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Impact of value chain linkage on sustainable agricultural economic development in the context of industrialization and modernization in Vietnam

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ABSTRACT

Agriculture is a critical area of focus, significantly contributing to the transformation of agricultural production systems toward enhancing value addition. This shift aims to address productivity challenges and meet the growing needs of the global population sustainably. Linking agricultural value chains integrates separate development stages to enhance value, boost the competitiveness of output products, and create a dynamic and efficient new production ecosystem. This study explores the effects of value chain linkage on sustainable agricultural economic development within the framework of industrialization and modernization in Vietnam. Using quantitative research methods, this study employs exploratory factor analysis (EFA) and structural equation modeling (SEM) analysis on a sample of 503 participants, including managers, workers, and farmers from business organizations and cooperatives in ecological agricultural areas. The research findings reveal significant contributions by demonstrating the direct and positive impact of value chain linkage on sustainable agricultural economic development, as well as the mediating role of outward-facing culture in the relationship between these two factors. Based on the results, the study proposes a number of recommendations for the sustainable development of the agricultural economy in Vietnam in the context of industrialization and modernization. The research results open up new and valuable directions for further research.

Contribution/ Originality: The study indicates that value chain linkage has both a direct and positive impact, as well as an indirect effect on the sustainable development of the agricultural economy through the mediating variable of outward-facing culture.

1. INTRODUCTION

The Fourth Industrial Revolution acts as a catalyst for many countries to accelerate the process of industrialization and comprehensive modernization across various industries and fields. Agriculture is a critical area of focus, significantly contributing to the transformation of agricultural production systems to enhance value addition. This shift aims to address productivity challenges and meet the growing needs of the global population sustainably. To keep pace with these trends, the Government of Vietnam has approved the "National Digital Transformation Program to 2025, with an outlook to 2030," which is based on three main pillars: digital economy, digital government, and digital society. Agriculture is one of the eight prioritized sectors of the program, with the goal of delivering fundamental benefits such as increased productivity and quality, resource conservation, cost reduction, creation of new products and services, and enhanced operational efficiency of the agricultural value chain.

Agriculture contributes to economic growth through its links with other sectors (Dürr, 2016). Research shows that sectors associated with agriculture are mainly informal sectors, and these sectors generate less added value but create more jobs than formal sectors. The studies also demonstrate that forward linkages are more critical than backward linkages. Agricultural links to downstream sectors exhibit high potential for job creation and value added, and therefore, should be supported by development policies (Dürr, 2016). Aligning information technology with business strategy has consistently posed a significant challenge for business executives. Although previous studies confirm the value of affiliation, questions remain regarding how affiliation creates value and the extent to which the value is created (Tallon, Ramirez, & Short, 2013).

Linking stages within agricultural value chains enhances overall value, improves the competitiveness of products, and cultivates a dynamic and efficient new production ecosystem (Tran et al., 2023). The study conducted by Naor, Goldstein, Linderman, and Schroeder (2008) explored the structure and dynamics of market linkages among farmers and assessed their influence on agricultural income and food security. The study findings indicate that, when controlling for a number of confounders, farmers with more commercialized market linkages receive significantly higher production prices and crop incomes than those without such linkages. Research by Adiyia and Vanneste (2018) indicates that inconsistencies in the supply of local produce weaken supply chain connections with local farmers. Instead, these inconsistencies encourage business relationships with local intermediary suppliers, which are the primary factors influencing the regional development potential of supply chain linkages.

In recent years, Vietnam has been restructuring its agricultural sector to enhance added value and promote sustainable development. This includes advancing organic, circular, and green agriculture. Green agriculture employs smart farming methods and utilizes organic fertilizers, reducing reliance on chemicals and pesticides. It implements water-efficient irrigation systems and leverages technologies to treat and reuse by-products and waste. Additionally, green agriculture enhances production efficiency, conserves resources, protects the ecological environment, and promotes the development of sustainable agricultural practices. However, in reality, Vietnam's agriculture is still primarily expanding through reliance on extensive exploitation of abundant resources and a highly concentrated labor force. This approach has led to land degradation, water resource pollution, ecosystem degradation, and a decline in biodiversity in many areas. Additionally, the agricultural and rural economic structures are slow to transform to meet market demands, and the level of science and technology applied to the agricultural industry remains generally low.

