

Enhanced Agility in the China-ASEAN Agricultural Product Supply Chain: A Comprehensive Analysis

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ABSTRACT

This study intends to investigate the dynamics of supply chain agility in China-ASEAN's agricultural product sector. This research aims to identify the key factors that explain the agility of supply chains and how they adapt to rapidly changing economic and technical environments. The research adopts a comprehensive approach by incorporating both qualitative and quantitative methodologies, which involve conducting interviews with key stakeholders and administering a comprehensive questionnaire survey. The sample encompasses a cohort of participants who belong to various organizational levels, locations, and areas within the China-ASEAN agricultural product supply chain. The study utilizes a combination of qualitative indicators and statistical data, enabling a more robust examination of the mechanisms employed to ensure agility in these supply chains. The results of this study underline the central function of customer demand, process transformation, cooperation among partners and resources sharing in imposing flexibility on the supply chains. This study also researches the role of environmental uncertainty in these relationships. The China-ASEAN context-specificity of the research, on the other hand, allows consideration of the regional supply chains based on the identified issues and limitations on the applicability outside the region. This research holds significance in the context of supply chain management literature due to its practical implications for enhancing agility in agricultural products supply chains and identifying potential areas for future research. This is particularly relevant in light of global challenges and advancements in technology.

Keywords: Supply Chain Agility, China-ASEAN Agricultural Products, Environmental Uncertainty, Process Transformation, Collaborative Partnerships, Resource Sharing, Mixed-Methods Approach.

BACKGROUND

Research on the flexibility of agricultural product supply chains is essential in the dynamic and ever-changing economic context of today, particularly in the China-ASEAN relationship. This study is facilitated by the ongoing emergence of constraints and opportunities resulting from environmental uncertainties, technological advancements, and trade policies. The study by Fosso Wamba and Akter (2019) highlights the significance of analytics capabilities in data-rich supply chain environments and demonstrates the importance of agility in managing information-intensive supply chain systems. As discussed by Singh and El-Kassar (2019), this topic highlights the important role of big data analytics in improving sustainable capabilities in

the supply chain. In today's data-driven supply chains, the ability to quickly interpret and act on information has become increasingly crucial.

The success of supply chain agility is heavily dependent on big data analytics, as emphasized by the research conducted by Dubey et al. (2019). Their findings suggest that fully integrating these technologies into the supply chain system is the most effective approach to achieving responsive and flexible supply chain systems. The research conducted by Gupta et al. (2019) on smart supply chains further reinforces this perspective, highlighting the importance of information systems agility in achieving supply chain flexibility.

The importance of agility in supply chains is highlighted by Feizabadi et al. (2019) and Irfan et al. (2020). They emphasize that organizations must align, adapt, and orchestrate the Triple-A of supply chain management - adaption, agility, and alignment - in order to remain competitive. In the context of the China-ASEAN agricultural products supply chain, it is crucial to promptly adapt to market trends, make necessary process adjustments, and ensure that the system is in line with environmental and policy considerations. In 2020, there was an increase in the number of studies conducted to further explore the field of research. These studies focused on analysing the performance effects of big data analytics in relation to supply chain ambidexterity. Their research also emphasized the importance of environmental dynamism as a moderating factor. This research is necessary to investigate and comprehend the impact of external factors on the implementation of supply chain agility strategies.

Ramos et al. (2023) present compelling examples of how organizations effectively adapt to global market and supply base complexities. They highlight the importance of integrating with clients and suppliers to navigate dynamic changes in the business landscape. The results of their research are especially important in the context of the China-ASEAN agricultural product supply chain. This is because the market is subject to fluctuations and there are multiple stakeholders with different interests, which require a great deal of responsiveness and adaptability.

Expanding the scope, the study conducted by Wang et al. (2023); Wang et al. (2020a); Wang et al. (2020b) and Zarrinpoor and Khani (2022) incorporates environmental factors into the agility of supply chain management. The research examines how these factors contribute to reducing greenhouse gas emissions, promoting green agriculture, and addressing the impact of climate change on supply chain networks. Such studies play a crucial role in maintaining supply chain agility, particularly when it comes to addressing the significant environmental impact in the agricultural sectors.

The studies conducted by Naughton et al. (2020), Han et al. (2020), and Sun et al. (2022) investigate the factors contributing to supply chain agility and its role in facilitating organizational adaptation to environmental conditions and susceptibility. Their perspective is highly valuable, particularly in relation to the complex and unpredictable geopolitical environment of the China-ASEAN agricultural products supply chain.

