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Modeling the Key Factors Influencing the Collaboration in Fresh Produce Supply Chain

Fengzhao Yin[1], May Chiun Lo[2], Abang Azlan Mohamad[3], Kit Yeng Sin[4]

Abstract

This study aims to elucidate the key factors driving collaboration within the fresh produce supply chain (FPSC) by conducting a comprehensive literature analysis and examining the interrelationships of these factors to pinpoint the most influential ones. Employing Interpretive Structural Modeling (ISM) alongside the Matrice d'Impacts Croisés-Multiplication Appliquée à un Classement (MICMAC) method, and complemented by content analysis for factor identification, this research identifies a collaboration culture as the paramount factor influencing collaborative behaviors in FPSCs. The study's scope is confined to internal factors, omitting external influences like government policies, logistics infrastructure, and financial support. The insights gleaned are intended to guide managers and policymakers towards enhanced understanding and strategic decision-making that foster collaboration in FPSCs, thus contributing to the achievement of sustainable development goals within this sector.

Keywords: *Fresh products; Supply chain; Collaboration; Key factors.*

1. Introduction

Attaining sustainable development within Fresh Produce Supply Chains (FPSCs) is a complex challenge, compounded by an array of social, environmental, and economic obstacles. The advent of the COVID-19 pandemic has exacerbated these challenges, adversely impacting FPSCs and leading to considerable delays in delivering fresh food to consumers at retail and wholesale levels. These disruptions can be attributed to a confluence of factors, including labor shortages, congested ports, elevated input costs, diminished road transport efficacy, and regulatory constraints.

A supply chain is conceptualized as an interconnected network comprising three or more entities—organizations or individuals—engaged in the bidirectional flow of products, services, finances, and information from the point of origin to the end consumer(Krykavskyy et al., 2023; Mugurusi et al., 2021; Oliveira et al., 2022). Supply Chain Management (SCM) involves the strategic and systematic coordination of conventional business functions and policies both within a particular enterprise and across the network of businesses constituting the supply chain, aiming to optimize the long-term efficacy of both individual entities and the supply chain collectively (Haleem & Sufiyan, 2021; Min et al., 2019; Oliveira et al., 2022). Supply Chain Collaboration (SCC) represents a multi-tiered collaborative effort that leverages the external business environment to amplify a firm's competitive edge(Aggarwal et al., 2020; Stefansson &

[1] Faculty of Economics and Business, Universiti Malaysia Sarawak, 94300, Kota Samarahan, Malaysia
Weifang Institute of Technology, 262500, Weifang City, Shandong, China
[2] Faculty of Economics and Business, Universiti Malaysia Sarawak, 94300, Kota Samarahan, Malaysia
[3] Faculty of Economics and Business, Universiti Malaysia Sarawak, 94300, Kota Samarahan, Malaysia
[4] Sunway Business School, Sunway University, Sunway City, Selangor, Malaysia

Russell, 2008; Yi et al., 2016) . The current discourse on SCC is vigorous, reflecting its criticality: empirical evidence suggests that enterprises engaging in efficacious supply chain collaboration report marked reductions in costs and inventory levels alongside enhancements in operational efficiency, service quality, and consumer satisfaction.

The perishable nature of fresh produce necessitates an intensified focus on timely delivery, setting it apart from other goods and imposing more stringent management requirements within the supply chain. To ensure the seamless integration of various stages such as production, procurement, storage, transportation, processing, and sales into a cohesive system, a profound comprehension of SCM principles is indispensable for both agricultural producers and production companies. Against this backdrop, this paper seeks to explore the following research questions:

