
Risk Management in Supply Chain Management and Operations

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ABSTRACT

The modern day supply chain management is a complex one, which has a lot do with operations management in the area of potential disruptions due to vulnerability to risks. The objective of this paper is to discuss risk management from the standpoint of supply chain and operations. Supply chain network theory forms the theoretical framework of the paper. The applicability of the theory is that it describes holistically the various agents and elements that relate in the supply chain and operations management. The paper relies on secondary data collected from content and documentary evidences in literature. Finding of the paper shows that there are various risks that can potentially affect supply chain management. The risks include but not limited to financial risk, suppliers risk, strategic risk, transportation and storage risks, and human resources. From the standpoint of the risk management processes in supply chain and operations management, further finding indicate that three-step process of risk identification/documentation, risk assessment and risk mitigation are available. One of the recommendations of the paper is that organisations that are into supply chain and management and operations should develop and apply proactive strategies in managing potential disruptions that may result due to vulnerabilities inherent in the ever complex activities in the supply chain and operations management.

Keywords: Risk, Risk Management, Supply Chain, Supply Chain Management, Operations, Operations Management.

1. INTRODUCTION

Traditionally, risk in supply chain management (SCM) focused attention on the flow of raw materials and finished products. But modern day supply chain management includes the flow of financial and information, which has widened the issue of risk in supply chain management. This has broadened the scope of risk management to include not just supply chain management but also operations aspect of it (Musa, 2012). Ahmed (2023) observes that supply chain management has been extended and more complex therefore, increasing the anticipation of risks and proffering more approaches to eliminating the risks. This has increased the stakes which has brought about nearly three-fourths of companies experienced significant disruptions. Rodriguez (2023) submits that supply chain management has received top attention among organization in procurement, which has triggered loss of millions in supply chain disruption, cost volatility, non-compliance fines and incidents that cause damage to both: the organizational brand and reputation.

One of the core elements of supply chain management is operations. The evolution of operations in supply chain management is historical from the amazing production feats from the pyramids of Egypt, the Great Wall of China to the Industrial revolution in the 1700s in Europe (Russell & Taylor, 2011). Supply Chain Junction (2023) asserts that operations in supply chain management helps to have accurate, real-time representation of inventory and production schedules that assist to monitor production output and forecast production and distribution patterns.

Russell and Taylor (2011, p. 2) outline the activities involved in operations to include “organizing work, selecting processes, arranging layouts, locating facilities, designing jobs, measuring performance, controlling quality, scheduling work, managing inventory, and planning production.” The relationship between supply chain management and operations management cannot be over explained. This is because according to Nagurney (2006, p. 43), “supply chains are the critical infrastructure for the production, distribution, and consumption of goods as well as services in our globalized Network Economy.” Strategically, operations and supply management tries to put in place policies and plan broad enough to use the resources of an organization and integrate its corporate objective. The focus of operations and supply in this wise is to enjoy strategic operations that is effective. And for operations to be effective it requires that the organization must focus attention on its core business processes, which cut across various functions such as taking customers’ orders, handling returns, manufacturing, and managing the updating of the website, to shipping products (Jacobs & Chaseu, 2018).

The objective of this paper is to discuss the place of risk management in supply chain management and operations. This was motivated by the fact that, to understand holistically the disruptions that happen in supply chain management, one must incorporate operations. This is predicated on the fact that according to Nagurney (2006), modern operation management encompasses formulating, analyzing, and managing supply chains. And to be able to understand comprehensively the scope of operations and operations management, supply chain cannot be isolated due to the relationships and interaction that exist between theories and practice of operations management and in supply chain management. The central concern of operations management is to improve processes while supply chain concentrates on how to use and advance theory, tools, and practice for operations across organizations.

2. METHODS

The research methods for this paper include the use of secondary data, descriptive and historical analysis of data based on their content and documentary evidences. It is purely based on quantitative research with no statistical presentation.

3 THEORETICAL UNDERPINNING

Supply chain network theory forms the theoretical understanding of the paper. Network theory was first applied to supply chain in the 1970s and the 1980s to explain the relationships between just two entities, or strategic alliances, towards an approach which entails multiple relationships between different counterparts throughout the supply chain (Wellenbrock, 2013). “Network is a specific type of relation that links a defined set of persons, objects or events” (Harland, 1996, p. 67).