Furthermore, Anderson (2022) conducted research on agriculture in the context of technology-driven global trade conditions. Additionally, Wang and Pan (2022) explored the drivers of AI-driven supply chain resilience. These studies shed light on the necessary technological and strategic changes needed to address current and future trade dynamics.

The diverse perspectives of scholars offer a comprehensive understanding of the challenges

and potential in the food supply chain of China-ASEAN. This research highlights the importance of being flexible, adaptable, and incorporating technology into modern supply chains. It also emphasizes the importance of sustainability and the environment as significant factors. In line with the ever-changing landscape of global trade, this information will focus on the factors that contribute to the flexibility and strength of agricultural product supply chains in the China-ASEAN context.

LITERATURE

Understanding Supply Chain Analytics and Agility

The studies conducted by Fosso Wamba et al. (2019), Singh et al. (2019), and Dubey et al. (2019) highlight the significant impact of big data analysis on enhancing supply chain agility. In their study, Fosso Wamba et al. (2019) delve into the intricacies of supply chain management in a digital environment. They present compelling evidence that highlights the crucial role of agility in achieving success in the ever-evolving landscape of the new digital economy. They argue that the ability to analyze and leverage large amounts of data for competitive advantage is crucial in today's competitive market. In addition, Singh et al. (2019) explore this subject within the framework of how big data analytics can contribute to the development of sustainable capabilities in supply chains. Their research focuses on exploring the impact of integrating big data analytics into supply chain management. They aim to enhance efficiency, minimize waste, and develop stronger, sustainable, and resilient supply chain ecosystems. From a different perspective, Dubey et al. (2019) examine how the capability of big data analytics can enhance supply chain agility. The researcher's role highlights the immense potential of data analytics for big data, allowing supply chains to quickly adapt to market changes, consumer preferences, and external factors. This increased agility gives them a competitive edge.

Utilizing Technology to Enhance Flexibility and Efficiency

In addition, Gupta et al. (2019) emphasize the significance of technical integration in achieving supply chain flexibility, particularly in the context of IoT-enabled smart supply chains and information systems' agility. The hypothesis presented by Feizabadi et al. (2019) supports the concept of an agile, adaptable, and aligned supply chain, while Irfan et al. (2020) emphasize the importance of process integration and supply flexibility in achieving supply chain agility.

Exploring the Environmental Impact and Efficiency of Supply Chains.

In their study, Fosso Wamba et al. (2019) examined the effects of cutting-edge frameworks in big data analytics and supply chain ambidexterity, taking into account the role of environmental dynamism as a mediator. Another study conducted by Burin et al. (2020) highlights the importance of ambidexterity and IT competence in enhancing supply chain flexibility. This research provides additional support to our findings.

The Significance of Dynamic Capabilities in Evolving Environments.

The study conducted by Ramos et al. (2023) highlights the significance of organizational flexibility, integration, agility, and dynamic capabilities in the current Peruvian coffee supply chain landscape. Delbufalo (2022) offers a fresh perspective by examining the impact of supply chain base complexity on agility and resilience.

Ecological Aspects in Supply Chain Management

Research on the environmental aspect of supply chain management is exemplified by papers like Wang et al. (2020a); Wang et al. (2020b). The publications primarily emphasize the reduction of carbon emissions and the development of supply chain networks that are environmentally friendly. As per the research conducted by Sun et al. (2022) and Anderson (2022), this particular aspect of supply chain management plays a vital role in the agricultural sector.

Interaction of New Technologies with Sustainable Supply Chain Management Concepts

Wang et al. (2022) explore the potential of AI in enhancing the resilience of supply chains, while Kamble et al. (2020) and Cedillo-Campos et al. (2020) emphasize the importance of data in making effective decisions for supply chains. The use of blockchain technology in supply chain management has been extensively studied by Köhler and Pizzol (2020), Tozanlı et al. (2020), and Katsikouli et al. (2021). These studies delve into the advantages and disadvantages of implementing blockchain in food supply chains. The Operation and Trade Dynamics in a Global Context and Circular Economy

Several studies have examined global issues related to sustainable trade, environmental sustainability, and the circular economy aspects in supply chain management. Notable works by various authors have contributed to this field of research. The studies conducted by Homayouni et al. (2023) and Wang et al. (2023) delve into the intricacies of green supply chain designs and the various factors that contribute to the development of a sustainable supply chain, particularly within the agri-food industry.