2. Literature review

2.1 Theoretical perspectives

The theoretical perspectives on supply chain management underscore the significance of collaborative management, stakeholder engagement, and critical success factors. Collaborative management, rooted in Ansoff's synergy concept, is pivotal for enhancing operational efficiency within supply chains through the strategic alignment and integration of stakeholder activities, focusing on shared objectives and resource optimization. Freeman's stakeholder theory extends beyond profitability to include the social responsibilities of organizations, advocating for a balanced consideration of all stakeholder interests in decision-making processes, thereby serving as an ethical and strategic means to achieve a competitive edge. The critical success factors theory highlights the necessity for organizations to recognize and manage a core set of essential elements—typically five to nine—to maintain competitiveness and achieve their mission, as neglecting these can impede goal attainment. Together, these theories provide a comprehensive framework for understanding the dynamics of supply chain management and the importance of collaboration, stakeholder consideration, and focused strategic planning.

2.2 Causes of Management Collaboration in FPSCs

Moon et al. (2020) suggest that the competitive edge of agricultural products depends on the collective efforts within a unified supply chain rather than isolated actions by individual entities. Effective FPSC management requires aligning individual and collective goals through systematic and comprehensive approaches to maximize benefits. The FPSC network, comprising farmers, co-ops, processors, logistics, retailers, and consumers, operates collaboratively, respecting mutual service boundaries and adhering to standardized protocols to enhance supply chain efficiency.

This collaboration is evident in decision-making and logistics. Companies within the FPSC align closely in their decisions, jointly analyzing market trends to devise unified production, procurement, and inventory strategies that reduce costs throughout the supply chain. In today's multi-channel retail environment, logistics integration is vital, including efficient distribution, returns handling, and after-sales support. Failures in last-mile delivery or return processes can significantly undermine supply chain performance.

2.3 Problem Statement

The distribution and production patterns of fresh produce are notably varied, which sets them apart from practices in other countries. In the U.S., agriculture is marked by high specialization, regional clustering, and large-scale production. Japan primarily uses a lengthy distribution process involving multiple stages of wholesale markets. In contrast, the U.S. favors a shorter distribution system focused on large-scale distribution centers. China's approach to product circulation is more complex and varied, featuring both multi-tiered wholesale markets and direct sales to supermarkets. However, compared to more developed systems, China's fresh produce market still requires significant improvements in the organizational abilities of its main distributors and the development of its distribution infrastructure.

2.4 Research gap

This study suggests that for successful supply chain collaboration in agriculture, indirect management of the chain is crucial. This involves aspects such as cooperative initiatives, shared tasks, a culture of partnership, adaptability, trust, dedication, the balance of power, continual progress, coordination, and consistency. These elements require joint action by all enterprises within the supply chain to reach common goals. Consequently, there's a need to deepen the understanding of how these variables interact by creating a standardized scale for measuring their interrelations, followed by an in-depth examination of how these factors are connected.

3. Research Method

3.1 Data collection method

The semi-structured interview is a commonly employed approach for data collection in the field, particularly when dealing with intricate matters (DiCicco-Bloom & Crabtree, 2006). The primary qualitative research methods employed in this study encompass literature research and expert interviews. The literature review focused on identifying the key factors that influence the fresh supply chain. Based on these factors, an interview outline was developed and expert interviews were conducted. Consultation with experts was conducted to determine the appropriate representative factors and establish the contextual relationship between these factors.

Table 1 Profile of Experts

Number	Years of Experience	Area of Expertise	Area of Expertise	Role in supply chain	Designation
1	20	Academics	Fresh supply chain		Professor
2	13	Academics	logistics and supply chain		Professor
3	8	Academics	Food policy		Associate Professor
4	7	Academics	Agribusiness		Associate Professor
5	12	Academics	Fresh supply chain		Associate Professor
6	11	Industry		Inputs	Senior Manager
7	16	Industry		Harvesting and Inventory	Senior Manager
8	6	Industry		Procurement	Chief Executive
9	8	Industry		Transportation	Senior Manager
10	9	Industry		Retail	Senior

3.2 Data analysis method

3.2.1 ISM analysis

The Interpretive Structural Modeling (ISM) approach breaks down a complicated system into its constituent elements, harnesses empirical knowledge through its practical use, leverages computer technology, and constructs a layered hierarchical model by further dissecting the complex system. The main use of ISM is to tackle issues involving numerous elements and their complex interconnections. This method not only methodically dissects the structure of the factors at play but also delineates the cause-and-effect relationships among them. However, the conclusions drawn from the model are largely based on personal experience, which necessitates careful consideration when identifying and selecting the factors to be included.