From the perspective of supply chain, Chang, Chiang and Pai (2012, p. 114) state that “the supply chain network is a complicated network model, and its specific context depends on the relationships among the network members.” The network according to Thorelli (1989, p. 37) is “two or more organisations get involved in long-term relationships. Supply chain network theory explains the relationships between organisations that operate within the same supply chain. The concept of network in supply chain looks at the strategic alliance that exists between two organisations considering the various counterparts within a supply chain network, suppliers, other organization, buyers, customer and manufacturers in the network (Wellenbrock, 2013).

Supply chain networks according to Ostrovsky (2008), is made up of a structure with various agents who interact. These agents are workers, producers, distributors, retailers, and so on. Some agents supply basic inputs for the industry and do not consume any of the outputs. For example, wheat farmers are the suppliers of basic inputs to millers, while the millers supply semi-finished material to bakers, who supply to the retailers, and finally the retailers supply to the consumers. This is the chain that forms the network.

The network of agents in the supply chain in another instance continues according to Ostrovsky (2008, p. 898) as:

Some agents purchase the final outputs of the industry (e.g., car manufacturers are the consumers of final goods in an “iron ore supplier to steel producer to steel consumer” supply chain). The rest are intermediaries, who get their inputs from some agents in the industry, convert them into outputs at a cost, and sell the outputs to some other agents (e.g., millers, bakers, and steel producers are intermediate agents in the examples above).

4 CONCEPTUAL EXPLANATIONS

4.1 Risk

Risk is an uncertainty potential harm that may occur in future due to certain present action. A risk is a potential future harm that may arise from some present action (Wikipedia, 2004). The risk can occur on operations and at the same time be disruptive, and most time operation and disruptive risk may not be differentiated (Tang, 2006). According to Christopher and Lee (2004, p. 389), risk is external effect events, which may result due to “wars, strikes or terrorist attacks and impact of changes in business strategy”. However, Spekman and Davis (2004) argue that risk can be either objective or subjective. Chopra and Sodhi (2004, p. 62) enumerate nine different types of risk such as disruptions, delays, systems, forecast, intellectual property, procurement, receivables, inventory and capacity.

4.2 Risk Management

Risk management in the opinion of Boehm (1989) has to do with the several steps taken in order to identify, address, and eliminate potential risks before they become threats to successful to the success of organisation (Boehm, 1989). To this effect, Williams (2004, p. 1) identifies identification, analysis, prioritization, planning, mitigation, monitoring, and communication as the risk management practice.

Risk management is a process that involves integration of particular risks and also developing all-encompassing plan on how to integrate the plan and at the same time, conducting evaluation of the risks (Gupta, 2016). Risk management is “the process devoted to protecting the organization and augmenting its capability to achieve its stated strategic objectives” (Borghesi & Gaudenzi, 2013, p. 117).

4.3 Supply Chain

Supply chain (SC) in the view of Ivanov, Tsipoulanidis and Schönberger (2017) is a complex nature of an organization that involves the process of network of activities that has to do with suppliers of raw materials, manufacturers, distributors and retailers. The network of activities in supply chain is to see that raw materials move from the suppliers to the organization’s manufacture unit (this involves input-processing-output mechanism), and delivery of these final finished or semi-finished products to the customers.