The study aims to assess the impact of value chain links on sustainable agricultural economic development within the context of industrialization and modernization in Vietnam. The research findings highlight significant contributions by demonstrating the direct and positive influence of value chain linkage on sustainable agricultural economic development, as well as the mediating role of outward-facing culture in the relationship between these two factors. Based on the results, the study proposes several recommendations for the sustainable development of the agricultural economy in Vietnam amid ongoing industrialization and modernization.

2. LITERATURE REVIEW AND HYPOTHESES

2.1. Literature Review

Value chain linkage: According to Kaplinsky and Morris (2006), a value chain is the sequence of activities required to transform a product or service from its initial idea, through various production stages, to distribution to the end consumer, and finally to its disposal after use. According to Catelo and Costales (2008), production linkage contracts can be categorized into four types based on the level of control over the agricultural production process: product consumption linkage, strategic linkage, production and consumption linkage, and closed-chain linkage. In their study, Magdoff, Lanyon, and Liebhardt (1997) analyzed the reasons for selecting ecological agricultural production, highlighting its benefits in fostering healthy natural ecosystems. Linking agricultural value chains involves comprehensive strategies, including planting healthy, adaptable, and resilient crops, preventing pests, and increasing

populations of beneficial organisms. Magdoff et al. (1997) elucidate the principles of agricultural value chain linkage as the strengths of natural ecosystems-efficiency, diversity, self-sufficiency, self-regulation, and resilience-and emphasize integrating these healthy ecosystem characteristics into agricultural systems.

Integration in the link chain: According to Lee, Padmanabhan, and Whang (1997), integration in the link chain needs to be considered from three angles: (1) Integration with customers; (2) Integration with suppliers and (3) Integration within enterprises. There must be connections among chain members to ensure the accurate and timely flow of information, materials, and products (Lambert & Cooper, 2000). Wolfert, Ge, Verdouw, and Bogaardt (2017) discuss how integrating digital technology and IoT into agricultural supply chains enhances management efficiency and improves transparency. Value chain integration within the agricultural sector can enhance food security and foster economic development in developing countries and transition economies (Reardon et al., 2019). Knickel, Ashkenazy, Chebach, and Parrot (2017) analyzed the effectiveness of direct linkage models between farmers and consumers, demonstrating their role in adding value and increasing profits. Integration within the agricultural value chain and sustainability aspects, particularly focusing on cooperation among stakeholders, are important factors to ensure sustainable development (Magoni, Adami, & Radaelli, 2021).

Information sharing among members: Knowledge sharing is defined as the deliberate act of enabling others to reuse knowledge through its transmission (Lee & Whang, 2000). According to Hari, Egbu, and Kumar (2005) information sharing is the process by which existing knowledge within an organization is transferred from those who possess it to those who do not, effectively imparting implicit and explicit knowledge. Tsui, Zhang, Wang, Xin, and Wu (2006) argue that knowledge sharing enables employees to exchange insights and experiences, facilitating the quick and cost-effective completion of projects and plans. Additionally, knowledge sharing involves each individual sharing information, ideas, suggestions, and expertise with the organization and with others. At the organizational level, according to the studies by Cheng, Lam, and Yeung (2006) and Ipek (2011), information sharing can be categorized into four aspects: sharing information with customers, sharing information with suppliers, sharing information between departments, and sharing knowledge and value internally. The study of Maponya (2024) also shows that knowledge sharing is based on experience gained during work inside and outside the organization. When knowledge is shared among members, the organization can reduce duplicate decisions and solve problems more quickly. Effective knowledge sharing practices facilitate the reuse of individual expertise and elevate overall knowledge to new levels (Tran et al., 2023). Krogh, Ichijo, and Nonaka (2000) assert that knowledge sharing is crucial for generating new knowledge and leveraging it to enhance business performance. Knowledge sharing is a vital mechanism through which employees contribute to the application of knowledge, foster innovation, and ultimately enhance the business's competitive advantage.

Market orientation: Organizational culture significantly influences both organizational performance and effectiveness Denison and Mishra, 1995) as well as the success of improvement initiatives implemented by the organization (Detert, Schroeder, & Mauriel, 2000). Narver and Slater (1990) define market orientation as an organization's focus on external factors such as customers, partners, and markets. Hitt, Li, and Xu (2016) discuss the development of an outward-looking strategy and organizational culture to enhance global competitiveness. Research by Deshpandé, Farley, and Webster Jr (1993) suggests that an organization's market orientation culture fosters innovation. Slater and Narver (1995) discuss the relationship between market orientation and organizational learning and demonstrate that market orientation is fundamental for organizations to learn from the market and continually improve. Detert et al. (2000) proposed a study on organizational culture that encompasses the following elements: (1) the foundations of authenticity and rationality within the organization; (2) time; (3) motivation; (4) stability versus change; (5) employee and colleague orientation; (6) independence versus cooperation; (7) control, coordination, and responsibility; and (8) focus on introversion versus extroversion.