3.2.2 Development of structural self-interaction matrix (SSIM)

Creating the structural self-interaction matrix (SSIM) begins with gathering insights from specialists via individual interviews. To clarify the connections among critical factors, a series of comparative questions was crafted, totaling 42 in number (7*7-42). Experts were asked to evaluate each pair's relationship, signaling agreement or disagreement. Moreover, these factors' interconnections are explored and measured as SSIM using the VAXO method. Table 3 presents the constructed SSIM to illustrate the connections between factors. The interpretation of relationships within the SSIM is facilitated by four symbols: "V" denotes that factor 'i' promotes the success of factor 'j'; "A" suggests that factor 'j' contributes to the success of factor 'i'; "X" indicates a reciprocal facilitation between factors 'i' and 'j'; and "O" signifies no relationship between the two factors.

3.2.3 Reachability Matrix

Table 4 presents the initial reachability matrix, which is derived from the SSIM by applying specific conversion rules:

a. When 'V' is the SSIM entry for a pair (i, j), it translates to '1' in the reachability matrix for (i, j) and conversely, '0' for (j, i).

b. An 'A' entry for (i, j) in the SSIM leads to a '0' for (i, j) and a '1' for (j, i) in the reachability matrix.

c. An 'X' in the SSIM for (i, j) results in both (i, j) and (j, i) being assigned a '1' in the reachability matrix.

d. An 'O' entry for (i, j) in the SSIM means that both (i, j) and (j, i) will be assigned a '0' in the reachability matrix.

3.2.4 MICMAC analysis

The MICMAC method, or Matrix of Cross-Impact Multiplications Applied to Classification, is primarily utilized to assess the relationships of influence and dependence among various elements within a system. Mathiyazhagan et al. (2013) state that its findings can be depicted using coordinate axes.

a. Dependence levels are plotted on the horizontal axis (abscissa), while the driving power is represented on the vertical axis (ordinate).

b. To determine the driving power of a factor, one sums up the number of '1' entries in the row of the matrix corresponding to the influencing factor Fi, which gives us the driving force $D_i = \sum f_i$.

c. The dependency of a factor is calculated by tallying the number of '1' entries in the column of the matrix where the influencing factor Fi appears, thus the dependency $R_j = \sum f_j$.

d. A higher driving force indicates a stronger impact that a factor has on others; similarly, a higher dependency shows a greater level of a factor's reliance on other influencing elements. The statistical outcomes for both driving force and dependency are then analyzed.

4. Results

4.1 Outcomes of content analysis

Through this process, a list of factors important for the given problem area was identified from the shortlisted research articles and is presented in Table 2.

Table 2 Collaboration factors

First-Order	Second-Order	Literature
Sharing activities (F1)	Information Sharing Risk sharing Benefit sharing	Makalew et al. ,2019; Simatupang & Sridhharan,2005; Ghicuru et al. ,2015
Culture and value (F2)	Organizational Culture Collaborative Culture Innovation Culture Customer Culture Quality Culture	Giedelmann-L et al., 2022; Frankish et al., 2021; Kumar et al.,2019; Aharonovitz et al. ,2018; Tsanos et al. ,2014
Adaption (F3)	Product Adaptation Technological Adaptation Environmental Adaptation Market Adaptation	Khan et al., 2023; Li et al., 2023; Jermsittiparsert & Kampoomprasert, 2019; Dania et al. ,2018; Eckstein et al., 2015; Ivanov & sakolov ,2012
Trust (F4)	Supplier Trust Customer Trust Partnership Trust Brand Trust Information Trust	Feng et al., 2022; Zhang & Su, 2020; Aharonovitz et al.,2018; Jacob-John & Veerapa, 2015
Commitment (F5)	Supplier Commitment ; Customer Commitment Internal Commitment Environmental Commitment Partnership Commitment	Siddh et al., 2022; Ül Kirci et al., 2022 Gokarn & Kuthambalayan, 2019 Slamet et al. ,2015
Coordination (F6)	Production Coordination Procurement Coordination Logistics Coordination	Handayati et al. ,2015 S. Tsanos et al. ,2014