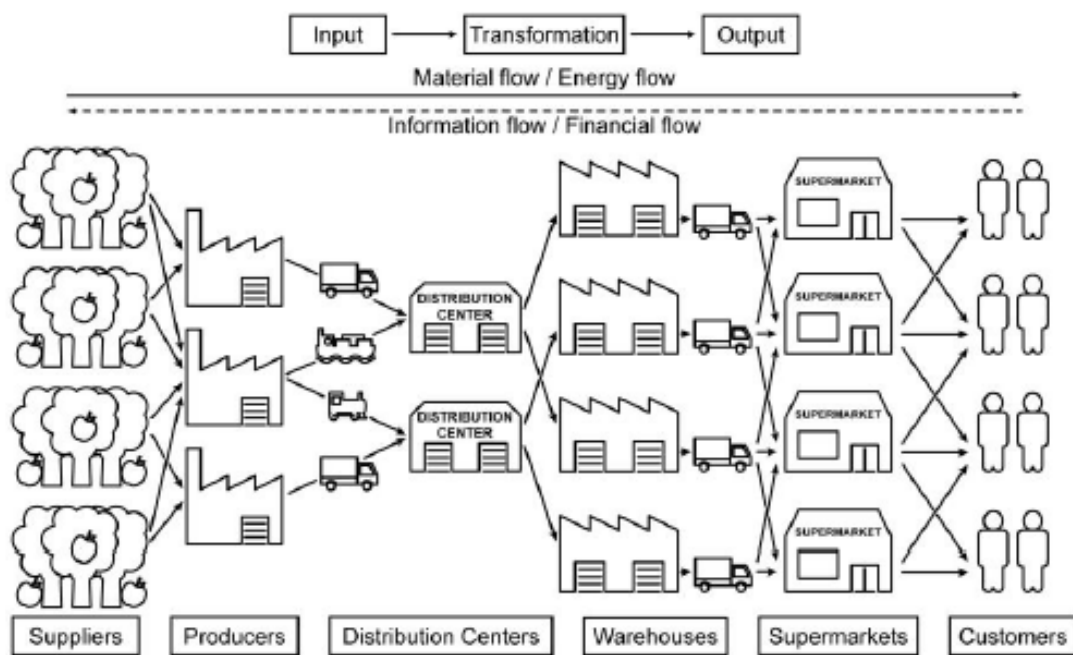


Figure 1: Supply chain

Source: Adopted from Ivanov et al. (2017).

4.4 Supply Chain Management

Supply chain management has been defined by Ivanov et al. (2017) as an integration and coordination of materials, information and financial that flow across departments and enterprises for the purpose of transforming them into value chain that starts with the material suppliers to customers. The APICS Dictionary, 13th edition, defines supply chain management as “the design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand, and measuring

performance globally.” Supply chain management is important in that it is critical components of any firm to balance its demand and supply that helps to achieve value chain in the entire system (Ivanov et al., 2017). According to Russell and Taylor (2011, p. 27), supply chain management is “managing the flow of information, products, and services across a network of customers, enterprises, and supply chain partners.”

Ritchie and Brindley (2001, p. 25) define supply chain management as “the management of material, information and financial flows through a network of organizations (i.e., suppliers, manufacturers, logistics providers, wholesalers/distributors, retailers) that aims to produce and deliver products or services for the consumers.” Tang (2006) identifies five issues that are interrelated in supplier in supply chain, which include supplier network design, supplier relationship, supplier selection process, supplier order allocation, and supply contract.

4.5 Operations Management

Operations management is the process of transforming raw materials as inputs to produce final product. The inputs include material, machines, labor, management, and capital) are transformed into outputs, which may be goods and services (Russell & Taylor, 2011). APICS1 defines operations management as the planning, scheduling, and control of the activities that transform inputs into finished goods and services. In line with this definition Walden (2021, p. 3) emphasis that among all the activities of every organization, operations management is central because it encompasses all that has to do with the “planning, design, production, sourcing, supply chain operations, customer service, and even the return of products that do not meet the needs of the customers.”

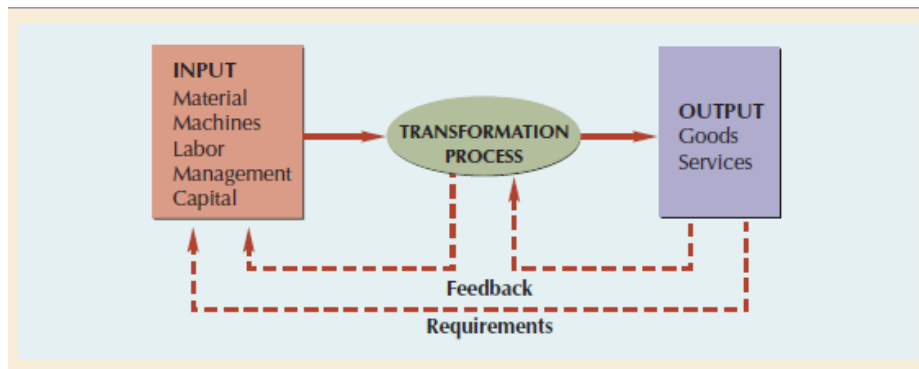


Figure 2: The Operations Function

Source: Russell & Taylor (2011).

