Identification, Analysis, and Prioritization of Effective Components of Agricultural Commodity Exchange with a Financial Foresight Approach

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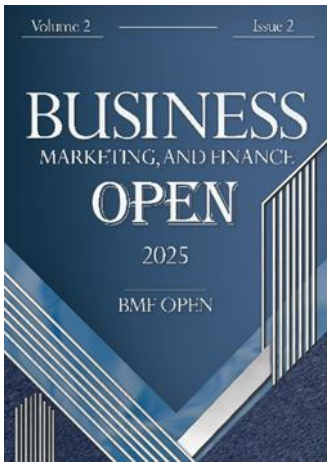

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Abstract: The present study was conducted to identify and analyze the effective components of the agricultural commodity exchange with a scenario planning approach and to identify and analyze the scenarios of the agricultural commodity exchange. In this study, the cross-impact analysis method was used. In fact, 30 effective indicators in realizing the creative city were compared in pairs, and the impact of these factors on each other was evaluated using expert questionnaires in MICMAC software. The results of the studies showed that 10 factors (culture and society, government policies, market and demand, technology and innovation, human resources, infrastructure, risk and crisis management, international interactions, sustainability and environment, and supply chain) can be considered as key factors in the agricultural commodity exchange. To develop scenarios for the agricultural commodity exchange, a scenario portfolio was prepared for the 10 key factors; in such a way that for each factor, three optimistic, intermediate, and pessimistic assumptions were considered. In total, 21 possible situations were designed, and based on the combination of 21 possible situations, 2187 combined scenarios were extracted, which include all possible situations and future developments of the agricultural commodity exchange. Based on the results of the Scenario Wizard software, an inconsistent assumption was found in the "culture and society" component. For each of the components of "government policies," "market and demand," "technology and innovation," "human resources," "infrastructure," "risk and crisis management," "international interactions," "sustainability and environment," and "supply chain," the selected assumption is supported by other scenario assumptions, and none of the other assumptions contradict it. The selected assumption was evaluated as consistent. Overall, this analysis shows that the presented scenario, despite the inconsistency in the "culture and society" component, has relatively good consistency in other components.

Keywords: Effective components, commodity exchange, scenario planning, financial foresight

1. Introduction

In economic crisis conditions, the optimal allocation of resources, which naturally become more limited, requires new strategies and perspectives. Therefore, all mechanisms and policies must be designed to protect the economy from threats and facilitate the path to achieving the country's goals. Iran, which has always faced hostilities and resisted them, must maintain a resilient economy under these circumstances. Economic resilience means the country's full readiness to cope with difficult conditions, preventing Iran from being caught off guard by

international pressures. Supporting domestic production is one of the fundamental pillars of economic resilience. This support for the agricultural sector and national production, as an endogenous part of the country's economy, is of high importance and has a direct impact on the lives of individuals in society. Given the decline in oil prices and the difficulty in accessing oil revenues, the government must increasingly focus on domestic production and remove existing obstacles to its growth. The Supreme Leader has also emphasized strengthening the production sector in recent years, urging managers and the private sector to prioritize production in their considerations [1].

One of the main obstacles to production growth is price volatility. Managing the risk arising from such fluctuations has been a concern for centuries. Primary commodities such as metals and agricultural products, due to severe price fluctuations, require risk hedging in trading. The inherent price instability, especially in the agricultural commodity market, is one of the main reasons for the establishment of commodity exchanges as organized markets for trading price risk instruments [2].

The Iran Mercantile Exchange (IME) was established in 2007 through the merger of the Iran Metal Exchange and the Agricultural Commodity Exchange, with petrochemical and oil products also added to its portfolio. This exchange comprises three markets: physical, derivatives, and financial, with the primary objective of trading commodities, managing price risk, and providing financial resources. Commodity exchanges, by reducing the high transaction costs typically borne by supply chain participants, can stimulate trade. These markets offer cheaper services compared to the costs incurred outside the exchange framework. Moreover, efficient exchanges can assist in the production, storage, marketing, and processing of agricultural products, enhancing the overall performance of the agricultural sector [3].

On the other hand, it is evident that the future is unpredictable; however, the important point is that organizations can prepare themselves to face it, creating a competitive advantage for them. Considering that the capital market environment, especially the agricultural commodity exchange, is continuously changing and evolving, and since future conditions cannot be easily predicted, it is hoped that by employing foresight and scenario planning methods, the mentioned problems and shortcomings can be addressed .

