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Supply Chain Using Risk Management

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Abstract :

Supply chain risk management plays a crucial role in identifying and overseeing potential threats that could impact the continuous operation and profitability of a supply chain. These threats encompass various factors such as significant cost fluctuations, material shortages, financial instability among suppliers, and the occurrence of natural disasters. To mitigate vulnerability, supply chain risk management engages stakeholders in a collaborative effort to comprehensively identify and analyze risks. It employs strategic approaches to both identify and assess risks within the supply chain.

Numerous practices have emerged to eliminate or minimize risks in the supply chain. One effective method involves automating the supplier risk management process to streamline the collection and management of supplier information. In this context, it is imperative to incorporate supplier performance metrics when analyzing financial issues. Additionally, leveraging technology for early problem identification becomes crucial. The utilization of software for e-sourcing, purchase-to-pay contract management, and the provision of dashboards for monitoring supply risk metrics are essential components of a robust risk management strategy.

The primary objective behind these initiatives is to proactively avoid potential risks that may adversely affect an organization. Strategies for early detection of risks are implemented, supported by the integration of counterpart measures necessary for ensuring a risk-free supply chain management. The achievement of these objectives relies on effective coordination and communication with stakeholders within an organization. By fostering collaboration and maintaining open lines of communication, supply chain risk management becomes a dynamic and proactive process aimed at safeguarding the overall stability and resilience of the supply chain.

Supply Chain Management :

Supply Chain Risk Management (SCRM) is widely acknowledged by both scholars and practitioners as a crucial facilitator that not only enhances company performance but also contributes to achieving a competitive advantage. The evolving business landscape since the early 1990s has witnessed intensified competition, compelling companies to undertake significant enhancements in their products and services.

This heightened competition has ushered in an era of increased uncertainty, necessitating companies to allocate resources for anticipating internal uncertainties, as well as fluctuations in supply and demand, to ensure the sustainability of their supply chains.

The rise in uncertainty is not solely a consequence of external business environments; rather, it is exacerbated by the intricate mechanisms and complex structures within the business supply chain. The prevalent trend of outsourcing activities to external entities has introduced new sources of uncertainty. For instance, relying on external parties for inbound logistics activities can lead to delays in the delivery of raw materials. Furthermore, the reduction in the supply base has exposed some companies to heightened risks.

Throughout the evolution of supply chain risk management, uncertainty and risk have consistently been recognized as critical issues. Early literature often framed risk in terms of demand volatility, price uncertainty, and time reliability, necessitating the implementation of hedging strategies, various contractual agreements, order splitting with suppliers, inventory pooling, and maintaining safety stock. The growing complexity of supply chains, particularly with the involvement of international contract suppliers and manufacturers, has propelled the increasing popularity of supply chain risk management.

In the contemporary business landscape, effective supply chain risk management is not just advisable; it is imperative. Companies like Nokia and Ericsson serve as noteworthy examples, having long realized the significance of implementing robust supply chain risk management practices in their operations. These companies exemplify the proactive approach needed to navigate the challenges of an uncertain business environment, emphasizing the importance of anticipating, assessing, and mitigating risks within the supply chain for sustained success.

Literature Review

Definitions of Risk

The literature on risk management offers diverse perspectives on the definitions of risk and vulnerability, with various scholars contributing to the understanding of these concepts. The study of risk dates back to the seventeenth century, and the probability theory, which is a fundamental method in contemporary risk management, emerged during this period. Several research papers have addressed the definitions of risk and vulnerability.

According to Manuj and Mentzer (2008), vulnerability is characterized as an event that is challenging to predict regarding its possible outcome. On the other hand, risk comprises three components: the likelihood

of losses, the probability of those losses occurring, and the significance of the resulting losses. Khan and Burnes (2007) have differentiated risk and vulnerability by asserting that risk can be measured and evaluated in terms of the likelihood of an outcome, while vulnerability cannot be assessed. Norrman and Jansson (2004) suggest that risk can be assessed by determining the likelihood of the occurrence of the primary event and measuring the outcome of that event.

