Advances in Social Science and Culture
ISSN 2640-9682 (Print) ISSN 2640-9674 (Online)
Vol. 6, No. 2, 2024
www.scholink.org/ojs/index.php/assc

Original Paper

Cluster Supply Chain Network Organization Governance Model and Governance Mechanism Research

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Received: January 29, 2024 Accepted: March 20, 2024 Online Published: April 01, 2024

doi:10.22158/assc.v6n2p122 URL: http://dx.doi.org/10.22158/assc.v6n2p122

Abstract

This paper aims to explore in-depth the organization governance model and governance mechanism of cluster supply chain networks, and analyze their roles and impacts in modern supply chain management. Firstly, the concept and characteristics of cluster supply chain networks are introduced, emphasizing their innovation and flexibility based on the Internet and information technology. Then, the common organization governance models in cluster supply chain networks are analyzed in detail, including decentralized governance, centralized governance, and collaborative governance, as well as corresponding governance mechanisms such as decision-making mechanisms, supervision mechanisms, and incentive mechanisms. Through comparing different organization governance models and mechanisms and conducting case studies, the advantages, disadvantages, and applicable scenarios are analyzed in depth. Furthermore, the challenges faced by cluster supply chain networks in organizational governance, such as information asymmetry and cooperation difficulties, are discussed, and strategies and suggestions for addressing challenges and making improvements are proposed. Finally, the main findings and conclusions of the research are summarized, emphasizing the importance of organization governance models and governance mechanisms in cluster supply chain networks and providing prospects for future research and practice.

Keywords

cluster supply chain network, organization governance model, governance mechanism, decentralized governance, centralized governance

1. Introduction

With the continuous development of the global economy and the increasing complexity of supply chain management, cluster supply chain networks, as a new organizational form, have gradually attracted attention from academia and industry. A cluster supply chain network is a networked organizational form formed by multiple enterprises or organizations sharing information, resources, and capabilities, aiming to improve the efficiency, flexibility, and innovation capability of the entire supply chain. Its core idea is to optimize and coordinate various links in the supply chain through collaborative cooperation and resource sharing. In cluster supply chain networks, organization governance models and governance mechanisms play a crucial role. Suitable organization governance models can promote cooperation and win-win among stakeholders, while effective governance mechanisms can improve decision-making efficiency and resource utilization. Therefore, in-depth research on the organization governance models and governance mechanisms of cluster supply chain networks is of great significance for improving the overall operational efficiency and competitiveness of the supply chain. This paper aims to further reveal the operation mechanism and influencing factors of cluster supply chain networks from theoretical and practical perspectives by exploring the organization governance models and governance mechanisms of cluster supply chain networks. Next, different organization governance models and governance mechanisms will be explored in depth, and their advantages, disadvantages, and applicability will be analyzed, followed by corresponding recommendations and prospects.

2. Introduction to Cluster Supply Chain Networks

2.1 Definition and Characteristics of Cluster Supply Chain Networks

Cluster supply chain networks are innovative organizational forms that bring together multiple independent yet interconnected enterprises or organizations through the sharing of information, resources, and capabilities. Unlike traditional linear supply chains, cluster supply chain networks exhibit greater flexibility and dynamism. A key characteristic of these networks is their interconnected structure, which comprises numerous independent entities linked through networks, forming a multi-party networked structure. This interconnectedness facilitates the swift exchange of information and resources within the network, fostering collaborative operations and cooperation across different segments of the supply chain. Participants in cluster supply chain networks commonly engage in resource sharing, encompassing production facilities, technical expertise, and market intelligence. This sharing of resources leads to cost reductions, efficiency enhancements, and expedited time-to-market for products or services. Additionally, these networks serve as platforms for collective innovation, encouraging advancements in technology, product offerings, and business models. By fostering cross-industry collaboration and knowledge exchange, cluster supply chain networks accelerate the dissemination and application of innovative solutions, thereby bolstering the competitiveness of the entire supply chain ecosystem. Furthermore, cluster supply chain networks demonstrate remarkable

flexibility and adaptability, enabling swift responses to market demands and fluctuations. Given the relative independence of network participants, production plans, supply chain configurations, and collaboration arrangements can be adjusted on the fly to align with evolving market dynamics and uncertainties (Adetoyinbo, A., Asravor, J., Olaleye, A. S. et al., 2024). Lastly, risks within cluster supply chain networks are often shared among participating entities. This risk-sharing mechanism mitigates individual enterprise risk exposure, enhancing the overall stability and resilience of the supply chain. In essence, as a novel organizational paradigm, cluster supply chain networks present modern enterprises with valuable opportunities for collaboration and growth in an ever-evolving business landscape.