Sustainable Agricultural Economic Development: Sustainable agriculture is defined as farming practices that meet the current needs of society without compromising the ability of future generations to meet their own needs.

Research by Bryan, Quist, Young, Steers, and Lu (2016) proposes strategies to increase production sustainably, reducing dependence on non-renewable resources while minimizing environmental harm in the agricultural system. Wheeler and Von Braun (2013) analyzed the impact of climate change on food security and emphasized the necessity of sustainable agricultural development in a global context. Their study highlighted that the integration of management and resource utilization is a crucial factor for the sustainable development of the agricultural sector. Bryan et al. (2016) highlight the importance of supportive policies to improve agriculture's adaptability to changing conditions.

2.2. Research Hypothesis

2.2.1. Value Chain Linkage and Sustainable Development of Agricultural Economy

Klerkx, Schut, Leeuwis, and Kilelu (2012) demonstrate that connecting producers with processing enterprises and markets can enhance the value of agricultural products. This not only boosts farmers' income but also produces high-value, safe products for consumers. Another study by Marsden and Murdoch (2006) focuses on creating short and transparent value chains, emphasizing that shorter supply chains can help preserve the ecological value of products and provide consumers with clearer information about their origins and production methods.

Several studies, such as Bryan et al. (2016), have highlighted the challenges faced by agricultural value chains, including initial transformation costs, lack of supporting infrastructure, and competition from industrial agriculture. However, they also recognize that with support from policy and international cooperation, these challenges can be overcome, opening up many opportunities for sustainable development. Research by Gliessman (2014) examines the role of policy in promoting agricultural value chain linkages, emphasizing that supportive measures such as subsidies for organic farmers, education and training programs, and initiatives to encourage green consumption are essential for fostering sustainable development in the agricultural sector. In the context of industrialization and modernization in Vietnam, the question arises: how does value chain linkage influence the sustainable development of the agricultural economy? The following hypothesis is proposed:

H_1: Linking value chains positively impacts the sustainable development of the agricultural economy in the context of industrialization and modernization in Vietnam.

2.2.2. Value Chain Linkage and Integration in the Value Chain

When the environment changes, organizations must adapt to survive and thrive. Organizations often seek to strengthen relationships to mitigate the impacts of instability in supply, demand, technology, and the overall environment (Chen & Paulraj, 2004; Mentzer et al., 2001). Since processes are often interconnected to form a complex chain of operations, the absence or disruption of any process can impact business performance elsewhere in the value chain (Tallon et al., 2013). The results of Tallon et al. (2013) study reinforce the call for companies to enhance the alignment between business strategy and technology by demonstrating how efforts to improve alignment within a specific process can generate a range of benefits throughout the value chain. Value chain linkage plays a crucial role in fostering sustainable integration and promoting long-term efficiency. In the context of industrialization and modernization in Vietnam, to answer the question of how the relationship between these two factors is manifested, the following hypothesis is proposed:

H_2: Value chain linkage positively impacts integration within the agricultural linkage chain in the context of industrialization and modernization in Vietnam.

2.2.3. Integration in the Linkage Chain and Sustainable Development of the Agricultural Economy

As economies grow and specialization increases Lummus and Vokurka (1999) organizations tend to strengthen cooperation with other supply chain members to leverage high-quality resources from their partners at a lower cost than producing them inefficiently in-house. Organizations are increasingly seeking collaboration to effectively

manage supply and distribution channels, aiming to optimize costs and enhance customer satisfaction. This approach contributes to greater competitiveness and improved profitability for participating organizations (Lee & Whang, 2000). In examining the relationship between integration within the linkage chain and sustainable agricultural economic development, the authors proposed the following hypothesis:

H_5: Integration within the linkage chain positively impacts the sustainable development of the agricultural economy in the context of industrialization and modernization in Vietnam.