Tang and Musa (2010) emphasize the importance of considering the impact outcome of risk and the anticipation of sources of risk as essential themes for examination. Merna and Al-Thani (2008) explain risk and vulnerability as decisions about risk being made if the outcome can be evaluated for both plausibility and likelihood. In contrast, vulnerability is defined when there are various possible outcomes, but the likelihood of each individual outcome cannot be assessed.

Building upon their research on "Global supply chain risk management strategies," Manuj and Mentzer (2008) refine the concept of risk by defining it as the potential losses that can be evaluated in terms of their probability. The significance of the outcome should also be assessed for effective risk mitigation. Therefore, for the purpose of this study, risk is defined as the potential for losses that can be evaluated in terms of their probability, and the significance of the outcome should be assessed for further risk mitigation.

Risk Management

Supply Chain Risk Management (SCRM) involves the actions taken by organizations to mitigate risks that may arise within their operations. This process includes identifying risks, assessing the likelihood and severity of potential events, deciding on measures to mitigate these risks, and implementing the chosen actions. Tang (2006) outlined four fundamental strategies that organizations can employ during coordination in their supply chains: supply management, demand management, product management, and information management.

The entire supply chain, from the sourcing of materials to the delivery of products to end-users, is susceptible to various risks. These risks can manifest both internally and externally within the supply chain. Major risk factors include supply risk, operational risk, financial risk, demand risk, information risk, financial crises, changes in government regulations, labor issues, natural and man-made disasters, and other unforeseen challenges. Numerous studies delve into risk assessment and the impact of these risks across different supply chains.

For example, Liangrokapart (2012) examined the case of disruptions in the hospital supply chain in Thailand. Raka and Liangrokapart (2013) provided insights into the risks present in the pharmaceutical supply chain. In a study by Blos et al. (2009) focusing on the automotive and electronic industries in Brazil, four vulnerabilities in the supply chains were identified: financial vulnerability, strategic vulnerability, hazard vulnerability, and operations vulnerability.

These studies highlight the multidimensional nature of risks in supply chains, emphasizing the need for a comprehensive approach to risk management. By understanding and addressing various risk factors, organizations can enhance their resilience and better navigate the complexities inherent in supply chain operations.

Various scholars have categorized supply chain risks differently, reflecting the multifaceted nature of risks within the business environment. Vilko and Hallikas (2012) identified six classifications of risks: supply risks, operational risks, security risks, macro risks, strategy risks, and natural risks. On the other hand, Manuj and Mentzer (2008) outlined eight groups of risks: supply risks, operational risks, demand risks, security risks, macro risks, strategy risks, competitive risks, and resource risks. It's worth noting that the first four categories align closely with supply chain considerations.

Another perspective comes from Olson and Wu (2010), who classified risks into two broad groups: internal and external. Internal risks encompass factors such as the organizational culture, political system, competitors, and market dynamics. External risks, on the other hand, include considerations like available capacity, internal operations, and information systems.

Ritchie and Brindley (2007) offered a structured framework for supply chain risk management. They suggested that risks within the supply chain originate from specific factors, including environmental, technological, organizational, issue-specific, and leadership-related factors. These factors not only influence risks in terms of being precise and unsystematic but also impact potential performance outcomes.

These diverse classifications underscore the importance of a comprehensive understanding of risks in the supply chain. By considering various dimensions and perspectives, organizations can develop more robust risk management strategies that address the complexities and uncertainties inherent in the supply chain environment.

The fresh produce supply chain in Thailand is a burgeoning industry that involves a series of stages starting from farmers or cultivators who cultivate a variety of products. Subsequently, these products are harvested, packed in various types of packaging, and then sold to local or regional wholesale markets. Many of these products are distributed through intermediaries or agents and transported to wholesale markets and processing plants. Processed goods are then distributed to local retail outlets and also exported overseas.