2.2 Advantages and Application Areas of Cluster Supply Chain Networks

Cluster supply chain networks offer a multitude of advantages, positioning them as indispensable solutions across various industries and applications. Primarily, these networks foster resource sharing and collaborative innovation, thereby enhancing the overall efficiency and competitiveness of supply chains. By pooling together production facilities, technical expertise, and market insights, participants can drive down costs, streamline production processes, expedite product development, and market entry. This collaborative approach optimizes and synchronizes the entire supply chain ecosystem, delivering mutual benefits to all stakeholders involved. Furthermore, the inherent flexibility and adaptability of cluster supply chain networks enable swift responses to market demands and fluctuations[2]. As individual entities within the network maintain a degree of autonomy, they can readily adjust production plans, supply chain configurations, and collaboration arrangements to align with evolving market dynamics and uncertainties. This agility ensures that the supply chain remains responsive and resilient in the face of changing conditions. Moreover, the concept of risk sharing within cluster supply chain networks is pivotal in mitigating individual enterprise risk exposure. By collectively bearing risks and uncertainties associated with supply chain operations, participants contribute to the overall stability and resilience of the network. This collaborative risk management approach fosters a sense of shared responsibility and fosters stronger partnerships among network participants. Cluster supply chain networks find application across a diverse array of industries, including manufacturing, retail, logistics, and beyond. In manufacturing, these networks facilitate process optimization, quality enhancement, and accelerated time-to-market for products. Within the retail sector, cluster supply chain networks streamline inventory management, order fulfillment, and customer satisfaction, thereby enhancing market competitiveness. Similarly, in logistics, these networks optimize transportation routes, enhance efficiency, and reduce costs associated with transportation operations. In conclusion, the versatility and effectiveness of cluster supply chain networks render them indispensable in modern business operations. With their ability to promote collaboration, flexibility, and risk sharing, these networks offer promising prospects for application across a wide spectrum of industries, driving innovation, efficiency, and competitiveness in the global marketplace (Gokhan, A., Birdogan, B., Murat, I. A. 2024).

3. Organizational Governance Models

3.1 Common Organizational Governance Models in Cluster Supply Chain Networks

In cluster supply chain networks, the organizational governance models play a pivotal role in shaping the collaborative dynamics and operational efficiency of the network. Let's delve deeper into the common organizational governance models and their applicability within these networks. The decentralized governance model empowers participants within the cluster supply chain network by dispersing power and decision-making authority among them. Each participant enjoys a level of autonomy, fostering a culture of collaboration and autonomy. Decisions are made through negotiation and consensus, allowing for flexibility and adaptability. While this model encourages innovation and initiative among participants, it may encounter challenges such as lower decision-making efficiency and disparities in resource allocation. Conversely, the centralized governance model consolidates power and decision-making authority within a centralized entity or organization. Typically managed by a dominant enterprise or institution, this model facilitates efficient decision-making processes and streamlined operations. However, it may lead to the neglect of other participants' interests and risks associated with information asymmetry and unilateral control. The federated governance model integrates elements of both decentralized and centralized governance, aiming to strike a balance between participant autonomy and centralized decision-making efficiency. In this model, decision-making authority and management rights are shared among multiple participants, fostering a collaborative governance structure. By allowing participants to engage in decision-making based on their interests and capabilities, this model promotes a more democratic decision-making process. Nevertheless, effective cooperation and coordination mechanisms are essential to ensure the successful execution of decisions. The choice of governance model depends on various factors such as the nature of relationships among participants, network goals, and resource allocation. The decentralized governance model is suitable for environments emphasizing flexibility and innovation, where participants value autonomy and collaboration. Conversely, the centralized governance model may be preferred in situations requiring swift decision-making and centralized control, such as during emergencies or market fluctuations. The federated governance model finds application in scenarios where a balance between autonomy and efficiency is sought, enabling diverse stakeholders to participate in decision-making processes while ensuring effective coordination. In conclusion, the selection of organizational governance models in cluster supply chain networks should be guided by an understanding of the network's unique characteristics and objectives. Each model presents its own set of advantages and challenges, highlighting the importance of aligning the governance structure with the specific needs and dynamics of the network. By carefully evaluating these factors, organizations can effectively harness the potential of cluster supply chain networks to drive collaboration, innovation, and sustainable growth (Peng, L., W. T. E. N., Edwin, T. C., 2024).

