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Original Article

Study of Implementation of Agile Supply Chain For Efficient Delivery of Essentials During Covid-19

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Abstract - *At present, a deadly first wave and second wave of Coronavirus attacked people worldwide. In India, different variants of the virus are spreading speedily across the country which causes a higher demand for large numbers of medical equipment and Oxygen gas cylinders for COVID-19 patients. Before this pandemic, such amounts of medical equipment and Oxygen gas have not been demanded in hospitals of India. The main objectives of this paper are: 1) to study the methods that assure reliable and economical delivery of essential commodities, 2) to research on the processes that permit easy access of essentials to all patients and registered suppliers when they are required, 3) to examine the dimensions of the agile supply chain and their utilization during pandemics, and 4) to contemplate the concepts and framework of the agile supply chain for the delivery and distribution of essential commodities during the Covid-19 pandemic.*

Keywords — *Coronavirus, agile supply chains, lean strategy, inventory management, logistics management, essential commodities.*

I. INTRODUCTION

The concept of supply chain management (SCM) was introduced in the 1980s. Several authors and researchers have pointed out the need to integrate key business processes, from end-user to first-time vendors. SCM focuses on planning, forecasting, purchasing, storage, mobility, product integration, and product tracking. SCM is essential for efficiency. It plays a role in cultural evolution and helps to improve the quality of life. It creates jobs, reduces pollution, and improves the quality of life. Agile Manufacturing (AM) is a novel manufacturing concept that is designed to improve the competitiveness of firms [1]. Manufacturing/service processes followed the concepts of AM are prioritized by integrated methods for PDS, actual production, marketing, delivery, and maintenance services [2]. In Agile manufacturing, there is a great focus on customers to ameliorate the competitiveness, accommodate the changes in markets, and also collecting data at every stage of the process. The term agility was coined in 1993 by Goldman et al. [3, 4]. Agility means "readiness to change", from the management viewpoint, the definition of agility is that it is a blueprint, which is more amenable in uncertain business scenarios and emergency situations [4]. As buyers purchasing patterns are varying every day, thereby the entire supply chain networks changes. The parameters such as speed, cost, and efficiency are the elemental drivers of supply chain agility [5] as shown in figure 1. Agile supply chain networks are dependent on the perceptivity of buyers' demand. The term Agile is traced from the Latin term *agilis* which means "nimble or quick," and from the term *agere* which means "to set or keep in movement". Therefore, the meaning of agility is to move quickly and easily [6].

The pandemic that occurred due to COVID-19 has outraged the global supply chains of almost all kinds of products including medical support systems, foods, drugs, automotive parts, textiles, etc. as lockdown inflicted in several countries where Coronavirus is spreading quickly. The government of several countries tries to re-establish the supply chain system for at least availing the healthcare support systems, medicines, foods, and other essentials. Still, there is a scarcity of life-saving commodities and their price hikes in several countries [7]. The people are afraid of losing their loved ones and unnecessary storing the essential items in large quantities. Therefore, it is the need of the present situation to create awareness among the common people, share information transparently, and utilize the modern supply chain concepts such as lean and agile supply chain [8]. At present, there are different challenges for researchers and companies to deal with, which are resisting the smooth operation of logistics and supply chain systems. In the present decades, the exploitation of agile manufacturing systems and agile supply chain systems are the key concerns during pandemic situations. To cogitate the furtherance in this field, a critical literature review has been carried out and found the research gaps.

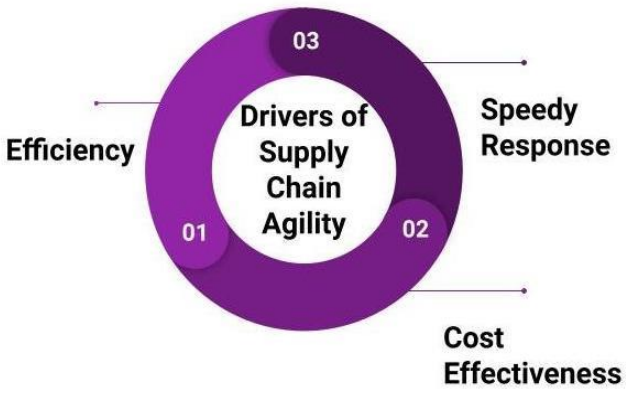

Fig 1: Drivers of supply chain agility.