Lertrat et al. (2008) conducted a study on the supply chain management for fresh vegetables in Nakornprathom province, Thailand. The study identified stakeholders in the supply chain from upstream to downstream, including farmers or producers (upstream), collectors (midstream), processors and exporters (downstream), and finally, the products are delivered to consumers in both domestic and overseas markets.

In alignment with this, Bourlakis and Weightman (2004) emphasized the significance of the food supply chain for all countries. They outlined a comprehensive supply chain in the United Kingdom that includes farmers, food manufacturing, wholesalers, retailers, catering or food service, and finally, the products are delivered to the end consumer.

Considering the literature and preliminary research, the fresh produce supply chain in Thailand does not differ significantly from the vegetable supply chain and food supply chain mentioned above. Fresh produce in this context includes perishable items such as fruits, vegetables, foods, flowers, meats, and more. This study specifically focuses on major stakeholders involved in the supply chain, including growers, collectors, wholesalers, processors, traditional retail outlets, and domestic consumers for data collection. Understanding the dynamics and relationships among these stakeholders is crucial for effective management and risk mitigation in the fresh produce supply chain.

Review Methodology

The methodology adopted for crafting this paper involved an extensive and systematic review of scholarly articles that specifically addressed the intricate realm of supply chain risk management. Emphasizing issues related to risk within the domains of supply and manufacturing chain management, the chosen articles span a time frame from 2013 to 2017. This temporal constraint was instituted because the terminology "supply chain risk" is considered relatively nascent in academic literature, despite the long-standing acknowledgment of uncertainty and risk as pivotal elements in the broader field of supply chain management.

The deliberate exclusion of articles predating 2013 was guided by the understanding that the term itself gained prominence in recent years, and literature within the chosen time frame is more likely to encapsulate the contemporary trends and dynamics in the operational landscape of companies. The literature search, conducted with precision and diligence, spanned several renowned electronic databases, including Inderscience, ABI/INFORM GLOBAL Pro-quest, EBSCO, Emerald Full text, and Science Direct. Employing the strategic keyword "supply chain risk," this search strategy aimed at capturing a comprehensive and relevant body of work.

The initial search across these diverse databases yielded a voluminous total of 200 articles, a testament to the burgeoning interest and scholarly output in the field of supply chain risk management. However, a judicious and meticulous selection process was subsequently employed to distill this vast pool into a more manageable subset. Through rigorous scrutiny and adherence to predetermined criteria, 10 highly relevant articles were identified and subjected to thorough review.

The chosen articles not only met the criteria for relevance but also demonstrated a high degree of scholarly rigor, methodological soundness, and applicability to the contemporary landscape of supply chain risk management. This meticulous approach to article selection ensures that the content of this paper is not only rooted in recent research but also reflects the pulse of current developments and challenges in the multifaceted realm of supply chain risk management. As a result, the insights derived from this methodological approach are poised to contribute meaningfully to the discourse surrounding effective risk mitigation strategies in the ever-evolving landscape of supply chain management.

The analysis of results in this research paper encompasses various methodologies, offering a comprehensive understanding of the landscape of supply chain risk management. The methodologies employed can be categorized into five classes: exploratory longitudinal, exploratory cross-sectional, empirical, descriptive, and conceptual.

Descriptive methodology emerged as a predominant approach, utilized in nearly half of the research studies. This methodology involves providing a detailed account of fundamental concepts related to supply chain risk management. In the context of this research, a conceptual approach was implemented to develop a framework for uncertainty management in the supply chain, with the overarching goal of reducing firm risks. One noteworthy article applied a risk option approach, seeking to maximize the company's flexibility as a strategy for dealing with risks and uncertainties.

Additionally, some studies in the conceptual category delved into clarifying issues related to supply chain management, including definitions and the relationship between risk and supply chain management. For instance, Peck (2013) discussed the term "supply chain management" and emphasized that addressing supply chain risk should not be confined to the functional perspective but should also consider cross-functional issues.

The descriptive methodology, prevalent in this research, involved the development, formulation, and description of frameworks in supply chain risk management. Notable examples include models that prioritize, analyze, and identify mitigation actions. Tools such as the analytical hierarchy process (AHP) and the failure mode and effect analysis (FMEA) were employed for this purpose.