	Retail Coordination	
Performance improvement (F7)	Timeliness Performance Cost Performance Quality Performance Flexibility Performance Sustainability Performance	Liu & Guo, 2021 Rodríguez et al., 2018 Zhong er al. ,2017 Gardas et al. ,2018 Yu et al. ,2018 Rong et al. ,2011

4.1.1 Sharing activities

In supply chains, collaboration is rooted in fair benefit distribution, shared risks, and transparent communication, essential for trust and unity (Dania, 2018). However, entities may engage in self-serving "free-rider" behavior, harming the collective interest. Information sharing positively affects quality (Lusiantoro et al., 2022) and, along with external integration, improves flexibility and operational performance (Yu et al., 2018). Risk sharing enhances resilience (Zhou et al., 2019), while benefit sharing boosts cooperation and performance, especially in forecasting and quality in the fresh food sector (Dan et al., 2023).

4.1.2 Culture and value

El Baz, J. and Iddik, S. (2022) emphasize the importance of a collaborative culture in organizations for co-creation and value addition in supply chains. Cultural clashes between various enterprises, particularly as the network expands, pose a challenge to collaboration. Effective cooperation requires cultural alignment among member companies; otherwise, partner selection should be cautious. Within fresh supply chain management, a shared cultural foundation is crucial for ensuring product quality and consistency (Giedelmann-L et al., 2022). Embracing innovation, focusing on customer needs, and maintaining quality standards (Frankish et al., 2021) are key cultural dimensions that enhance the efficiency and reliability of the fresh supply chain.

4.1.3 Adaption

Adaptability in supply chains is the ability to reconfigure in the face of market shifts, disruptions, and changing consumer behaviors to maintain effectiveness (Eckstein et al., 2015). This adaptability is essential for collaborative efforts within organizations to manage and respond to changes effectively. In fresh supply chain management, adaptation encompasses product, technology, market, and environmental aspects. Product adaptation aligns offerings with consumer needs and preferences; technological adaptation adopts new efficiencies and reliability measures (Jermsittiparsert & Kampoomprasert, 2019; Li et al., 2023). Market adaptation adjusts strategies to remain competitive, and environmental adaptation aims to meet sustainability goals by reducing energy use and emissions (Khan et al., 2023). Understanding these adaptive dimensions helps supply chain managers respond swiftly to market dynamics, boosting efficiency, cutting costs, and satisfying demands for fresh products.

4.1.4 Trust

Trust is a cornerstone of supply chain collaboration, significantly enhancing integration (Jacob-John & Veerapa, 2015). Trust across partners allows for effective integration across production, operations, sales, and service. In fresh product supply chains, trust manifests in various forms—trust in suppliers, customers, partners, the brand, and information (Feng et al., 2022; Y. Yi et al., 2022). Understanding these trust dimensions helps new supply chain managers develop strategies to build and maintain trust-based relationships. Such trust is vital for collaborative success, reliability, efficiency, customer satisfaction, brand loyalty, and sustainable growth.

4.1.5 Commitment

Partners' commitment to the relationship is necessary to ensure the security of information exchange (Daugherty et al, 2002). In fresh supply chain management, commitment can be divided into several dimensions: supplier commitment, customer commitment, internal commitment, environmental commitment, and partnership commitment.