Nagurney (2012, p. 7) defines operations management as “the design, improvement, and the management of the transformation processes that create value by converting inputs, such as raw materials, labor, and/or customers into outputs, such as goods or services.” The central purpose of operation management is to create value. Therefore, value creation is the core role of operations through the process of transformation that include a series of activities along a value chain extending from supplier to the manufacturer and to the customers (Russell & Taylor, 2011).

4.6 Operations and Supply Chain Strategy

Strategy in operations and supply chain entails setting all-encompassing plan and policies in the use of use the available resources of an organization through an integration of corporate strategy with the central objective to achieve effective operations (Jacobs & Chaseu, 2018).

4.7 Supply Chain Risk Management

Risk in supply chain management is defined as the likelihood that there will be disruption that will affect the ability of the organization not to have a continuous supply of goods and services. The disruption is not planned and anticipated activities that disrupt the regular supply and flow of materials and goods along the supply chain. The risk exposes the organization to operational and financial risks (Jacobs & Chaseu, 2018). Supply chain risk appraisal process according to Zurich Insurance Company (2010, p. 59) helps organisation “to make strategic decisions and operational plans to reduce the quantity of supply chain defects.”

There is growing number of works in literature on supply chain risks management that have outlined disruption that range from economic and political instabilities. These disruptions have also come inform of precariousness of market changes and natural disasters both human and man-made. These have a new trend in the supply chain operations (Norrman & Jansson, 2004; Berger, Gerstenfeld & Zeng, 2004; Christopher & Lee, 2004; LaLonde, 2004; Quinn, 2006; Tang, 2006; Poirier, Swink & Quinn, 2007).

4.8 Operations Risk

Operational risks in supply chain management are the type of risk that is related to such issue as supply disruption, price variability and product quality. Operational risks affect supply chain in the areas of accidental issues, temporary suspension of vehicles, improper personal, defective materials etc. (Kundu, n.d.). In another instance, Litov and Yeung (2005, p. 26) give example of operational risks to include those that result “from unsuccessful processes or a few equipment, inefficient employees and systems in external accidents, damages are brought about from processes, improper personnel and defective systems or accidents due to the companies outside factors are those to be mentioned.” Ahmed (2023) explains that operational risks in supply chain are internal in nature and can cause disruptions. If not controlled or maintained can bring about knock on the supply chain, which may also cause machine breakdowns or production problems.

5 EMPIRICAL REVIEW OF LITERATURE

5.1 Types of Risk in Supply Chain Management

There are some risks that are involved in supply chain management and operations, which some of them are discussed herein.

5.1.1 Financial Risk

Financial risk occurs as a result of financial crisis as the situation becomes worse that it affects the marginal profit cannot be recovered (Kundu, n.d.). Shenkir (2007) explains that financial risk in supply chain management and operations is when an organization does not have enough money to carry out its financial obligations. Rodriguez (2023) and Pranjali (2023) state that financial risk in supply chain management occurs due to fluctuation of the exchange rate, which always causes budget overruns, price volatility, commodity risk, low profit margins, and credit risk that adversely, affect the volume of raw materials from suppliers and cost of finished products. In some cases it leads to suppliers’ bankruptcy.

5.1.2 Supplier Risk

Supplier risk in supply chain comes inform of dependency on other firms for supply of raw materials when the depended firm goes bankrupt that makes it not to deliver the right quantity of certain product on time (Ahmed, 2023).

5.1.3 Strategic Risk

This is the type of risk in supply chain management that is subject to organisation's strategic target and advance whereby the profit is tied to the present and future of the organization, especially as the organisation tries to fix its resources are against business strategies. This will course strategic risks to appear (Brannan, 2007). According to Fitzgerald (2023), strategic risk in supply chain management happen when there are changes in technology, personnel and certain events that would affect an organization business strategy or objectives. A good example of this is when suppliers operation could not be in line with the organization's objectives and security requirements.