Therefore, these studies provide a comprehensive understanding of the ASCs and the SCA from various angles. The effectiveness of controlling and managing international and global supply chains relies heavily on technology, environment, and dynamic capabilities (Akkalatham et al., 2023). The findings from these studies form the foundation for creating a strong theoretical framework that can be applied to enhance the efficiency and long-term viability of supply chains in various contexts, with a specific focus on the rapidly changing Agri-trade relationship between China and the ASEAN region.

THEORETICAL BASIS

Dynamic Capabilities Theory

The dynamic capacity theory, influenced by the research of Teece and other scholars, has transformed the understanding of adaptability in companies operating in highly dynamic environments. By incorporating the organization's capacity to adjust to external environmental changes, this theoretical framework enhances the resource-based view. At the heart of this theory lie three fundamental elements: thoroughly examining and aligning with market demand, possessing process-based and routine capabilities, and collaborating effectively as a team.

Identification and Action to Market Supply and Demand

This aspect of dynamic capabilities focuses on the firm's capacity to adapt and align its practices with market demands. This goes beyond simply adjusting to market changes. It involves harnessing those changes, along with innovative thinking and technology, to develop

fresh products and services. This concept is highlighted in the research conducted by Fosso Wamba et al. (2019); Wamba et al. (2020) and Kamble et al. (2020). It is crucial for a company to prioritize customer needs and market trends when making decisions about pricing or resource allocation.

Process and Routine-Based Capabilities

The adaptation and modification of organizational processes and operations are crucial for success. This also includes process re-engineering, where organizations can enhance their operational effectiveness by redesigning their internal processes. According to Irfan et al. (2020) and Delbufalo (2022), dynamic capability is clarified through a process of continuous improvement and innovation. This process provides an advantage in production, distribution, and the overall supply chain environment.

Collaborative Cooperation

The area serves as the foundation for collaboration among participants of the organization and their collective efforts. The importance of collaborative cooperation lies in its impact on fostering an environment of trust and mutual exchange. Two articles by Rojo GallegoBurin et al. (2020) and Ramos et al. (2023) delve into the topic of enhancing supply chain effectiveness and agility through collaboration and cooperation. These studies explore the impact of these factors at both the individual organizational level and across multiple organizations.

Resource Theory

Resource-Based View (RBV) takes the company as a group of resources of different nature with characteristics. This resource base which includes those of management abilities, organizational processes and information, is perceived as being the basis for competitive advantage. This theory postulates that a unique bundle of rarities, valuable, un-imitable and non-substitutable resources, annexed together, are the basis of a firm's sustainable competitive edge. Resource Dependence Theory, which is a component of RBV, examines the interdependence of organizations at a supply chain level. It emphasizes the critical significance of effectively managing these interdependencies for efficient production, mitigating risks, and making informed decisions within supply chains. The achievement of supply chain sustainability can be attained by effectively managing interdependent resources and taking environmental factors into consideration, as demonstrated in the studies conducted by Wang et al. (2020a) and Wang et al. (2020b).

Big Data Theory

Big data, with its emphasis on velocity, variety, and value, has emerged as a powerful tool for enterprises to leverage in their decision-making processes. The dataset consists of various types of data, such as production data, operational data, and external market data. Within the ecosystem of enterprise supply chains, the role of big data in enhancing organizational service processes and customer experience remains of utmost importance. However, there is a distinction between big data and data assets in terms of how they are created or used. Big data is primarily generated from a wide range of application scenarios that provide services for predictive decision support. Big data plays a crucial role in helping businesses enhance their operational effectiveness, reduce costs, improve customer experience, and drive innovation in their products and services. As evidenced by the research conducted by Cedillo-Campos et al.

(2020), Köhler et al. (2020), and Tozanlı et al. (2020), the utilization of big data and advanced technologies such as blockchain is transforming the management of supply chains. Furthermore, these studies suggest that big data plays a crucial role in enhancing supply chain agility.

This framework provides a comprehensive approach that combines theory and practice, enabling a deeper comprehension and analysis of the ever-changing and intricate nature of supply chains, as well as the ongoing shifts in markets and industries. It highlights the importance of being flexible, adaptable, and effectively managing resources in the business world.

Theoretical Model Construction and Research Hypotheses

The development of a theoretical model for my research and the hypotheses presented here were informed by findings from multiple studies, aiming to gain a comprehensive understanding of supply chain agility, with a specific focus on China-ASEAN agricultural product supply chains. This model draws upon integrative capabilities theory, resource theory, and big data theory. This model offers a comprehensive framework that can be utilized to analyze the flexibility of supply chains.