Supplier commitment refers to the level of commitment suppliers demonstrate towards fulfilling their responsibilities and obligations within the supply chain, such as timely delivery, consistent product quality, reliability, and maintaining cooperative relationships(Gokarn & Kuthambalayan, 2019). Customer commitment involves a long-term commitment to collaboration, stable order placements, and timely payment obligations. Internal commitment involves the commitment of internal stakeholders towards shared goals, values, and organizational strategies. Environmental commitment addresses the commitment of supply chain participants towards environmental sustainability and responsibility, promoting sustainable resource utilization and conservation(Ül Kirci et al., 2022).

Partnership commitment involves information sharing, mutual support, risk-sharing, and fostering mutually beneficial relationships. By understanding these dimensions of commitment, fresh supply chain managers can develop a comprehensive understanding of the role of commitment within the supply chain, which can inform strategies and measures to enhance commitment levels. This contributes to fostering stability, collaboration, and sustainability, improving customer satisfaction, and driving sustainable development.

4.1.6 Coordination

Effective coordination in collaborative organizations streamlines operations, cuts supply chain costs, and standardizes outputs (Chen, 2005; Msaddak et al., 2017). In fresh supply chains, coordination spans production, procurement, logistics, and retail (Zhou et al., 2019). Production coordination aligns activities across the supply chain to ensure efficient production and delivery. Procurement coordination harmonizes supplier interactions and material sourcing. Logistics coordination integrates inventory, transport, and warehousing to move products efficiently (Song & He, 2019). Retail coordination ensures that consumer demand is met promptly (Yan et al., 2020). Managers in fresh supply chains can leverage these coordination aspects to enhance efficiency, quality, customer satisfaction, and overall supply chain sustainability and success.

4.1.7 Performance improvement

In fresh supply chain management, performance enhancement spans several key areas. Timeliness is essential for fulfilling customer needs promptly and boosting supply chain effectiveness (Liu & Guo, 2021). Cost performance targets the reduction and optimization of expenses across the supply chain. Emphasis on quality ensures products meet high standards, securing customer trust and brand integrity. Flexibility allows the supply chain to adapt to dynamic market conditions and disruptions (Rodríguez et al., 2018). Sustainability focuses on the supply chain's environmental, social, and ethical impacts, promoting green practices and social accountability (Gardas et al., 2018). Managers can utilize these performance metrics to pinpoint improvement opportunities and devise strategies to strengthen each aspect, leading to a more efficient, effective, and sustainable fresh supply chain.

4.2 Outcomes of ISM analysis

4.2.1 SSIM

Based on the outcome of the contextual relationships and semi-structured interview, the SSIM is developed for the selected key factors, which is presented in Table 3.

Table3 Structural Self-Intersection Matrix (SSIM)

S/N	Factors	F1	F2	F3	F4	F5	F6	F7
F1	Sharing activities	-	O	O	V	A	O	V
F2	Culture&Value		-	V	V	O	O	O
F3	Adaption			-	O	O	O	V
F4	Trust				-	V	O	O
F5	Commitment					-	V	O
F6	Coordination						-	V
F7	Performance improvement							-

4.2.2 Reachability Matrix

According to the content of Table 3, the initial reachable matrix can be obtained, and the final reachable matrix can be calculated according to the initial reachable matrix.

Table 4 Reachability matrix

(a) Initial reachability matrix

S/N	F1	F2	F3	F4	F5	F6	F7
F1	0	0	0	1	0	0	1
F2	0	0	1	1	0	0	0
F3	0	0	0	0	0	0	1
F4	0	0	0	0	1	0	0
F5	1	0	0	0	0	1	0
F6	0	0	0	0	0	0	1
F7	0	0	0	0	0	0	0

(b) Final reachability matrix

S/N	F1	F2	F3	F4	F5	F6	F7	Driving power
F1	1	0	0	1	1	1	1	5
F2	1	1	1	1	1	1	1	7
F3	0	0	1	0	0	0	1	2
F4	1	0	0	1	1	1	1	5
F5	1	0	0	1	1	1	1	5
F6	0	0	0	0	0	1	1	2
F7	0	0	0	0	0	0	1	1
Dependence Power	4	1	2	4	4	5	7	27/27

4.2.3 level partitions

In this study, all seven factors achieved their level after four times of iteration as shown in table 4. These four levels will help in developing the ISM base model.