Foresight involves a set of efforts that, through the analysis of resources, patterns, and factors of change or stability, aim to envision potential futures and plan for them [4]. Foresight is an approach that, by visualizing the future, explores possible and desirable trends to achieve a future drawn within a vision framework [5]. Given that foresight is a multidisciplinary research field providing a broad perspective on human processes and activities, it should not be compared with interdisciplinary studies such as global studies or environmental studies [6].

Lee et al. (2022) examined the relative contribution to the price discovery process of EUR/USD futures in the Chicago Mercantile Exchange (CME) and the Intercontinental Exchange (ICE). The results indicated that a commodity exchange can have one or more potential functions, depending on its nature and local conditions. For exchanges offering cash transactions or support activities, the institutional function of the commodity exchange in facilitating trading—bringing together buyers and sellers and imposing a framework of rules to ensure the trust required for transactions—is evident. Robust oversight procedures for these transactions can also enhance the efficiency and infrastructure of cash commodity markets. From another perspective, the exchange market structurally resembles a perfectly competitive market, where numerous participants enter, observe prices, and trade contracts. Chintapalli and Tang (2021) analyzed the impact of guaranteed purchase policies on agricultural production and farmers' welfare, concluding that such policies increase total crop production and farmers' income [7]. Fiker (2020) explored the development of commodity exchanges in Ethiopia, highlighting that after the failure of international commodity price stabilization programs, the development of commodity futures exchanges gained

traction among economists and international agencies [2]. The successful development of standard exchanges must necessarily be accompanied by steps to improve basic and financial infrastructure, which is crucial for enhancing food security—a significant challenge in the demographic transition of Sub-Saharan African societies. However, fully establishing futures markets may be a significant initial step for most developing countries. Simplice et al. (2020) analyzed the impact of African stock market development on economic growth using a dynamic panel model. Their results showed that the relationship between the financial market and economic growth varies depending on the index used [8]. Economic growth, measured by the real per capita GDP growth rate, is significantly influenced by two other stock market development indices: turnover ratio and stock market liquidity, particularly for emerging markets. Chandio and Xiang (2019) examined the relationship between guaranteed purchase policies and wheat production in Pakistan from 1971 to 2016, concluding that these support policies significantly increased wheat production both in the short and long term [9]. Mojaverian, Eshghi, and Ahangari (2021) studied the impact of the COVID-19 pandemic on the stock value of food companies in the Tehran Stock Exchange. The model estimation showed a relationship between the number of COVID-19 cases and the stock value of food industries, with an increase in cases leading to a decline in the index. Like other economic sectors, the capital market was affected by the pandemic, with rising dollar prices as a competing market negatively impacting the stock price index. Additionally, the relationship between risk and stock value in the food industry revealed an expected inverse relationship, meaning that increased risk led to lower stock prices in the food sector [3]. Amiri et al. (2021) evaluated the regulatory effects of the Iran Mercantile Exchange on commodity price volatility, comparing the price fluctuations of 20 commodities traded on the exchange with 20 off-exchange commodities using their coefficients of variation through the propensity score matching method. The results indicated that commodity listing on the exchange increased price volatility compared to similar off-exchange commodities, attributing this to institutional competitiveness barriers [10].

As observed, numerous studies, both domestic and international, have explored the effects of exchanges on the economies of various countries. Some studies have examined the importance and role of commodity exchanges in the national economy. However, given the lack of a comprehensive study on the role of commodity exchanges in economic growth, this study aims to analyze the effects, interrelationships, and prioritization of components in the agricultural commodity exchange using a financial foresight approach.

2. Methodology

This study is descriptive in nature, providing an accurate description of the subject under investigation. Due to the use of past literature and expert opinions, it is classified as a fundamental research study. The analyses were conducted cross-sectionally within a specific time frame. Finally, given that the objective is to provide practical solutions based on specific needs, it can be considered a fundamental-applied study.

The statistical population for the fuzzy Delphi and scenario planning sections consisted of academic experts and specialists in this field. Snowball sampling was employed, including 14 participants in the fuzzy Delphi section and 10 participants in the scenario planning section. Data collection was conducted using library resources such as books, domestic and international journals, websites, and reputable scientific research and ISI articles.