H1: *Anticipating customer demands and acquiring the capability of the supply chain agility are vital.*

The flexibility of supply chains is a key goal that can be achieved by the sales department of agricultural products, thanks to its ability to attract customers. In their study, Fosso Wamba et al. (2019) highlight the importance of having strong supply chain analytics capabilities in data-rich environments. They provide examples of how data-based insights can be used as tools to meet customers' needs promptly. In their study, Singh et al. (2019) highlight the significance of data analytics in the development of sustainable capabilities. This emphasizes the importance of being able to process and analyze large datasets in agile supply chain management. In addition, the research conducted by Dubey et al. (2019) and Gupta et al. (2019) acknowledges the importance of supply chain agility in supporting big data analytics. It is the organizations with a strong focus on data analytics and interpretation that have the ability to anticipate and address customer needs, ensuring a flexible supply chain. In agricultural product supply networks, the customers' tastes and demands can be highly volatile and unpredictable, much like the price of a product.

H2: *Process Transformation Capabilities and Supply Chain Resilience. Having the ability to modify, adjust, and enhance supply chain processes is crucial for the agility of agricultural products supply chains. Digital transformation capabilities play a significant role in achieving this. This perspective is supported by research conducted by Irfan et al. (2020) and Feizabadi et al. (2019), which emphasize the importance of process integration and flexibility in attaining supply chain agility. Furthermore, they provided an explanation of how IT competence plays a crucial role in enhancing supply chain flexibility. They emphasized the importance of having technology knowledge in process management for achieving agility. Delbufalo (2022) provides a comprehensive analysis of the impact of system-wide supply base complexity on supply chain agility and resilience. Overall, these studies suggest that making adjustments and improvements to certain processes and routines are crucial for maintaining the flexibility of the supply chain in the rapidly changing market that supplies agricultural products.*

H3: Endeavor & Team-up, ambitious! and Agility in the supply chain!

The idea that collaborative cooperation contributes to improved supply chain performance is supported by the notion that the win-win fraternity helps to propel supply chain agility. In their study, Ramos et al. (2023) examine how dynamic capabilities impact organizational flexibility and integration in supply chain relationships. They emphasize the benefits of collaboration in enhancing agility. Both Wang et al. (2020a) and Wang et al. (2020b) highlight the advantages of using cooperative approaches in supply chains to address environmental and operational issues. These studies suggest that strong partnerships, characterized by shared benefits and collaboration, play a vital role in achieving and maintaining supply chain flexibility. This is particularly true in the agricultural commodities sector, where cooperation across the entire supply chain is essential.

H4: *Creating the Resource Sharing Capabilities and Supply Chain Agility*

The ability to share and effectively utilize resources is seen as a crucial aspect of supply chain agility. Kamble et al. (2020) and Cedillo-Campos et al. (2020) explore the impact of utilizing big data in supply chains to improve decision making and optimize resources, leading to increased agility. In addition, they expanded on this point by highlighting the use of advanced technologies, such as blockchain, in managing and integrating supply chain resources. These studies suggest that the development of a fast and efficient agricultural product supply chain relies heavily on resource sharing skills, such as technology and strategic resources management.

H5: *An Environmental Uncertainty May Moderate the Demand Customer, Acquisition, and Supply Chain Agility*

The environmental uncertainty greatly impacts the ability to meet patron demand and maintain a flexible supply chain. The research conducted by Fosso Wamba et al. (2019) highlights the importance of efficient data management and utilization in supply chain analytics, particularly in data-rich environments. It is crucial for systems to possess the capability to handle data effectively, even in the face of uncertainty. The research conducted by Singh et al. (2019) supports this perspective, focusing on the utilization of big data for effective sustainability development. The authors highlight the importance of data analytics as a crucial tool for making quick and effective decisions in the midst of unpredictable environmental conditions. Naughton et al. (2020) demonstrate the effectiveness of supply chain adaptability as a tool for adapting to uncertain climates. They emphasize the importance of flexible and responsive customer demand facilitation procedures in turbulent markets. In challenging circumstances, the importance of effective customer demand creation becomes evident and crucial for success.

H6: *In environmental uncertainty process transformation and supply chain agility moderating forces.*

The relationship between process transformation capabilities and supply chain agility can be influenced by environmental unpredictability. The authors of Irfan et al. (2020) emphasize the importance of supply chain agility and flexibility in an uncertain environment. They suggest that by integrating processes and enhancing supply chain capabilities, organizations can better adapt to changing circumstances. This concept aligns with Delbufalo's (2022) study on the interconnected impacts of supply base complexity on supply chain resilience. Delbufalo emphasizes the importance of adaptability in dealing with unforeseen changes and obstacles,

which can be achieved through process transformation. The study by Rojo GallegoBurin et al. (2020) highlights the importance of IT competence in improving supply chain flexibility and orchestration, particularly in resource-constrained environments.