II. LITERATURE REVIEW

Large numbers of research works had been published in the field of agile supply chain before the existence of the Covid-19 pandemic. The context of the previous literature was applied for developing new models and methods for further improvement in this field. The purpose of supply chain management has historically been informed by knowledge of narrow functional areas such as logistics, materials handling, distribution, and documentation of deliveries. Nagel & Dovein [1] recommended the use of automation technology to achieve agility in supply chain management. A significant increase in work published in this field has occurred between 2001 and 2011. Supply chain management continues to be largely eclectic with little consensus on its conceptualization and research methodological bases. Moreover, it has been identified works of literature on logistics and transportation capabilities and the various elements and dimensions that contribute to supply chain agility [9]. In today's competitive environment and pandemic situations, businesses are increasingly reliant on the relationships they have with their suppliers or buyers in a timely manner. The purpose of this paper through reviewing cross literature analyzes critical determinants of the agile supply chain and provides a new theoretical framework for underpinning and driving the supply chain agility [10]. Choi [11] identified that the supply chain disruption can be controlled and smoothen by efficient logistics systems. They have also supported the "bring-service- near-your-home" concept to deal with the disruptions due to Coronavirus. Mehrotra et al. [12] procreated demand scenarios based on the multi-period stochastic programming model for distribution of ventilators for COVID-19 patients. Ivanov et al. [13, 14] developed a plan of digital supply chain model to cope with the issues of supply chain disruptions during and post COVID-19. Shahed et al. [15] formulated a mathematical inventory model based on the renewal reward theory to diminish the risk of supply chain discontinuity. They also suggest agile supply chain networks. There is the utilization of optimization techniques to help the manufacturer for decisions making & maximizing the profit [16]. Sing et al. [17] worked up a simulation model for public distribution of foods and other essentials. They have identified a breach in the food supply chain due to COVID-19 and suggested that their simulation model assist in decision-making and procreate agile supply chain networks.

In this work, a critical review of published articles, books, and magazines has been carried out in the field of agile supply chain management and its applicability during the COVID-19 pandemic. Several authors have developed various empirical, mathematical, and simulation models on the concept of agile supply chain management but none of them has applied those models for efficient delivery and distribution of essential commodities during the COVID-19 pandemic. It is required to examine the influence of supply chain collaboration and flexibility in pandemic circumstances. It is also crucial to investigate the impact of supply chain agility on the smooth delivery of commodities in need of people. However, it has been found that very little research has been performed to apply the concept of agile supply chain management to deliver medicines, equipment, and essential items in a challenging pandemic situation.

III. METHODOLOGY

A. Supply Chain Agility

Agility refers to the effective and flexible accommodation of unique customer demands. The major role to impart an agile response is flexibility throughout the supply chain. In modern manufacturing, this could necessitate the capability to manufacture and supply in large or small batches, reducing the pain related to machines and product changeovers, often known as a critical component of lean manufacturing. Agility must also require flexible personnel with members cross-trained or capable to carry out a variety of jobs as directed by the demand condition during the COVID-19 pandemic. Product development and design would also reflect mitigated in the assembly that allows for quick transformation of materials from raw to finished good. Beyond the capabilities of the dedicated industries, the rest of the supply chain must be responsive as well for agile market accommo-dation. Moreover, the term short is used for feedback-related supply chains where fewer or no middle-man is allowed. The delivery and distribution could be located at appropriate places, and information sharing among the companies should be transparent and frequent. The fundamental elements of a supply chain are shown in figure 2. A well-known example of agile industry transformation is exercised by Dell in its direct-to-consumer business model. The computer maker holds inventories of component parts such as hard drives, processors, memory storage media, monitors, speakers, and a host of other supplies at each of the company's three assembly plants in the U.S.

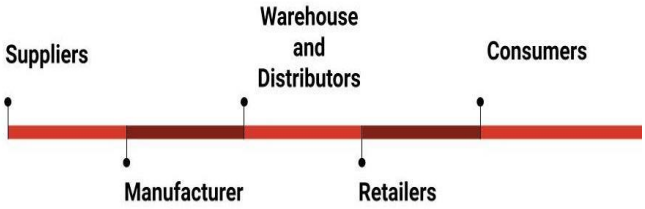

Fig 2: Fundamental elements of a supply chain.

B. Methodology for agile supply chain

The methodology for obtaining the agile supply chains during the circumstances of COVID-19 pandemic can be discussed under the following four viewpoints:

- Agile Planning
- Manufacturing and supply chain systems
- Utilization of technology
- Manpower planning

a) Agile Planning

A novel agile structure system needs to be developed for the COVID-19 pandemic based on the well-established architecture of supply chain systems. The context such as processes, control & monitoring, information, and data sharing, development, delivery, and distribution are primary elements of the architecture of agile manufacturing and supply chain systems. In the present portion, the strategically consummated structure of agility is explained. High-level integration of suppliers, manufacturers, distributors, retailers, and delivery personnel for each and every product is significant for supply chain management in pandemic conditions.