3.2 Explanation and Comparison of Governance Models

The governance models adopted within cluster supply chain networks play a pivotal role in shaping the network's dynamics and effectiveness. Let's delve deeper into the characteristics and comparisons of decentralized governance, centralized governance, and federated governance models. In a decentralized governance model, autonomy and cooperation are emphasized, with decision-making authority distributed among network participants. This model promotes a collaborative environment where decisions are made through negotiation and consensus, granting each participant a level of autonomy and rights. Decentralized governance fosters innovation and proactiveness among participants, enhancing the network's flexibility and adaptability. However, it may encounter challenges such as lower decision-making efficiency, disparities in resource distribution, and difficulties in achieving cooperation due to diverse interests. Conversely, the centralized governance model centralizes power and decision-making authority within a single entity or organization, typically led by a dominant player responsible for making unified decisions and managing operations. This model facilitates efficient decision-making processes, enabling swift responses to market demands and changes (E. C., A. F. G. I., et al., 2024). However, it may overlook the interests of other participants, leading to risks associated with information asymmetry and unilateral control. The federated governance model integrates aspects of both decentralized and centralized governance models, aiming to strike a balance between participant autonomy and centralized decision-making efficiency. In this model, decision-making authority and management rights are shared among multiple participants, fostering a collaborative governance structure. By allowing participants to engage in decision-making based on their interests and capabilities, this model achieves a balanced power distribution and democratizes the decision-making process. Nevertheless, effective cooperation and coordination mechanisms are essential to ensure the successful execution of decisions. Each governance model presents its own set of advantages and challenges, necessitating careful consideration based on the network's objectives and characteristics. The decentralized governance model is conducive to fostering autonomy and innovation, making it suitable for environments emphasizing flexibility and creativity. In contrast, the centralized governance model prioritizes efficiency and rapid decision-making, making it suitable for situations requiring centralized control and swift responses to market dynamics. The federated governance model offers a middle ground, balancing autonomy with efficiency, making it applicable to scenarios where diverse stakeholder interests and participation need to be considered. In conclusion, the selection of governance models in cluster supply chain networks should be guided by a thorough understanding of the network's unique requirements and goals. Each model offers its own benefits and drawbacks, highlighting the importance of aligning the governance structure with the specific needs and dynamics of the network to ensure its effectiveness and success.

4. Governance Mechanisms

4.1 Governance Mechanisms in Cluster Supply Chain Networks

Governance Mechanisms in Cluster Supply Chain Networks play a vital role in ensuring smooth operations and effective coordination among network participants. Let's delve deeper into each of these mechanisms and their significance within the context of cluster supply chain networks. Decision-making mechanisms encompass the processes and structures used to determine and implement network decisions. In cluster supply chain networks, decision-making mechanisms may vary, including voting systems, consensus-building processes, and delegation systems. These mechanisms empower participants to contribute to decision-making, ensuring fairness and effectiveness in the decision-making process. For instance, in scenarios requiring rapid responses to market changes, a consensus-based decision-making approach may be more appropriate, allowing stakeholders to collectively assess and address emerging challenges. Supervisory mechanisms involve monitoring and evaluating the performance of the network's operations. Within cluster supply chain networks, various supervisory mechanisms can be employed, such as internal audits, external audits, and self-assessment protocols. These mechanisms serve to detect and rectify operational issues promptly, enhancing transparency and accountability within the network. For example, regular performance audits can help identify inefficiencies or compliance breaches, enabling corrective actions to be taken promptly to maintain operational integrity. Incentive mechanisms are designed to motivate participants to actively engage in network operations by offering rewards for desirable behaviors and imposing penalties for undesirable ones. In cluster supply chain networks, incentive mechanisms can take various forms, including financial rewards, recognition programs, and collaborative incentives. By aligning incentives with desired outcomes, such as improved cooperation and performance, these mechanisms encourage participants to contribute their best efforts, thereby enhancing overall network efficiency and effectiveness. Information sharing mechanisms facilitate the flow and exchange of information among network participants, fostering transparency and collaboration. In cluster supply chain networks, information sharing mechanisms may encompass the use of information platforms, regular exchange meetings, and standardized reporting procedures. These mechanisms enable timely access to relevant information, reducing information asymmetry and transaction costs while promoting informed decision-making and coordinated actions among participants. In summary, governance mechanisms in cluster supply chain networks, including decision-making, supervisory, incentive, and information sharing mechanisms, are essential for promoting effective collaboration, enhancing operational efficiency, and achieving the optimization of the entire supply chain. By implementing and leveraging these mechanisms effectively, cluster supply chain networks can navigate challenges, seize opportunities, and drive sustained growth and development in today's dynamic business environment.