Table 4 label partition for factors: iteration I-iteration IV

	Reachability set	Antecedent set	Intersection set	Level
Iteration I				
1	[1, 4, 5, 6, 7]	[1, 2, 4, 5]	[1, 4, 5]	
2	[1, 2, 3, 4, 5, 6, 7]	[2]	[2]	
3	[3, 7]	[2, 3]	[3]	
4	[1, 4, 5, 6, 7]	[1, 2, 4, 5]	[1, 4, 5]	
5	[1, 4, 5, 6, 7]	[1, 2, 4, 5]	[1, 4, 5]	
6	[6, 7]	[1, 2, 4, 5, 6]	[6]	
7	[7]	[1, 2, 3, 4, 5, 6, 7]	[7]	I
Iteration II				
1	[1, 4, 5, 6,]	[1, 2, 4, 5]	[1, 4, 5]	
2	[1, 2, 3, 4, 5, 6]	[2]	[2]	
3	[3]	[2, 3]	[3]	II
4	[1, 4, 5, 6]	[1, 2, 4, 5]	[1, 4, 5]	
5	[1, 4, 5, 6]	[1, 2, 4, 5]	[1, 4, 5]	
6	[6]	[1, 2, 4, 5, 6]	[6]	II
Iteration III				
1	[1, 4, 5, 6]	[1, 2, 4, 5]	[1, 4, 5]	III
2	[1, 2, 4, 5]	[2]	[2]	
4	[1, 4, 5]	[1, 2, 4, 5]	[1, 4, 5]	III
5	[1, 4, 5]	[1, 2, 4, 5]	[1, 4, 5]	III
Iteration IV				
2	[2]	[2]	[2]	IV

4.2.4 Ism-based model

Taking the reachability matrix as the criterion, divide the different positions of the elements in the system into reachable sets and antecedent sets, let the reachable set be R(Fi), which is determined by the value of the i-th row of the reachable matrix M. The factors corresponding to the column of the reachability matrix M; let the first row set be A(Fi), which is composed of the factors corresponding to the rows whose value is 1 in the column of the reachable matrix M; then R(Fi) and A(Fi), the results are shown in Table 1. The highest-level element T={Fi∈F|R(Fi)=R(Fi)∩A(Fi)}, as shown in Table 1, T={F7}, which means that F7 cannot reach other factors Let L1={F7}. Delete the 7th row and 7th column corresponding to F7 from the reachability matrix M, and find a new highest-level element from the remaining matrix of M, let the highest-level element be L2={F3 F6}, the calculation process is shown in Table 2 shown.

According to the principle of {Fi∈F|R(Fi)=R(Fi)∩A(Fi)} and so on, L3={F1 F4 F5}; L4={F2};

4.3 Outcomes of Micmac analysis

Considering the summated values of each factor, a graph is plotted for each factor by treating the dependence and driving power of each factor as X and Y coordinates, respectively, as shown in Fig.2.