In the next stage, fuzzy Delphi analysis was used, which is a combination of the Delphi method and data analysis based on fuzzy set theory definitions. Experts typically provide their opinions in the form of minimum, most likely, and maximum values (triangular fuzzy numbers). The values provided by the experts and the level of disagreement among them are calculated as the deviation from the mean. This information is then returned to the

experts for new input. Subsequently, each expert revises or reaffirms their previous opinion based on the results from the prior stage. This process continues until the mean fuzzy values reach the required stability, confirming validity and reliability through theoretical saturation.

In the second stage, to identify key factors and determine robust scenarios using a foresight approach in the agricultural commodity exchange, cross-impact analysis was performed in the MICMAC software environment, along with scenario planning using Scenario Wizard software. Cross-impact analysis addresses the need to assess the likelihood of different events or driving forces independently, as well as the probability of an event occurring in the presence of other events and their mutual influence, based on expert opinions.

The steps in this method include:

(1) Preparing a list of drivers or variables as trends with specific directions.

(2) Creating a diagonal matrix (n x n) for the number of drivers, assessing the extent to which driver A affects driver B, usually on a scale from 0 to 3, where 0 indicates no impact, 1 indicates low impact, 2 indicates moderate impact, and 3 indicates high impact.

(3) Summarizing the results, where the sum of each row indicates the driving power of each variable, reflecting its influence on other variables, and the sum of each column indicates the dependency level of each variable.

(4) Plotting the trends (variables) on a graph with dependency on one axis and driving power on the other.

MICMAC software visualizes the influence and dependency of factors on a conceptual graph formed by two axes representing influence and dependency.

In the next stage, a Scenario Wizard expert panel consisting of 10 specialists in this field was formed. After inviting participants and holding the first panel meeting, the project objectives and the purpose of forming the expert panel were thoroughly explained to create a collaborative environment. Panel members were asked to identify the key descriptors of the research issue.

In the third stage, after identifying the descriptors, panel members were asked to specify the possible future states for each descriptor using verbal expressions.

In the fourth stage, panel members were asked to verbally express the impact of state X of descriptor X on state Y of descriptor Y, ranging from very high to very low impact on a spectrum.

In the fifth stage, the identified impacts were assigned numerical values ranging from 3 to -3 and entered into a matrix, which was then processed and analyzed using the software.

3. Findings and Results

The key factors influencing the agricultural commodity exchange were identified through the Delphi method and questionnaires, resulting in ten main indicators: government policies, market and demand, technology and innovation, human resources, infrastructure, risk and crisis management, international interactions, sustainability and environment, supply chain, and culture and society.

Cross-Impact Analysis Steps

Creating the Cross-Impact Matrix: A 10x10 matrix was created with each indicator placed in rows and columns, where each cell represents the impact of the row indicator on the column indicator.

Evaluating Impacts: The direct impact of each pair of indicators was evaluated quantitatively on a scale from 0 to 3, with 0 indicating no impact and 3 indicating a strong impact.

Interpreting the Matrix: Analyzing the matrix allowed for identifying indicators with the most influence on the system, serving as focal points for system improvement.

Table 1. Cross-Impact Matrix

Indicators	Government Policies	Market and Demand	Technology and Innovation	Human Resources	Infrastructure	Risk and Crisis Management	International Interactions	Sustainability and Environment	Supply Chain	Culture and Society
Government Policies	186	230	221	195	244	177	214	208	204	203
Market and Demand	230	240	264	218	260	207	235	232	245	244
Technology and Innovation	221	264	244	232	270	202	236	248	246	230
Human Resources	195	218	232	186	241	180	207	200	208	217
Infrastructure	244	260	270	241	264	220	244	254	262	246
Risk and Crisis Management	177	207	202	180	220	160	192	196	193	188
International Interactions	214	235	236	207	244	192	210	220	232	226
Sustainability and Env.	208	232	248	200	254	196	220	210	222	231
Supply Chain	204	245	246	208	262	193	232	222	218	222
Culture and Society	203	244	230	217	246	188	226	231	222	206

Cross-impact analysis in the Iranian agricultural commodity exchange system reveals that infrastructure, market and demand, and technology and innovation have been identified as key and influential indicators in this system.

Government Policies: Government policies significantly impact infrastructure and the market but have less influence on risk and crisis management, highlighting the need for more attention to crisis management.

Market and Demand: This factor has the greatest impact on technology, innovation, and infrastructure, with market needs being strong drivers for development. It also has a significant influence on culture and society.

Technology and Innovation: These two factors have the most substantial impact on infrastructure and also affect the market, demand, sustainability, and the environment.