The empirical methodology, another significant category, involves deriving data from existing databases, typology or taxonomy approaches, literature reviews, or case studies. Survey studies were developed, utilizing practitioners as respondents. For instance, Zsidisin and Ellram (2014) conducted a survey involving purchasing professionals to explore the concept of agency theory within the context of supply risk management. Juttner et al. (2003) conducted a field study, engaging representatives from logistics service providers, retail sectors, and manufacturing companies through interviews and focus group discussions. The objectives of these studies included identifying future research agendas and proposing relevant definitions for supply chain risk management.

In conclusion, the diverse range of methodologies employed in these studies contributes to a well-rounded analysis of supply chain risk management, offering insights from conceptual frameworks to empirical surveys and case studies. This multifaceted approach enriches the understanding of the complexities and challenges associated with managing risks in the supply chain.
The Exploratory Cross-Sectional methodology, as applied in supply chain risk management, involves the collection of information at a single point in time. Peck (2013) utilized this approach to propose a model that analyzes the dynamics and scope of supply chain risks. The model consists of four levels: the environment, organizations and inter-organizational networks, assets and infrastructure dependencies, and value stream/product/processes. Peck argues that achieving a resilient or robust supply chain requires more than just effective management and design of supply chain processes. It necessitates a broader consideration of the entire system, encompassing the other three levels identified in the model.

On the other hand, the Exploratory Longitudinal methodology involves the collection of data at two or more points in an organization. This approach allows researchers to observe changes, trends, or developments over time within the context of the supply chain. By conducting longitudinal studies, researchers can gain insights into how supply chain risks evolve and how organizations adapt to these changes over an extended period.

The distinction between exploratory cross-sectional and exploratory longitudinal methodologies is crucial in understanding the temporal dimension of supply chain risk management research. While cross-sectional studies offer a snapshot of a specific moment, longitudinal studies provide a more dynamic perspective by capturing the unfolding dynamics and responses to risks over time. Both methodologies contribute to a comprehensive understanding of the multifaceted nature of supply chain risks and aid in the formulation of effective risk management strategies.

Industry Sectors

The articles included in this research paper encompass a wide range of industrial sectors, showcasing the applicability of supply chain risk management across diverse industries. The majority of applications, however, are concentrated in the aerospace and electronics sectors, indicating a pronounced focus on these industries within the context of supply chain risk management.

In the electronics sector, supply chain risk management becomes particularly crucial due to the inherent vulnerabilities associated with high demand uncertainty and the rapid product life cycle characteristic of this industry. A notable example is the application of supply chain risk management in the electronic industry, where Ericsson developed a risk management framework following the destruction of one of its sub-suppliers due to a fire incident. This incident underscores the critical importance of proactively managing risks in the electronics sector.

Similarly, the aerospace industry is identified as an industry sector exposed to significant risks owing to its inherent complexity. Sinha et al. (2015) contributed to this domain by creating a model specifically tailored for supply chain risk mitigation in the aerospace industry. The model addresses challenges such as the lack of common terminology among supply chain companies, scarcity of raw materials, and conflicts in original equipment manufacturer (OEM) requirements. These factors underscore the complexity and multifaceted nature of risks in the aerospace sector, necessitating specialized risk management approaches.

While the primary focus has been on the aerospace and electronics sectors, the supply chain risk management literature also extends its reach to other industry sectors, albeit to a lesser extent. Notable mentions include the metal industry, machinery tools, semiconductors, telecommunication, and the automotive sector. This broader application reflects the recognition that effective risk management is pertinent across a spectrum of industries, each facing unique challenges and complexities within their supply chains.

In summary, the research highlights the diverse applications of supply chain risk management across multiple industry sectors. By focusing on specific industries such as aerospace and electronics, researchers and practitioners aim to tailor risk management strategies to address the unique challenges and vulnerabilities present in each sector, ultimately contributing to the overall resilience and sustainability of supply chains in various industrial contexts.