2.2.4. Value Chain Linkage and Sharing Information among Members

Information sharing is a key factor in creating value within an organization. Many researchers assert that information sharing among supply chain members has a significantly positive impact on the efficiency of supply chain linkages (Li, Ragu-Nathan, Ragu-Nathan, & Rao, 2006; Madlberger, 2009). Eastwood, Klerkx, Ayre, and Dela Rue (2019) investigated the role of digital platforms in facilitating the participation of farmers and stakeholders in the value chain. These platforms not only offer information and support services but also connect farmers with markets and suppliers, thereby enhancing cooperation and efficiency within the ecological value chain. Thus, the following hypothesis is formulated:

H_4: Agricultural value chain linkage positively impacts information sharing among members in the context of industrialization and modernization in Vietnam.

2.2.5. Information Sharing Among Members and Sustainable Development of the Agricultural Economy

Information sharing enables companies to make better decisions in forecasting, ordering, production planning, and materials management, as inventory values, demand, and supply capacity are clearly displayed. Benefits of information sharing include enhanced cooperation (Kwon & Suh, 2004) and reduced uncertainty and risk in forecasting (Li et al., 2006; Zhou & George, 2003). Information plays a crucial role in all activities, and the bond between members grows stronger and more sustainable when it is founded on a willingness to share information and resources, fostering long-term, mutually beneficial development among participants. In the context of industrialization and modernization in Vietnam, to evaluate the impact of information sharing among members on the sustainable development of the agricultural economy, the following hypothesis is proposed:

H_3: Information sharing among members positively impacts the sustainable development of the agricultural economy in the context of industrialization and modernization in Vietnam.

2.2.6. Linking the Value Chain and Market Orientation

Research by Nahm, Vonderembse, and Koufteros (2004) and Naor et al. (2008) shows that organizational culture has an impact on efficiency in supply chain linkage. According to research by Rose and Chilvers (2018) developing policies to support digital transformation is essential for promoting ecological value chains. The government should provide legal frameworks and financial support programs to encourage farmers and businesses to adopt digital technologies in production and supply chain management. Studying this issue, the authors hypothesize:

H_6: Agricultural value chain linkage has a positive impact on market orientation in the context of industrialization and modernization in Vietnam.

2.2.7. Market Orientation and Sustainable Development of the Agricultural Economy

Supply chain linkage is a process that promotes cooperation with both suppliers and customers, including upstream suppliers and downstream customers (Fawcett & Magnan, 2002). A business with a market orientation often takes risks from the environment to adjust, interact, and adapt accordingly. Conversely, companies with an inward-focused culture tend to prioritize internal resources and place less emphasis on external relationships (Denison & Spreitzer, 1991). Therefore, to examine whether market orientation impacts the sustainable development

of Vietnam's agricultural economy in the context of industrialization and modernization, the following hypothesis is proposed.

H_7: Market orientation has a positive impact on the sustainable development of the agricultural economy in the context of industrialization and modernization in Vietnam.

2.2.8. Integration in the Value Chain Linkage and Information Sharing Among Members

For an organization to share information about its internal activities with another organization, mutual trust is essential (Cheng et al., 2006). The result of supply chain integration is a strategic relationship that fosters cooperation among partners in the chain, serving as a catalyst for the sharing of accurate and timely information (Ipek, 2011; Li et al., 2006; Yeung, Selen, Zhang, & Huo, 2009). Integration within the linkage chain is an effective solution for fostering trust and long-term cooperation among all parties involved. Therefore, the following hypothesis is formulated:

H_8: Integration within the agricultural linkage chain positively impacts information sharing among members in the context of industrialization and modernization in Vietnam.

2.2.9. Market Orientation and Information Sharing Among Members

Dynamic and flexible businesses often seek to strengthen cooperation with their supply chain partners (Cameron & Quinn, 1999). These businesses are often characterized by a desire for growth, leveraging external resources, innovating, and adapting to their environment. These characteristics also indicate that the organization has a flexible culture (Denison & Spreitzer, 1991). In contrast, organizations with a stable culture often focus on internal efficiency, synchronization, and conservatism (Denison & Spreitzer, 1991). Organizations with such a culture often face many difficulties in adapting to changes. This hypothesis is therefore formulated:

H_9: Market orientation has a favorable impact on information sharing among members in the context of industrialization and modernization in Vietnam.

Figure 1 illustrates the proposed research model.