Human Resources: This factor significantly influences infrastructure but has less impact on risk and crisis management.

Supply Chain: The supply chain also has a considerable impact on infrastructure and the market, playing a critical role in meeting market demands.

Sustainability and Environment: This factor greatly influences technology, innovation, infrastructure, culture, and society.

The conclusion from this analysis indicates that improving the performance of the Iranian agricultural commodity exchange requires more attention to infrastructure, market and demand, and technology and innovation. Additionally, indicators such as risk and crisis management need to be enhanced to operate effectively within the system (Figure 1).

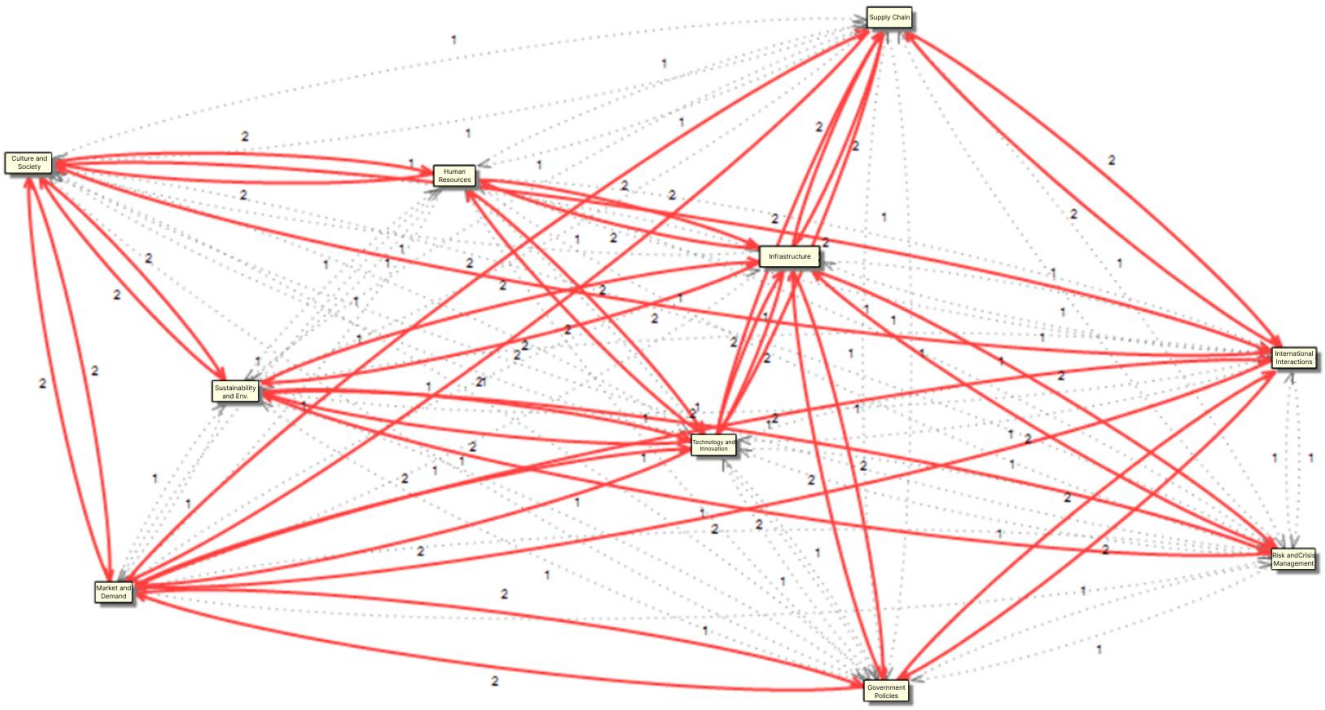

Figure 1. MICMAC Software Output Model

Based on the proposed components and subcomponents, scenario planning was used to examine possible futures for the Iranian agricultural commodity exchange. Table 2 presents the main components and their corresponding drivers, which are considered potential scenarios for each component.