Results

The results of the study revealed a total of 33 risk events identified within the fresh produce supply chain. These risk events were categorized based on their significance to each stakeholder, resulting in classifications such as atmosphere risk, demand risk, financial risk, information risk, operational risk, policy risk, price risk, regulatory risk, and supply risk. The sources of these risk events were further classified into two major categories: internal and external.

Throughout the various stages of the fresh produce supply chain—from farming to consumption—numerous challenges and obstacles were identified. These challenges encompass factors such as price fluctuations, environmental disasters, lack of information, insufficient resources, demand variability, regulatory issues, and the short shelf life of fresh produce. The risk events were evaluated based on a scoring system, where scores of 6 and 9 were considered high risks, scores of 3 and 4 were deemed medium risks, and scores of 1 and 2 were classified as low risks.

The results indicated that climate risk, financial risk, price risk, and supply risk scored 6 and 9, placing them in the high-risk category. These risks were identified as top priorities for producers and were considered critical for intermediaries, processors, and consumers as well. Revenue issues, raw material prices, raw material supply, climate change, operational costs, labor costs, and selling prices were identified as the most critical factors for these stakeholders. On the other hand, demand risk, information

risk, and operational risk scored 3 and 4, falling into the medium-risk level. The lack of information, operational challenges, labor shortages, and demand uncertainty were deemed to have a medium potential impact on the supply chain. Finally, policy risk and regulatory risk received scores of 1 and 2, indicating the lowest priority for risk mitigation.

In response to these findings, the researchers proposed several recommendations to reduce the impact of risks. These recommendations were then translated into a 4Ts methodology—treat, transfer, terminate, and tolerate—following the risk control approach outlined by the Chartered Quality Institute, UK (2010). This approach involves treating risks to minimize their consequences, transferring risks to third parties (e.g., considering insurance), terminating risks by ceasing activities that pose a risk, and tolerating risks by accepting minimal risks or not taking any corrective actions.

Overall, the study provides a comprehensive understanding of the risk landscape within the fresh produce supply chain and offers practical recommendations for mitigating these risks using a structured risk control methodology.

Conclusion

In conclusion, this investigation delves into the identification and assessment of risk events within the fresh produce supply chain in Thailand. The categorized risk events span nine classifications, including atmosphere risk, demand risk, financial risk, information risk, operational risk, policy risk, price risk, regulatory risk, and supply risk. The study reveals that atmosphere risk, financial risk, price risk, and supply risk have the most significant impact on the fresh produce supply chain, while demand risk, information risk, and operational risk exhibit an average impact. Policy risk and regulatory risk are considered irrelevant to the chain according to the perspectives of experts.

Furthermore, the study proposes risk relief strategies based on the 4Ts approach (treat, transfer, terminate, and tolerate) to reduce the likelihood and severity of these risks, particularly in the most impactful categories. The fresh produce supply chain structure, along with internal and external risks, is illustrated. The involvement of various stakeholders in the entire chain should be considered for further study to ensure comprehensive risk management. Other research methods, such as the Analytical Hierarchy Process (AHP), could be applied to determine the most suitable risk mitigation strategies.

When applying risk management to business supply chains, maintaining a balance between risk and reward is crucial for managers. The findings from this research, along with existing evidence on business supply chains, can provide valuable insights for military commanders to understand and leverage risk and rewards. While this study focuses on the research topic of military combat aviation, the findings can also be extrapolated to examine the aircraft parts market as a whole.

Despite the exploratory and foundational nature of this study, there are opportunities for improvement. The need for more in-depth data, possibly through additional cases or surveys, is essential for generalizing the results into effective risk management strategies. Overcoming research barriers in military contexts, such as security considerations, could be addressed by adopting statistical models as a potential avenue for further investigation. Additionally, conducting longitudinal research to gain insights into the long-term dynamics of the issue is suggested as another approach to providing valuable insights into risk management within the fresh produce supply chain and beyond.

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