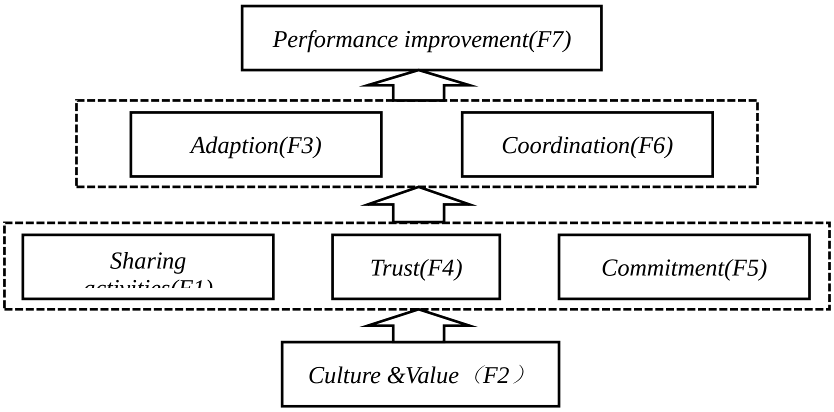

Fig.1. ISM based hierarchical model of factors

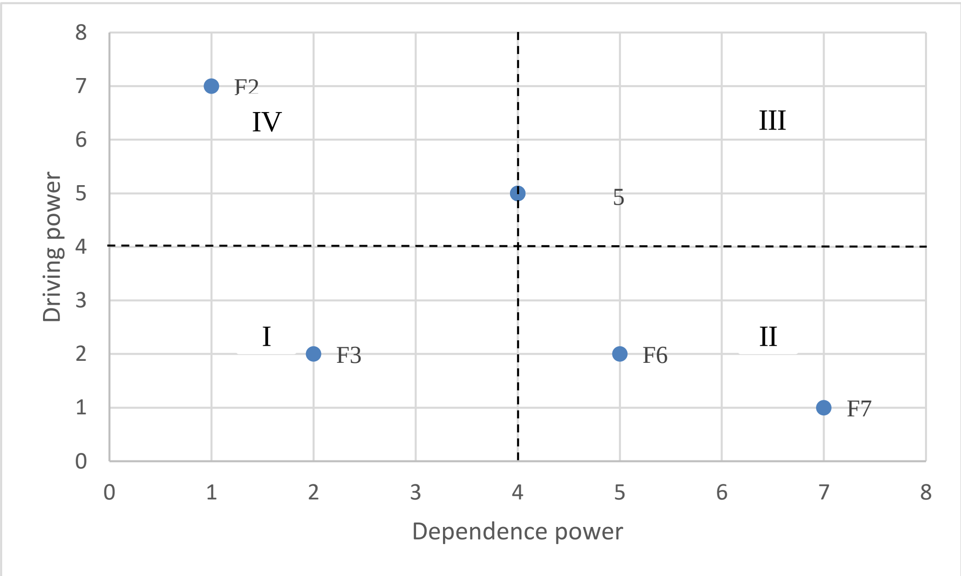

Fig.2. ISM based hierarchical model of factors

The results of MICMAC analysis are represented through a graph divided equally into four clusters, namely: autonomous(I), dependent (II), linkage(III), and independent(IV).

Autonomous factors group: The factors located in the first quadrant(I) are low in driving force and dependency, relatively independent, and less susceptible to other factors, which are intervention factors affecting supply chain collaboration. The factor in this group is adaption F3.

Dependent factors group: The factors located in the first quadrant (II) are coordination F6 and F7. These factors are greatly affected by other factors in the system, are at the upper level of the explanatory structure model, can be effectively controlled through the management of their related factors, and are the target factors affecting supply chain collaboration.

Linkage factors group: The factors located in the third quadrant (III) have high driving and dependence power. The linkage factors are unstable and any action on them will reflect the impact on others. This group contains sharing activities (F1), trust(F4), and commitment(F5).

Independent factors group: The factors located in the fourth quadrant (IV) are highly motivating and have a large impact on the rest of the system, are located deep in ISM and are the fundamental factors affecting supply chain collaboration. Although they do not have a direct impact on the effectiveness of supply chain collaboration, other factors are greatly influenced by them, so they should be put in a first-mover position in the work of promoting supply chain collaboration. The factors in this group is culture &value(F2).