5.1.4 Transportation and Storage Risks

For supply chain to be complete there must movement of materials and humans from point to another, which is the work of logistics through a transportation system. This essence of this is to optimise product's shipment and distribution. Risk occurs when there is disruption in delivery- either non-delivery or late delivery due to failure in transportation system brought about by vehicle shortage or breakdown. Concerning storage risk in supply chain, produced warehoused may get damaged, spoilt or stolen, which can affect the entire supply chain management especially in the area of inventory (Pranjal, 2023).

5.1.5 Human resources risk

This is supply chain management risk that result from human resource activities. This type of risk according to Erven (2007) is in two types namely: first, lack of trained personnel when an organization wants to apply programmes that have to do with the management; and second, unexpected accident that occur when an organization tries to apply strategy that connects with risk that involves intelligence. Rodriguez (2023) is of the view that lack of human resources in supply chain happens when key staff are not available from the process. One of the reason for this can be that the key staff are either sick or holidaying, which makes supply chain not work to work optimally.

5.1.6 Technological risk

According to Adam et al. (2005), risk in supply chain is technical when it occurs when the potential uncertainty happens in the organisation's information system, process automation, and projects reimbursement. This type of supply chain risk is identified when the role of shareholders is misunderstood.

5.1.7 Fame (reputational) risk

Fame risk in supply chain management happens when an organisation's fame or reputation is in doubt as its earnings and capital from various financial firms and commercial beneficiaries are not in a good shape (Fiorino, 1989). According to Rodriguez (2023) reputational risk in supply chain happens when the unethical practices by external stakeholders, which affects the perception of the shareholder. This usually leads to loss in demand, moral and investment.

5.1.8 Legal risk

This can also called contractual risk, which occurs due to disputes or conflicting interpretation of contractual obligations or failure to comply with the terms and condition. The violation or breach of the terms and conditions between the suppliers and the organization sometimes lead to civil and criminal lawsuits (Rodriguez, 2023; Pranjal, 2023).

5.1.9 Environmental risk

In the process of sourcing raw materials, environmental risks come as the organisation's negative impact on water, air, and soil. These risks are products of discharge, emissions and other types of waste that are hazardous (Rodriguez, 2023; Ahmed, 2023). Ahmed (2023)

further outlines two other ways environment risk can occur in supply chain management, which include, first, extreme weather and natural disaster like earthquakes, floods, and severe hot and cold temperatures can all hamper the movement of goods through the supply chain, shutting down operations. The second way environmental risks affect supply chain is when worker are exposed to dust, gases, radiation, loud noise, and toxins such as lead, mercury, arsenic, etc., can result in various ailments and eventually result in the suspension of operations.

5.1.10 Cyber security risk

Cybersecurity risk happens in supply chain management when there is suspicion by suppliers that there would be cyber-attack due to lose of data. “Cybersecurity risks include ransomware attacks, malware, phishing, denial-of-service attacks, counterfeit file sharing, and even insider threats, to name a few” (Fitzgerald, 2023, p. 1). Speaking in the same vein, Pranjali (2023) observes that cyber security risk happens when the Internet of Things (IoT) and other digital technologies are exposed to threats as malware, ransomware, phishing, and hacking, which, cause damages in modern day supply chain management.

5.2 Risk Management Processes in Supply Chain and Operations Management

In order to manage risk in supply chain and operations management, there are some step-processes that are available when the disruptions are possible (Jacobs & Chaseu, 2018). There are various approaches in risk management processes in literature. For the purpose of this paper, three step-process approaches have been discussed in this section, which include risk identification/documentation, risk assessment and risk mitigation.

5.2.1 Risk Identification and Documentation

The first step in the process of managing risk in supply chain management is to identify and document the potential risks. This involves identifying the sources of the risk, its impact and potential consequences (University of Adelaide, n.d.). Fitzgerald (2023) is of the opinion that identification of potential risk that could impact negatively on supply chain management would help to measure and manage the risk on time and over time. Rodriguez (2023) and Fitzgerald (2023) explain that the potential risks in supply chain management that should be identified and documented in a risk register include “natural disasters, geopolitical issues, supplier failures, demand fluctuations, technological disruptions, and regulatory changes, capacity failures, infrastructure failures such as air traffic system, terrorists, supplier failures, labour actions, equipment failures, commodity price volatility, and military/ civil conflict.