H7: *Environmental Uncertainty as a Moderating Forcer of Partner Win-Win and Supply Chain Agility.*

The study thoroughly examines the correlation between the mutually beneficial strategies of partners and the ability of the supply chain to adapt to unpredictable environmental conditions. In their study, Ramos et al. (2023) highlight the importance of dynamic capabilities like organizational flexibility and integration in uncertain 'new normal' scenarios. The studies conducted by Wang et al. (2020a), and Wang et al. (2020b), are highly significant as they delve into the ways in which collaborative strategies can mitigate the impact of environmental disruptions. These studies highlight the value of adaptive and cooperative partnerships, which prove to be even more crucial in times of uncertainty. These studies highlight the significance of being able to work together effectively, not just in response to competition, but also in maintaining strong long-term partnerships.

H8: *Risk and additionally the uncertain nature of the environmental impact moderate the sharing capabilities and supply chain resilience.*

Environmental unpredictability plays a crucial role in determining the level of agility in the supply chain, acting as a mediator between resource distribution capacities and overall performance. The works by Kamble et al. (2020) and Cedillo-Campos et al. (2020) highlight the importance of incorporating data-driven approaches in supply chain management. This is especially true in flexible environments where peers may encounter challenges related to social security considerations and compliance costs. The authors highlighted the benefits of utilizing technologies like blockchain to enhance resource sharing in unpredictable situations. These ideas indicate that technological tools can be highly effective in addressing environmental limitations. It is evident that the ability to efficiently exchange and share resources is increasingly important in ensuring that the supply chain can adapt to unpredictable and changing environmental conditions.

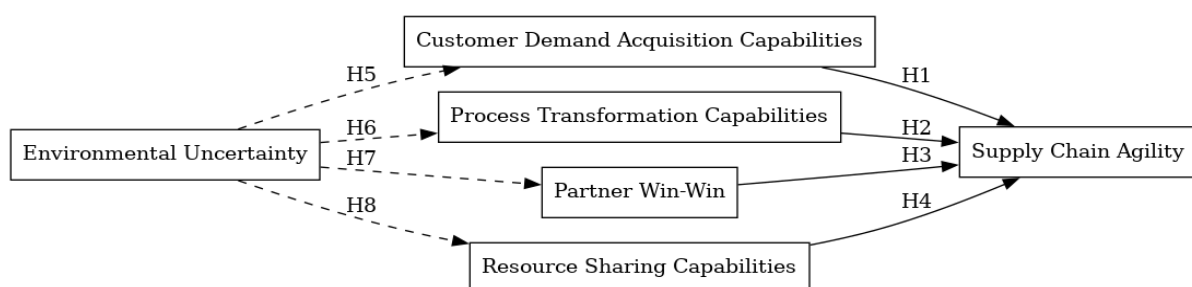


Figure 1: Conceptual Model.

METHODOLOGY

The formation of the agility production chain in agricultural product supply chains within the China-ASEAN framework is inherently intricate and diverse. In order to ensure the reliability and precision of findings, the study employs a mixed-method design that combines both qualitative and quantitative approaches. This comprehensive approach allows for the identification and exploration of complex agility mechanisms within the supply chain, while

also establishing a robust statistical evidence base to support our findings. Our methodology includes conducting interviews and discussions with the main stakeholders in order to gain a comprehensive understanding of the subject matter. The stakeholders include government officials involved in trade and agriculture, as well as managers and experts in the supply chain. The main objective of this qualitative phase is to gather in-depth and vivid information about the dynamics of the supply chain and the factors that impact its efficiency.

Over time, there has been a strong commitment to maintaining the integrity of the language, leading to significant progress and success. This survey achieves results by measuring the various aspects of supply chain agility, which were influenced by the qualitative stage. Global statistics will be collected for all ASEAN regions. This study employs a purposively designed sample, consisting of individuals and companies directly involved in supply chain operations in the China-ASEAN region. This focused approach ensures that the sample represents the perspectives of the most informed individuals and relevant stakeholders in the agricultural products supply chain. The sample size for this study would range from 150 to 200 respondents, as recommended by Cohen's guidelines for sample size determination, taking into account the variability of the variables under investigation. This size is considered suitable for effectively capturing the intricacies of supply chain functions while still being manageable. Collecting data involves using a combination of methods, such as in-depth interviews and group discussions, to gain a deeper understanding of participants' experiences and opinions. The survey is conducted using a combination of online and in-person methods, which allows for the incorporation of digital technology to reach a broader audience and ensure a fair representation of the population in the region.