5. Discussion

The direct factor influencing FPSC collaboration is performance improvement. Enhancing the resilience of the agricultural product supply chain bolsters the stability of agricultural product supply, while increasing the response speed of the supply chain ensures faster responsiveness to customer needs, and improving security guarantees the quality of agricultural products.

The initial influencing factors of FPSC collaboration involve adaptation and coordination. Adaptation involves enterprises adapting to environmental and demand changes, improving the quality and safety of fresh products. Coordination involves close cooperation between channels and enterprises to solve problems like procurement, storage, transportation, and sales. Conflicts are inevitable, but effective communication and conflict resolution can promote collaboration and maintain cooperative relationships.

The intermediate influencing factors for FPSC collaboration encompass sharing activities, trust, and coordination. The establishment of effective supply chain collaboration is contingent upon the presence of mutual trust, as it serves as a catalyst for fostering enduring and reliable cooperation. The act of sharing information is an essential prerequisite for fostering collaboration within supply chains. In instances where information is withheld or shared unevenly, supply chain participants tend to adopt individualistic viewpoints. This phenomenon not only impedes the prompt comprehension of the authentic requirements of partners situated upstream and downstream but also has the potential to result in erroneous market forecasts and actions that undermine the cooperation among members of the supply chain.

The fundamental influencing factor of FPSC collaboration is culture and value, which holds the greatest significance. Culture and values serve as the fundamental basis of soft power, exerting influence on supply chain collaboration as an underlying factor. The phenomenon exerts a significant impact on the formulation of development strategies, the adoption of business philosophies, and the implementation of management modes within enterprises. The disparities in cultural norms, managerial concepts, and core principles among nodal enterprises contribute to heightened conflict potential, consequently amplifying the risks associated with collaborative efforts within supply chain enterprises.

6. Conclusion

In conclusion, this article has thoroughly examined the various factors influencing collaboration within fresh produce supply chains (FPSC), revealing the importance of performance improvement, adaptation, coordination, trust, information sharing, and culture. The multi-layered agents have revealed the direct factors, initial influencing factors, intermediate influencing factors, and fundamental influencing factors that contribute to successful FPSC collaboration. Understanding these elements is critical in enabling both individual enterprises and the overall supply chain to effectively respond to consumer demand, optimize operations, and establish long-term stability.

This study has identified the value of addressing conflicts through effective communication, building trust through transparency, and promoting a cultural alignment amongst supply chain partners. By considering these factors, FPSC stakeholders can foster collaboration, reduce risks, cut operational costs, drive innovation, and ensure the delivery of high-quality products to consumers. Ultimately, these collaborative efforts contribute to enhancing the resilience and sustainability of the agricultural supply chain.

Notwithstanding the elucidations offered in this article, there exist constraints that necessitate additional investigation. This study primarily relies on a comprehensive review of existing literature and theoretical frameworks to examine the various factors that influence collaboration in the field of FPSC. Future research would be enhanced by the inclusion of empirical evidence derived from both qualitative and quantitative data, thereby establishing a more robust and solid theoretical framework.

Furthermore, the primary focus of this article pertains to agricultural supply chains, thereby limiting its generalizability to other categories of supply chains. It is imperative to recognise that different supply chain industries possess distinct attributes and obstacles, necessitating customised approaches to foster collaboration.

Thirdly, it is worth noting that this article has provided an overview of various significant elements that impact supply chain collaboration. However, it is important to acknowledge that certain aspects, including legislation, infrastructure, and technological advancements, have not been thoroughly examined in this context. Further investigation is warranted to delve into these themes in order to gain a comprehensive comprehension of the dynamics of collaboration within the field of FPSC.

In light of these limitations, further research is encouraged to analyze the intricate dynamics of FPSC collaboration more comprehensively. By expanding the scope of the investigation, we can deepen our understanding of the supply chain ecosystem and support the development of more efficient, sustainable, and resilient systems that cater to an ever-evolving global market.

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