In line with ISO 31000 (2009), Borghesi and Gaudenzi, B. (2013) state the key aim of risk identification is to:

Generate a comprehensive list of risks based on those events that might create, enhance, prevent, degrade, accelerate, or delay the achievement of objectives. It is important to identify the risks associated with not pursuing an opportunity. Comprehensive identification is critical, because a risk that is not identified at this stage will not be included in further analysis (p. 43).

Hall (2008) and Franco-Santos et al. (2007) outline the four stages in risk identification to include: identification of the unfavorable event, analysis of the hazards associated with the event, analysis of related contingencies, and identification of the types of effects stemming from the event. Borghesi and Gaudenzi (2013, p. 44) further state that “the scope of risk identification is to build a template for recording appropriate information about each risk.”

5.2.2 Risk Analysis and Assessment

The second step-process in the management of risks in supply chain management is assessment. The assessment is carried out to determine the potential impact of the risks. The risk may assess to determine and evaluate their financial and environmental impacts, its impact on the ongoing business viability, brand image/reputation, potential human lives, and so on (Rodriguez, 2023). The essence of risk analysis and assessment is to develop a detailed understanding of the risk (University of Adelaide, n.d.). “Each risk should be assessed based on its probability and potential impact. This will allow you to identify the products and supply chain nodes with the greatest risk or failure potential and prioritize resources to manage them accordingly” (Borghesi & Gaudenzi, 2013).

Risk analysis helps in transforming the risks that were identified for decision-making purpose, and can be achieved by first, assessing the probability of a loss occurring, and second, assessing the impact of the loss if the loss were to occur (Williams, 2004). For the purpose of understanding the supply chain management cost and performance implication of the potential risk, Borghesi and Gaudenzi (2013, p. 53) further states that “risk analysis supports managers in understanding the negative impacts of adverse events (in terms of costs or underperformance) and likelihood of negative consequences.”

5.2.3 Risk Mitigation Strategy

The next step in the risk management process is to develop mitigation strategy. Such strategy includes diversifying suppliers than relying on a particular one. Mitigation strategy also entails creating redundancy in critical processes, and developing contingency plans if a disaster occurs (Fitzgerald, 2023). There is no particular mitigation strategy to be applied; it is dependent on the nature of the risk identified and the expected impact on supply chain management.

The essence of risk mitigation as a strategy in management risk in supply chain management is to reduce the possibility or the loss impact of a risk. Risk mitigation produces a situation in which the risk items are eliminated or otherwise resolved. The risk mitigation strategies include risk avoidance that helps the supply chain team to develop a product or a specific risky feature, and risk protection that comes inform of insurance to cover any financial loss that may arise if the risk becomes a reality (Hall, 2008).

6 CONCLUSION AND RECOMMENDATIONS

Risks in supply chain management and operations are inherent considering the volume of activities is related in the whole system. The concern is not how organisations would not have the risks but more importantly, how organization would manage the risks and still remain focused to achieve its supply chain management and operations objectives. As observed by Ahmed (2023), it is important to understand which of the risk in supply chain can hurt most. However, effective supply chain risk management implementation is a difficult one and therefor requires the collaborative efforts of various agents in the system.

It is on this note that Pranjal (2023) explains that supply chain risk to any disruption in the normal course of business can come inform of financial risks, legal risks, environmental risks, cyber risks, and so on. And the failure to identify and analysis them would some difficult in mitigating them.

On the basis of the findings of the paper on the various supply chain risks, the paper therefore makes the following recommendations:

- i. For effective supply chain risk management, supply chain and operations managers need to know the enabling factors and their relative importance, hence, keeping an eye on the supply chain risk in order to mitigate them when they happen (Pranjal, 2023).
- ii. In order to identify, assess and mitigate environmental risk in supply chain, it is recommended that there should be good communication system to ensure that observations of the disruption are accurately identified and documented to ensure that all procurement contracts have clause of Force Majeure (Ahmed, 2023).
- iii. It is further recommended that organisations that are into supply chain management and operations should develop and apply proactive strategies in managing potential disruptions that may result due to vulnerabilities inherent in the ever complex activities in the supply chain and operations management.

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