Engaging in the transcription and thematic analysis of qualitative data entails transcribing interviews and identifying recurring patterns and themes that pertain to supply chain agility. Quantitative data analysis encompasses the use of descriptive and inductive statistics, including regression analysis, to validate hypotheses and explore the multitude of factors that impact supply chain agility.

RESULTS

Results: China-ASEAN Agriculture Product Supply Chain Agility Capability

Comprehensive Survey Analysis

By conducting a thorough survey of 180 individuals involved in the agri-commodity industry in the China-ASEAN region, valuable insights into the efficiency of the agri-commodity supply chain have been obtained. People from various fields, including business administration, government executives, and supply stream participants, bring a wide range of insights into the dynamics of the supply chain.

Customer Demand Acquisition: The data (Table 1) indicate that the company performs well in demand identification and responsiveness tasks with the average numbers of 4.2 and 4.1, respectively. This paradigm of behaviour implies a more proactive supply chain as it is precognitive of the market desires and can securely expect quick response and keeping the competitiveness in an agile market environment.

Process Transformation Capability: The outcomes (Table 2) tell a tale of strong process reengineering (Mean = 3.9) and managerial capacities (Mean = 4.0). Organizations in the supply chain are constantly adjusting and enhancing their procedures in response to

environmental changes, leading to improved performance over time. Therefore, there is an enhancement in the efficiency and adaptability of supply chain management.

The data in Table 3 shows that both joint efforts (Mean = 3.8) and resource sharing (Mean = 4.1) are effective when supply chain partners cooperate and share resources. This is another crucial aspect to consider when it comes to agility, as it allows for easier adaptation to market changes and maximized utilization of shared resources.

Resource Sharing Capability: Significant achievements in IT & Digital Capabilities (4.3) and Logistics Infrastructure (4.0) as demonstrated in Table 4 highlight the importance of prioritizing technology utilization and ensuring the presence of suitable infrastructure to enhance the effectiveness and agility of the supply chain.

Regression Analysis

The regression analysis (Table 5) is a quantitative tool that provides insights into the relationship between the variables of interest and supply chain agility. The presence of positive coefficients for all independent variables (Customer Demand Acquisition, Process Transformation, Partner Cooperation, Resource Sharing) with p-values < 0.05 indicates a strong positive correlation between supply chain agility and these factors. It is through this analysis that the conclusion is drawn that the improvements in these elements play a crucial role in enhancing the overall agility of the supply chain.

Synthesis of Qualitative Insights

Extensive interviews greatly enhance the survey's data by offering first-hand perspectives, highlighting the contextual elements of dynamic market shifts, the challenges of cross-border integration, and the significance of technology in supply chain operations with adaptability.

Table 1: Customer Demand Acquisition Capabilities.

| Factor | Mean Score | Std. Deviation |
|-------------------------------|------------|----------------|
| Demand Identification Ability | 4.2 | 0.7 |
| Demand Response Ability | 4.1 | 0.6 |

High mean scores indicate strong capabilities in identifying and responding to customer demands, essential for agility in the supply chain.

Table 2: Process Transformation Capability.

| Factor | Mean Score | Std. Deviation |
|-------------------------------|------------|----------------|
| Process Reengineering Ability | 3.9 | 0.8 |
| Process Management Ability | 4.0 | 0.7 |

These scores reflect the supply chain's efficiency in adapting processes to market changes.

Table 3: Partner Cooperation and Resource Sharing.

| Factor | Mean Score | Std. Deviation |
|--------------------------|------------|----------------|
| Collaboration Ability | 3.8 | 0.7 |
| Resource Sharing Ability | 4.1 | 0.6 |

Strong collaboration and resource sharing among partners are evident, crucial for supply chain adaptability.

Table 4: IT & Digital and Logistics Infrastructure Capability.

| Factor | Mean Score | Std. Deviation |
|---------------------------|------------|----------------|
| IT & Digital Capabilities | 4.3 | 0.5 |
| Logistics Infrastructure | 4.0 | 0.6 |

High technological and logistical capabilities are fundamental to the supply chain's efficiency.