4.2 Advantages, Disadvantages, and Applicability of Different Governance Mechanisms

In cluster supply chain networks, different governance mechanisms can address various challenges and needs. Decision-making mechanisms, as a means of rapid decision-making, are particularly suitable for

situations requiring rapid responses to market changes and emergencies. For example, during sudden shortages of raw materials or sharp increases in market demand within the supply chain, decision-making mechanisms can be used to quickly coordinate resources from various parties, optimize supply chain configurations, and ensure timely supply. However, a potential disadvantage of decision-making mechanisms is the possibility of overlooking the interests of some participants. Therefore, in situations involving complex conflicts of interest among multiple parties, careful consideration is needed. Supervisory mechanisms are crucial for ensuring fair and compliant network operations (Maram A., Ali B., Ali, A., et al., 2024). In cluster supply chain networks, supervisory mechanisms can promptly identify and correct problems in operations, enhancing network transparency and accountability. Especially in cases involving large amounts of funds or resource flows, supervisory mechanisms can effectively reduce potential fraud and misconduct, enhancing participants' trust and willingness to cooperate. However, supervisory mechanisms may bring additional costs and complexity, especially in establishing and maintaining supervisory institutions or committees, requiring significant human and material resources. Incentive mechanisms are effective means of stimulating participant enthusiasm and creativity. In cluster supply chain networks, incentive mechanisms can guide participant behavior through rewards and penalties, improving cooperation efficiency and quality. For example, by establishing reward mechanisms to encourage participants to propose innovative solutions or efficient workflows, supply chain innovation and development can be effectively promoted. However, inappropriate use of incentive mechanisms may lead to waste and abuse of resources, requiring the design of reasonable incentive mechanisms based on actual circumstances and goals. Finally, information sharing mechanisms play an important role in improving communication efficiency and information sharing among network participants. In cluster supply chain networks, information sharing mechanisms can reduce information asymmetry and transaction costs, promoting cooperation and collaboration. However, information sharing mechanisms may also pose risks of information leakage and misuse, especially when involving trade secrets or sensitive information, necessitating the establishment of strict information protection measures and permission management systems. In conclusion, selecting appropriate governance mechanisms requires comprehensive consideration of the network's characteristics, environment, and goals to ensure the maximum improvement of operational efficiency and cooperative effects (Oyebode, J. O., & Abdulazeez, O. Z., 2023).

5. Case Analysis

In real cluster supply chain networks, the application of different organizational governance models and governance mechanisms can be demonstrated and analyzed through specific cases. In a certain automotive manufacturing cluster supply chain network, which includes automotive manufacturers, component suppliers, logistics service providers, and other participants, appropriate organizational governance models and governance mechanisms are needed to improve the efficiency and

competitiveness of the supply chain. In the decentralized governance model and decision-making mechanism, in this automotive manufacturing cluster supply chain network, automotive manufacturers adopt a decentralized governance model where each participant has a certain degree of autonomy and decision-making power. In response to urgent market demand changes, participants can quickly negotiate and formulate response measures, such as adjusting production plans or increasing the production of certain components. This decision-making mechanism allows the supply chain to adapt more flexibly to market changes, improving the responsiveness and adaptability of the entire supply chain. In the centralized governance model and supervisory mechanism, at the same time, a centralized supervisory mechanism is also established in the cluster supply chain network, with the automotive manufacturer acting as the leading enterprise responsible for unified decision-making and supervising network operations. By establishing a supervisory committee and formulating supervisory rules, problems and contradictions in supply chain operations can be promptly identified and resolved, increasing the transparency and accountability of the network. For example, when a component supplier encounters quality issues, the supervisory mechanism can intervene promptly and require improvements to the quality management system to ensure the stable operation of the entire supply chain. Incentive mechanisms and information sharing mechanisms, to incentivize the active participation and creativity of all participants, the automotive manufacturing cluster supply chain network also adopts incentive mechanisms and information sharing mechanisms. By establishing reward systems such as annual best supplier awards and technology innovation awards, suppliers are encouraged to provide high-quality products and services, promoting technological innovation and quality improvement. Meanwhile, establishing an information sharing platform enables real-time information sharing and communication, allowing participants to timely understand market demands and supply chain dynamics, thereby enhancing communication efficiency and cooperation effectiveness. In this case, through the combined application of different organizational governance models and governance mechanisms, the operational efficiency and cooperation effectiveness of the automotive manufacturing cluster supply chain network have been effectively improved. The rapid decision-making mechanism under the decentralized governance model enhances the flexibility and responsiveness of the supply chain, while the centralized supervisory mechanism ensures the normative and stable operation of the network. Incentive mechanisms and information sharing mechanisms stimulate the enthusiasm and creativity of all participants, promoting technological innovation and quality improvement. In summary, this case demonstrates the application and effects of different governance models and mechanisms in cluster supply chain networks, providing valuable reference and insights for similar supply chain networks (Miri, K. L., M. Z, B., Bahar, M. et al., 2023).