Table 2. Scenario Planning Components

Components	Key Factors
Government Policies (A)	Increased financial support and facilities
	Intensification of regulations and government controls
Market and Demand (B)	Rapid demand growth due to increased exports
	Decline in demand due to economic recession
Technology and Innovation (C)	Widespread adoption of new agricultural technologies
	Resistance to technological changes
Human Resources (D)	Enhanced skills and capabilities of the workforce
	Shortage of skilled labor due to migration
Infrastructure (E)	Development of digital and physical infrastructure
	Insufficient infrastructure investment
Risk and Crisis Management (F)	Improved risk and crisis management systems
	Increased occurrence of unexpected crises
International Interactions (G)	Strengthened international trade relations
	Increased trade tensions and tariffs
Sustainability and Environment (H)	Implementation of sustainable environmental policies
	Aggravation of environmental issues due to climate change
Supply Chain (I)	Optimization and digitization of the supply chain
	Supply chain instability and disruptions due to crises
Culture and Society (J)	Increased public awareness and sustainable consumption
	Cultural resistance to change

Balance:	15	17		19	18		14	21		19	19		19	19		20	18		17	21		19	16		16	15		13	15
A1				1	1		1	2		2	1		1	1		2	2		1	1		3	2		3	2		1	1
A2				2	3		-2	2		2	1		2	2		3	3		1	2		2	2		1	2		1	2
B:																													
B1	1	1					1	2		2	2		3	2		3	2		2	2		1	1		2	1		1	2
B2	2	2					1	2		2	3		2	3		2	2		1	2		1	1		2	2		2	2
C:																													
C1	3	3		2	2					2	2		2	2		2	1		2	2		1	2		2	2		2	1
C2	1	2		2	2					1	2		2	2		2	1		2	2		3	2		1	1		1	1
D:																													
D1	1	2		2	2		1	2					3	2		3	3		2	3		3	3		3	2		2	1
D2	2	2		2	3		1	2					2	2		3	3		3	3		2	3		3	2		3	2
E:																													
E1	2	2		2	2		2	2		2	2					2	2		3	3		3	3		2	1		1	2
E2	3	3		2	3		1	2		2	2					3	3		2	3		2	3		3	2		2	2
F:																													
F1	2	2		3	2		3	3		2	2		2	3					3	3		2	1		2	2		2	2
F2	3	3		2	2		3	2		3	3		2	3					3	3		2	3		3	3		3	3
G:																													
G1	2	2		2	2		2	2		2	2		2	2		2	2					1	2		1	1		1	2
G2	2	2		1	1		2	3		2	1		1	2		1	1					2	1		1	1		1	2
H:																													
H1	2	2		3	2		3	2		3	3		1	2		3	3		2	3					2	3		3	1
H2	3	3		2	3		3	2		3	3		2	2		2	2		2	3					2	2		2	2

Figure 2. Scenario Wizard Software Output

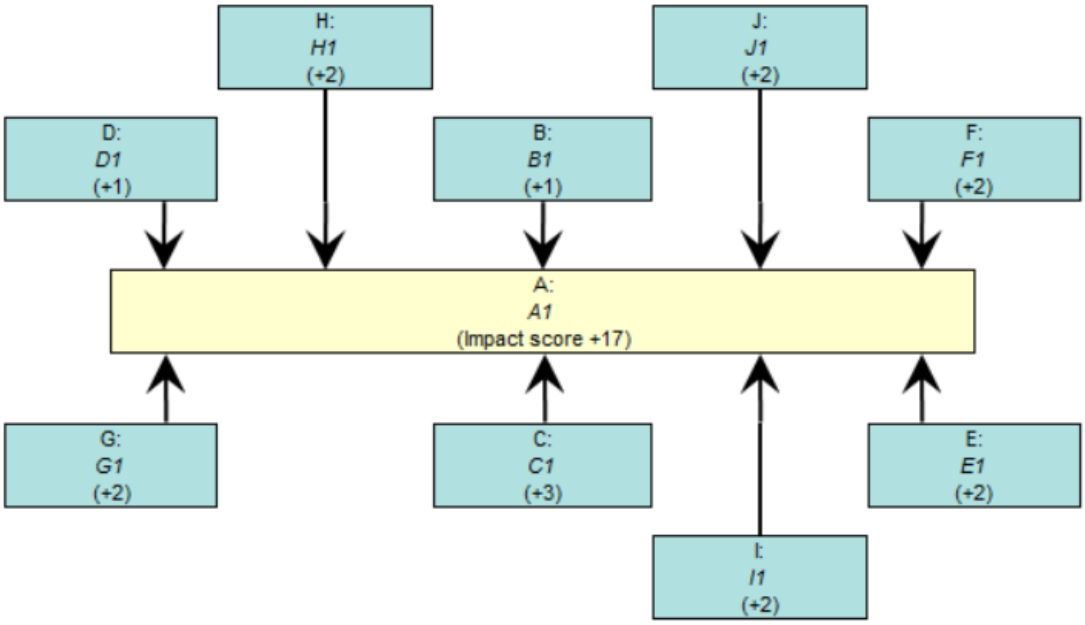

Figure 3. Identified Scenarios Model

Based on the Scenario Wizard software output and the table of components and key factors, the presented scenario includes an inconsistent assumption in the "culture and society" component. For each of the components of "government policies," "market and demand," "technology and innovation," "human resources," "infrastructure," "risk and crisis management," "international interactions," "sustainability and environment," and "supply chain," the selected assumption is supported by other scenario assumptions, with no contradictions from other assumptions.