b) Manufacturing and Supply Chain Systems

The first pace of methodology of agility is to combine a designed route sheet, schedule, control, monitoring, and feedback system. Real-time monitoring of essential commodities from their production to end use is an important criterion for expedient development and implementation of an agile supply chain. Since the essential items are well-established products, there is no need to waste time in design and process planning. The production should be continued by using automatic machinery in less time and at minimum cost based on the demands during an emergency. The shop floor manager furnishes the items' requirements to the automatic machines. The manufacturer has knowledge about the functionality, process plans, capabilities, schedules, and tooling. Collaborating with suppliers or traders is a matter of concern and a traditional task in the agile supply chain rather than timely dispatching and delivery are complicated in dynamic market conditions. The parameters such as timely dispatching and delivery, location, quality of and quantity of essentials responsiveness, and costs, and online platforms should be considered primary during collaboration with partner companies during pandemics. The conventional way of collaboration will not work in emergency conditions like COVID-19.

c) Utilization of Technology

It is a crucial circumstance, when everyone should learn from Indian e-commerce giants such as Amazon, Flipkart, shopclues, Paytm mall, Zomato, swiggy, Jiomart, Domino's and many more how they are utilizing the modem technologies such as internet, robots, automation in materials handling, drones, artificial intelligence, and machine learning, IoT, etc. How do they manage their physical resources and manpower to achieve agility and high-level flexibility? In this pandemic, Government and private sectors should utilize these advanced techniques and managerial concepts effectively and expeditely. Agility in the supply chain can also be augmented by the use of these appropriately integrated technologies.

d) Manpower planning

Manpower is the crucial factor for acquiring agility in the supply chain and logistics for loading, unloading, and distribution of products. Several authors have found that it is hard to organize and directs people towards flexibility in supply chain and logistics. Manpower planning significantly influences the decisiveness and ideas of obtaining agile supply chain systems. Many authors suggested that there should be openness and transparency to sharing information from top management to bottom and vice-versa in a speedy growing agile environment. In COVID-19 circumstances, novel challenges have occurred for HR managers as the deadly coronavirus spreads from person to person who is working together without maintaining social distancing. So many personnel are in fear of getting affected by COVID-19; therefore, they refuse to work in a flexible environment. It is very difficult to encourage people to join their duties on time and work efficiently. This scenario originates & new research challenges for industries and academia.

IV. DISCUSSION AND DISSEMINATION

A. Agile Supply Chain

Basically, the agile supply chain is referred to the concept of responsiveness, competency, flexibility, and quickness to manage a supply chain entity that operates on a daily basis. The benefit of Agility in the supply chain is to focus on avoiding quick shortages and eliminating excessive stocked inventory. 1. The concept of the agile supply chain is first built by Dr. Fisher’s which works with efficient and responsive supply chain strategies. 2. That involves Conditions of demand uncertainty and implicitly of stable characteristics. 3. After Dr. Fisher’s concept of an agile supply chain is described that supply uncertainty also needs

to be considered for varying conditions of the supply chain. 4. Focusing on the Agile supply chain there should be high demand uncertainty and supply uncertainty which means high responsiveness and risk-hedging.

B. Agile Supply Chain Strategy involves

1. Relationships 2. Sensitivity 3. Processes 4. Information 5. Flexibility

In a complex covid-19 situation, the supply chain management plays a crucial role and due to this pandemic, there are lots of failures of this process: 1) missing documentation, 2) late for damage shipment, 3) quality issues, and 4) ingredient shortages. Due to these kinds of failures, new challenges occur in front of industries which is something extraordinary and unexpected that's why we should have the ability to identify, track and manage issues anywhere in the supply chain. To improve the way of supply chain management Agile supply chain is used which basically focuses on being responsive and flexible towards customer changing needs while in disruption risks. The goal of agile supply chain management is to quickly respond to changing supply and demand conditions. The essential components of agile supply chain are shown in figure 3.

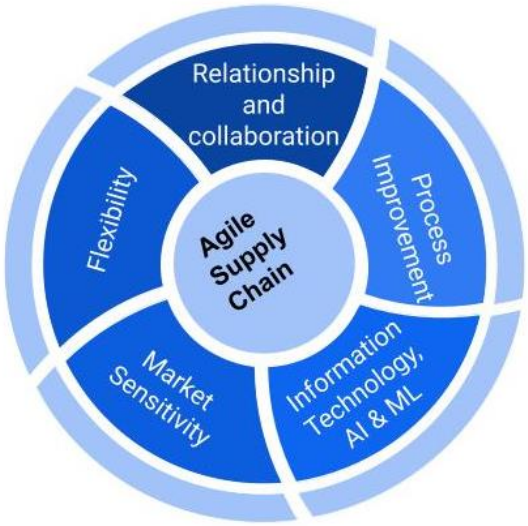

Fig 3: Essential components of agile supply chain.