6. Potential Challenges and Response Strategies

In cluster supply chain networks, despite the adoption of different organizational governance models and governance mechanisms, a series of challenges may still be faced. Firstly, conflicts of interest may

lead to tension and difficulties in cooperative relationships. Various participants in the supply chain network may pursue maximizing their own interests, making cooperation difficult to achieve consensus, or even leading to competitive relationships. For example, suppliers may prioritize maximizing their profits, while manufacturers focus on cost reduction, potentially resulting in conflicts over pricing or resource allocation. To address this challenge, establishing effective negotiation and conflict resolution mechanisms is crucial. By facilitating open dialogue and fostering mutual understanding, participants can find common ground and collaborate more effectively, mitigating conflicts of interest and promoting cooperation. Secondly, information asymmetry is another potential challenge, where some participants may have more information resources, resulting in unfairness in information and imbalance in transactions, thereby affecting the efficiency and effectiveness of cooperation. For instance, manufacturers may possess market insights or production data that suppliers lack, leading to unequal bargaining power or suboptimal decision-making. To mitigate information asymmetry, enhancing information sharing and transparency is essential. Implementing robust information-sharing platforms and protocols enables all participants to access relevant data and insights, fostering trust and collaboration while reducing the risk of misunderstandings or misalignments. Additionally, technological risks are also a significant concern. Technological developments in the supply chain network may face challenges from market changes and technological updates, potentially leading to instability and increased risks in the supply chain. For example, disruptions in technology adoption or advancements in competitors' systems can impact the competitiveness and resilience of the supply chain network. To address technological risks, increasing investment in technological innovation and research and development is paramount. By staying abreast of emerging technologies, investing in robust infrastructure, and fostering a culture of innovation, supply chain networks can adapt to technological disruptions and maintain their competitive edge. Moreover, collaboration risks and competitive pressures also impact the stable operation of the supply chain network. The constantly changing market environment and challenges from competitors may bring uncertainty and pressure to the supply chain. For instance, changes in consumer preferences or the emergence of new market entrants can disrupt existing supply chain dynamics and relationships. To mitigate collaboration risks and competitive pressures, establishing flexible cooperation mechanisms and risk management systems is essential. By proactively identifying potential threats and opportunities, supply chain networks can develop contingency plans, diversify their supplier base, and cultivate strategic partnerships to enhance resilience and competitiveness. In conclusion, response strategies to the challenges faced by cluster supply chain networks include establishing effective negotiation and communication mechanisms, enhancing information sharing and transparency, increasing investment in technological innovation and research and development, establishing flexible cooperation mechanisms and risk management systems, and strengthening internal cooperation and alliances with industry peers. Through the comprehensive application of these strategies, various challenges can be effectively addressed, enhancing the operational efficiency and cooperation effectiveness of the supply chain network, and achieving

common development and success.

7. Conclusion

In cluster supply chain networks, the choice of organizational governance models and governance mechanisms is crucial for the stable operation and cooperation effectiveness of the network. Through the discussion in this paper, we can see that different governance models and mechanisms play different roles in addressing various challenges and promoting cooperation. The decentralized governance model can improve the flexibility and responsiveness of the supply chain, while the centralized supervisory mechanism ensures the normative and stable operation of the network. Incentive mechanisms and information sharing mechanisms can also stimulate the enthusiasm and creativity of participants, promoting cooperation and collaboration. However, it should be noted that in practical applications, these governance models and mechanisms may face some challenges such as conflicts of interest, information asymmetry, and technological risks. To address these challenges, a series of effective response strategies need to be adopted, including strengthening communication and negotiation, enhancing information sharing and transparency, increasing technological innovation and risk management, etc. Through these efforts, potential challenges can be better addressed, enhancing the operational efficiency and cooperation effectiveness of the supply chain network. In conclusion, the selection of appropriate governance models and mechanisms, coupled with effective response strategies, is key to achieving sustained development and mutual success in cluster supply chain networks.

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