4. Discussion and Conclusion

The results showed that the strategic model of the Iranian agricultural commodity exchange with a financial foresight approach includes the components of culture and society, human resources, supply chain, sustainability and environment, market and demand, technology and innovation, risk and crisis management, international interactions, infrastructure, and government policies. These results are consistent with the prior findings [1, 3, 6-8, 10-15].

The key philosophy behind the formation of stock markets globally is to aggregate capital and finance companies and their projects through an organized, regulated, continuous, and transparent market system. The fundamental basis of these markets is the original and simple concept of partnership, sharing potential profits and losses among partners. By pooling small and scattered capital, the stock market enables significant and large-scale investments, significantly impacting the economic and social conditions of society, advancing industries, and contributing to national development while generating profits for shareholders [3, 14].

As evidenced by advanced societies today, the origin of development in many advanced economies lies in agricultural surplus during the early stages of development, serving as a foundation for subsequent changes and transformations. Moreover, based on the Scenario Wizard software output and the table of components and key factors, the selected scenario assumption is supported by other scenario assumptions, with no contradictions from other assumptions, indicating internal consistency within these components.

Alternative assumptions were also evaluated for each component, comparing their strengths and weaknesses with the selected assumption. In most cases, alternative assumptions failed to provide a better balance than the selected assumption, thus the selected assumption was evaluated as consistent. The only exception was the "culture and society" component, where the selected assumption of "increased public awareness and sustainable consumption" was deemed inconsistent. The alternative assumption of "cultural resistance to change" offered a better balance between strengths and weaknesses and was therefore considered more likely.

Overall, this analysis indicates that the presented scenario, despite inconsistency in the "culture and society" component, demonstrates relatively good consistency in other components. Cross-impact analysis further indicates that government policies significantly affect infrastructure and market and demand, but have less impact on risk and crisis management. Market needs are recognized as strong drivers for innovation and infrastructure development, while technology and innovation play a key role in improving infrastructure. Human resources significantly impact infrastructure but are less effective in crisis management. International interactions and environmental sustainability also influence culture and society. The supply chain is crucial in meeting market demands, and societal culture plays a role in infrastructure development and environmental issues.

This analysis helps decision-makers design more effective strategies to improve the performance of the Iranian agricultural commodity exchange and highlights that the agricultural sector contributes to economic growth by providing food, foreign currency, and employment opportunities. Commodity exchanges, through transparent and participatory price discovery processes, ensure stable and increasing profits for agricultural products and provide farmers with multiple options for selling their goods in cash markets, futures markets, or off-exchange products based on futures markets.

Additionally, national electronic futures markets connect banks and trading institutions to commodity markets, offering various institutional options to farmers. Indeed, the capital market is recognized as a primary support for

resource mobilization and allocation, fostering investment in high value-added sectors and thereby assisting governments in achieving sustainable economic growth and development [13, 16].

The primary objectives of capital markets in a country's financial sector include investment, risk reduction, profitability, and meeting the social and economic needs of companies [4].

Based on the results obtained from the cross-impact analysis, it is recommended that variables such as government policies, infrastructure, sustainability and environment, and supply chain be given more attention due to their significant impact on other components. Given the substantial impact of government policies on infrastructure and the market, these policies must be designed to provide greater support for farmers and infrastructure development. Investment in technology and innovation should be prioritized to improve infrastructure and meet market needs. The supply chain should be emphasized to effectively respond to market demands and prevent price volatility. Strengthening international interactions can enhance exports and attract foreign investments. Training and improving the skills of human resources in the agricultural sector can positively impact infrastructure development, and efforts should be made to ensure environmental sustainability throughout all stages of agricultural production and supply. A limitation of this research is the exclusion of other important intervening variables due to their complexity.

Authors' Contributions

Authors equally contributed to this article.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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