the army to ensure negligible disruptions therefore has a lot to teach the corporate SCM and this is used by the SCM experts to design their logistical chains which cater to all possible contingencies and respond to supply chain interruptions with very little response time.

Gap or Glut, neither of these situations are desirable in any SCM system. A gap with shortage of goods means loss of business and a glut with overloading puts pressure on warehouses and damaged or expired goods means loss of revenue. Therefore, it is the aim of all SCM to make their logistical chain as lean and flexible to reduce wastage without compromising on the actual availability of goods for the end customer as and when needed

5. Conclusion

Modern-day supply chain management evolves relentlessly, with the emergence of new technologies and approaches in order to be able to cater to the changing needs of consumers and businesses. A lifeline so full of dynamism and providence for many livelihoods as the SCM needs to continuously evolve to remain flexible to respond to any challenges raised due to business requirements or changing consumer needs. To cite an example, the advent of e-commerce platforms has led to a rise in new models of logistics management, such as last-mile delivery and drop-shipping and the use of artificial intelligence and blockchain technology for transshipment of goods is making the process of supply chain management undergo significant transformation. With the continuous growth in complexity and significance of supply chains, it becomes highly likely that modern business will witness continued evolution and innovation in the arena of management of supply chain.

Today's supply chain is very different from what it used to be before the advent of e-commerce and the altered consumers' preference. As a consequence, supply chain management has also undergone significant evolution to become a key strategic function inside a number of organizations.

Supply chain professionals continue to remain responsible for handling supplier relationships, optimization of the levels of inventory, reduction in costs, and for making sure that the products are delivered to customers, sometimes even to their doorsteps, on time and in respectable condition, as desired by the customer. Despite the hype about the

stress on efficient supply chain management policies and procedures all most all business enterprise, especially the ones with supply chains spread across multiple nations, became the victim of disruption caused to supply chains due to the recent pandemic.

The pandemic was an eye opener in the sense that it brought to light the gross inadequacies within the modern global supply chains and the inability of even large organizations to respond swiftly to emerging adversaries. This led to the idea that modern commercial organizations should try to learn a thing or two from the military which so adept in responding to adverse situations with minimum time lag and remain resilient in the face of rapidly changing surroundings.

The modern era is the era of technology and such advancements in technology, as the Internet of Things (IoT) and blockchain, continue to drive the evolution of supply chain management. These technologies has made real-time tracking possible, providing higher visibility across the complete supply chain, from raw materials to finished products.

We can therefore conclude that the evolution of supply chain management has been driven by an amalgamation of factors, including advancements in technology, changes in customer expectations, and the need to compete in an increasingly global marketplace. As supply chain management evolves continuously, businesses will need to adapt to novel technologies and increase learning from other supply chain and logistics enterprise like the one run by the military especially during times of war where the front line soldiers needs to be fed their daily rations but the need for ever increasing requirement of ammunition and weapons repair become a necessity rather than a need and business processes need to remain competitive and meet the changing needs of their highly demanding customers. The commercial world also needs to learn from the army how to respond quickly even in the direst of the situations. Also, there is a need to have an extremely wide angled view of what could go wrong in operations. This will help businesses come with disruptive situations like the COVID-19 pandemic. The army considers even the wildest of situations and assesses what could go wrong and plan in advance. A lesson that private commercial enterprises could use to better prepare themselves for any COVID like situation that might surface in the near future.

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