C. Five dimensions of the agile supply chain

The five dimensions of the agile supply chain suggested by Gligor et al.[9, 10] his article are alertness, accessibility, decisiveness, swiftness, and flexibility. These dimensions are sequential and mandatory criteria to obtain an agile supply chain in any industry & Government organization. The intended zone of agility will be consummated by effectuating these five capabilities in their organizations for supply chain management in normal conditions as well as COVID-19 pandemics. These five dimensions of the agile supply chain are illustrated in figure 4.

a) Alertness

When we start discussing the dimensions of agility in the supply chain, alertness comes first. The alertness is the characteristic of being attentive in all conditions similar to what happens in sports and the military. The sportsperson and army men are always alert when they are on duty in the battleground. In the case of the COVID-19 pandemic, the Government entities and private sectors which are involved in supply chains of essential commodities should be alert when coronavirus is surging rapidly and different waves are about to attack the people of the various country. The Government authorities also need to be alert for stopping the perfidious black marketing of life-saving drugs and equipment, foods, and other important things.

b) Accessibility

Accessibility is the quality of using the information right away to study the data concerned with an event. In another word, it is the approachability towards facts based on the relevant data. In a pandemic situation, it is imperative to present the related data about the number of active COVID patients, medications, foods, and health care equipment required for them, the time required to deliver these items to respective places, so that the government executives can coordinate and makes plans for delivery of commodities at right places and distribute it at right time.

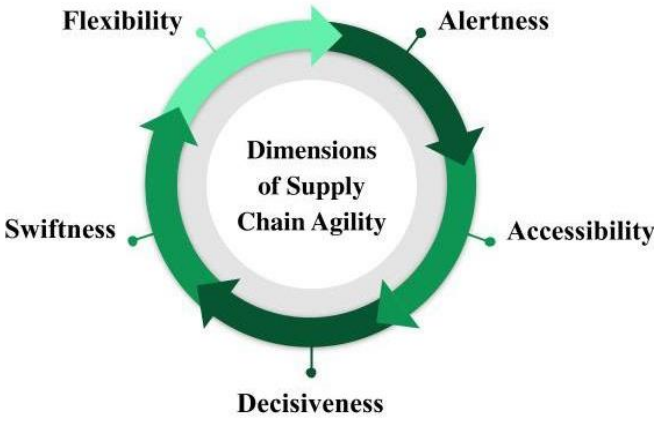

Fig 4: The five dimensions of the agile supply chain.

c) Decisiveness

Decisiveness is the third dimension of supply agility which is one of the crucial dimensions. It is the potential to decide to execute the plans firmly based on the accessed data and facilities available. Decisiveness plays a crucial role in emergency circumstances like the COVID-19 pandemic as it is the question of life and death. The decision-making time should be as minimum as possible to attain agility in the supply chain during pandemics. In several countries, it was a challenging question of who will and how will make decisions regarding lockdowns and supply of commodities to the people who are in need.

d) Swiftness

Swiftness deals with the proper action decided during the decisiveness phase and the implementation required coping up with changes. The swiftness is the criterion on which the agility relied. For example, as soon as the decision is made to increase the production of medicines and smooth its delivery, all the stakeholders should work hard to achieve the production rate decided. They should be capable of speedily pursuing the new transitions such as new machines, raw materials, required to accommodate the changes that occurred due to pandemics thereby agility can be obtained in supply chains. It is a prerequisite to expediting all the activities necessary for increasing the production as well as delivery of life-saving drugs, equipment, and significant groceries.

e) Flexibility

To completely actualize the agility in supply chain flexibility is the important dimension. Flexibility is the changeability in materials and machines within a specified limit. It is a versatility of manpower to accomplish different tasks for the fulfillment of organizational objectives. As far as the CAVID-19 pandemic is concerned. flexibility in manufacturing and supply chain is a means of framing the agility. The pharmaceutical company manufacturing traditional drugs should be flexible to manufacture drugs for the treatment of COVID-19 patients. Textile factories should be flexible with present circumstances to produce masks and personal protective gowns for people. The steel plants, which are traditionally producing Oxygen gas for metallurgical work, should be flexible and they have delivered medical Oxygen gas to hospitals for COVID-19 patients. With the proper attention and utilization of these five dimensions of supply chain agility, Government entities and private sectors all over the world can mitigate the influence of COVID-19 as minimal as possible, and thereby we can win the war against the uninvited evil.

V. CONCLUSIONS

In the COVID-19 pandemic and lockdown circumstances, the success of delivery and public distribution of essential goods depends on efficacious management and advancement of the supply chain system by utilizing supply chain concepts. To end the dependency on imports from other countries, Indian Government entities and private companies had to develop a framework based on the lean and agile manufacturing concepts. Several authors and researchers are suggesting that India has to establish its supply networks and delivery systems by implementing the lean and agile supply chain concepts thereby it will be capable to deal with pandemics like COVID-19 in the future. It is believed that the suggestions given in this article will assist the organizations to re-establish their supply chain strategies and re-direct their workforce to deal with the pandemic environment and survive in the long run.

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