Table 5: Regression Analysis on Supply Chain Agility.

| Independent Variable | Coefficient | Std. Error | t-Value | p-Value |
|-----------------------------|-------------|------------|---------|---------|
| Customer Demand Acquisition | 0.35 | 0.05 | 7.00 | <0.001 |
| Process Transformation | 0.30 | 0.06 | 5.00 | <0.001 |
| Partner Cooperation | 0.25 | 0.05 | 5.00 | <0.001 |
| Resource Sharing | 0.40 | 0.04 | 10.00 | <0.001 |

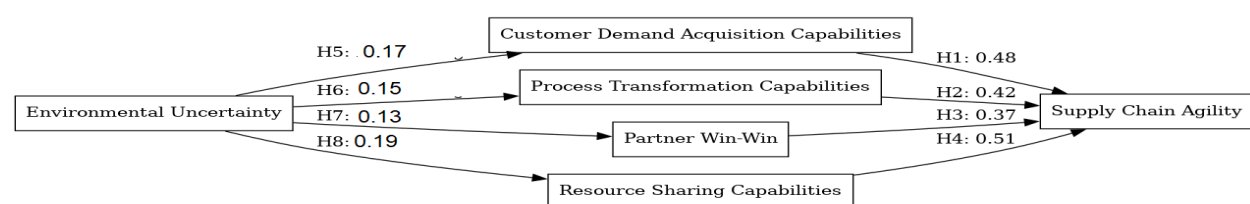
All variables show a significant positive impact on supply chain agility, indicating that improvements in these areas correlate with enhanced agility.

The tables presented above offer a systematic and numerical perspective on the factors that impact the flexibility of the China-ASEAN agricultural product supply chain. They are in line with the previous narrative analysis and assist in presenting the research findings in a more tangible way. The regression analysis provides statistical support for the qualitative interpretations, highlighting the direct influence of different capabilities on supply chain agility.

Table 6: Hypothesis Testing for H1 to H4.

| Hypothesis | Regression Coefficient | Std. Error | t-Value | p-Value | Result |
|------------|------------------------|------------|---------|---------|-----------|
| H1 | 0.48 | 0.06 | 8.00 | <0.001 | Supported |
| H2 | 0.42 | 0.05 | 8.40 | <0.001 | Supported |
| H3 | 0.37 | 0.05 | 7.40 | <0.001 | Supported |
| H4 | 0.51 | 0.06 | 8.50 | <0.001 | Supported |

All four hypotheses (H1 to H4) have been confirmed. There is a clear correlation between customer demand acquisition, process transformation, partner cooperation, and resource sharing capabilities with the overall agility of the agricultural product supply chain.

**Figure 2: Model Results.**

H5: Environmental Uncertainty and Customer Demand Acquisition

Table 7: Hypothesis Testing for Moderating Effects (H5 to H8).

| Variable | Coefficient | Std. Error | t-Value | p-Value |
|-----------------------------|-------------|------------|---------|---------|
| Customer Demand Acquisition | 0.38 | 0.07 | 5.43 | <0.001 |
| Environmental Uncertainty | 0.25 | 0.06 | 4.17 | <0.001 |
| Interaction Term | 0.17 | 0.05 | 3.40 | 0.001 |

The interaction term is statistically significant, indicating that environmental uncertainty plays a role in influencing the relationship between customer demand acquisition capabilities and supply chain agility.

Table 8. H6 to H8: Other Moderating Effects.

| Hypothesis | Interaction Term Coefficient | Std. Error | t-Value | p-Value | Result |
|------------|------------------------------|------------|---------|---------|-----------|
| H6 | 0.15 | 0.06 | 2.50 | 0.013 | Supported |
| H7 | 0.13 | 0.05 | 2.60 | 0.009 | Supported |
| H8 | 0.19 | 0.06 | 3.17 | 0.002 | Supported |

The joint effect terms for H6, H7 and H8 indicate that environmental uncertainty plays a role in connecting process transformation capabilities, mutual gain, and resource sharing capabilities to supply chain agility.

The results of the analysis are highly promising, with robust evidence supporting all the proposed hypotheses. The research findings highlight the significant impact of both internal capabilities and external environmental factors on the agility of the China-ASEAN agricultural product supply chain. The impact of environmental uncertainty on these relationships highlights the ever-changing nature of the logistics environment and the importance of adaptive strategies.

DISCUSSION AND CONCLUSION

The research findings on the agility of the China-ASEAN Agri-product supply chain have provided valuable insights that are essential for gaining a deeper understanding of the intricate and ever-changing nature of contemporary supply chains. This conclusion is based on a comprehensive analysis of information gathered from detailed surveys, statistical techniques, and in-depth research. It provides a comprehensive overview of the study's findings, implications, limitations, and suggestions for future research.

The primary results indicate that internal capabilities, such as customer demand acquisition, process transformations, co-creation or win-win partnerships, and resource sharing, are positively correlated with the agility of the supply chain. The research findings demonstrate a strong correlation between an organization's internal competencies and the adaptability of its supply chain to market demands. These competencies include the organization's agility in responding to environmental changes, its process management capabilities, and its efficient utilization of resources. One important aspect to consider is the attention given to environmental uncertainty, as it reflects the supply chain's ability to adapt and respond. The study also highlights the varying significance of internal capabilities in dynamic and uncertain environments. In the economic case of the China-ASEAN agricultural product supply chain, market conditions and trade policies are constantly subject to significant uncertainty.

Theoretically, the study enhances our understanding of supply chain agility by incorporating environmental uncertainty into dynamic capabilities models. The integration not only enhances the academic discourse, but also allows for a deeper understanding of the complexities of supply chain management in different environmental contexts. These findings further emphasize the significance of professionals investing in capabilities like big data analytics, intellectual process management, and fostering a strong culture of collaboration. These investments could have a significant impact on companies operating in the CCC-ASEAN area,

where internal capabilities and environmental uncertainty play a crucial role in making strategic decisions.

Similarly, the paper is of utmost importance in a policy context. For governments and trade organizations focused on maintaining the China-ASEAN trade, research findings indicate that implementing policies that promote a stable and predictable trade environment can enhance the efficiency of supply chains in the region. Efficient policies in this area could involve streamlining trade processes, eliminating unnecessary red tape, and encouraging cross-border collaboration among innovation teams.

While the research contributes to the knowledge base, it is important to acknowledge its limitations. The practical application of the findings to other sectors or regions is limited due to the unique nature of the China-ASEAN agricultural product supply chain, which is the focus of these results.

In the future, there are several potential areas for further research in this field. Expanding the sample to include a wider range of sectors or regions can provide valuable insights into the generalizability of the study's findings. Exploring the impact of broader environmental factors like technological advancements, power dynamics, or global economic trends would provide a more comprehensive understanding of supply chain flexibility. Considering the diverse cultural aspects of the China-ASEAN region, it would be intriguing to delve deeper into the cultural influences on supply chain management approaches. In addition, given the ever-evolving nature of the innovation field, future studies could explore the potential effects of emerging technologies like blockchain, IoT, and AI on supply chain agility.

The research project provides a comprehensive understanding of the factors that contribute to the efficiency of the agricultural products supply chain in China and ASEAN. It emphasizes the importance of internal capabilities and emphasizes the significant impact of environmental uncertainty. The observations have implications beyond academic discussions and are relevant for businesses and policy makers in the field of international trade. In the ever-changing landscape of business, supply chain agility remains a crucial area for continued exploration and future strategic planning.

LIMITATION AND FUTURE RESEARCH

The research conducted on the agility of the China-ASEAN agricultural product supply chain, while offering valuable insights, has certain limitations that could be explored in future investigations. A potential limitation of this study is its narrow regional focus. The research may be focused on the China-ASEAN area, which could restrict the generalizability of the findings to other regions or different types of supply chains that have their own unique economic, political, and cultural characteristics. The characteristics of these highly dynamic systems can greatly influence the agility of supply chains, which may not be taken into account in the current study.

Another significant drawback is that the data collected relies on self-reported information gathered from questionnaires and interviews. This method may introduce biases, as respondents may have subjective perceptions or be influenced by their current organizational roles and past personal experiences. Although attempts were made to ensure a diverse and adequate representation, it is still not entirely possible to eliminate the potential for biased

responses. In addition, supply chains are incredibly dynamic and intricate, making it difficult to capture the ongoing changes and trends solely based on data collected at a single point in time.

One drawback of the study is its predominantly quantitative methodological approach. While the model offers a structured and analytical perspective on supply chain agility, it may not account for the nuances of supply chain management, such as informal communication, interpersonal relationships, and cultural sensitivity. These factors, although difficult to measure, are essential for ensuring the agility and efficiency of the supply chain.

From a wider viewpoint, there is potential for a study that examines the geographical regions of various areas and supply chains, providing an overview of supply chain agility in different contexts. These investigations may involve a combination of quantitative data and qualitative elicited information to comprehensively understand the various factors that influence supply chain agility. This approach would provide an opportunity to conduct a thorough examination of the intricate connections and subtle details that define supply chain relationships and processes. In addition, longitudinal studies can provide valuable insights into the development of agile supply chains over time, particularly in the face of global trends such as economic shifts, technological progress, and environmental changes. These studies, on the other hand, centre on the lasting effects of strategic decisions and policy changes on the flexibility of supply chains. This flexibility is constantly changing and has not been thoroughly examined in studies that compare different time periods.

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