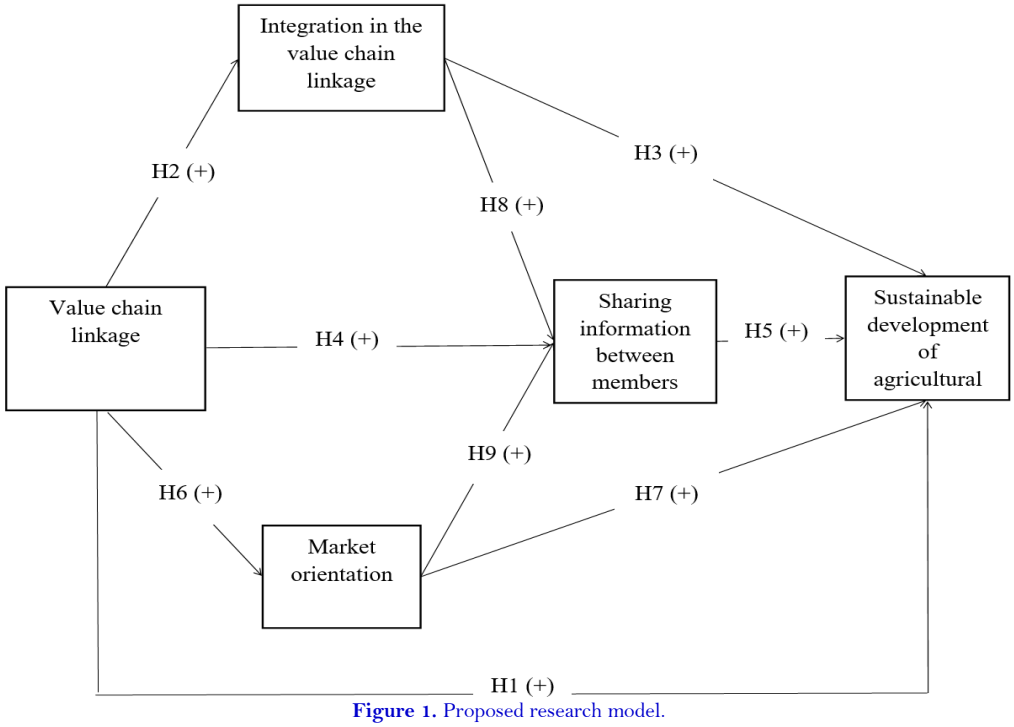

Figure 1. Proposed research model.

3. RESEARCH METHODOLOGY

3.1. Study Scale

Based on the theoretical overview, we propose a research model with five variables. The independent variable is value chain linkage; the target variable is the sustainable development of the agricultural economy. The intermediate variables include: (1) integration in the supply chain linkage, (2) information sharing among members, and (3) market orientation. The study used a Likert scale with five levels, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The indicators used in this study are derived from previous research, with adjustments made to suit the context of Vietnam's agricultural economy amidst industrialization and modernization.

Table 1 presents the origin of the variable's scale.

Table 1. Origin of the scale of variables.

No.	Variable	Code	Number of observations	Origin of scale
1	Value chain linkage	VCL	6	Kaplinsky and Morris (2006)
2	Integration in the value chain linkage	ICL	7	Lambert and Cooper (2000)
3	Sharing information between members	SIM	7	Chennamaneni (2006)
4	Market orientation	MAO	5	Detert et al. (2000)
5	Sustainable development of the agricultural economy	SDA	6	Bryan et al. (2016)

3.2. Research Samples

Data was collected using a convenient sampling method with relative stratification across business organizations and agricultural cooperatives in Vietnam's agro-ecological regions: the Northern Midlands and Mountains, the Red River Delta, the North Central Coast, the South-Central Coast, the Central Highlands, the Southeast, and the Mekong Delta. The participants in the study included managers, workers, and farmers working in these organizations and cooperatives. The sample size consisted of 503 participants. Data collection was conducted using two methods: direct distribution of questionnaires and an online survey via Google Forms. A total of 500 questionnaires were distributed directly, with 278 collected and 245 deemed usable. For the online survey, the research team distributed 400 forms and shared a survey link, resulting in 261 responses, with 258 deemed usable. The total number of valid responses used for analysis is 503. According to Hair, Black, Babin, and Anderson (2010), the minimum sample size should be five times the total number of observed variables. With 31 observed variables in this study, a sample size of 503 meets the requirements for analysis. The data collection period was from January 2024 to June 2024.

Table 2 presents the characteristics of the research samples.

Table 2. Characteristics of research samples.

No.	Survey area	Survey subjects (Number of people)			
		Managers	*Workers*	*Farmers*	*Total*
1	Northern Midlands and Mountains	11	32	23	66
2	Red River Delta	14	24	25	63
3	North Central Coast	12	29	31	72
4	South Central Coast	9	24	32	65
5	Central Highlands	15	37	34	86
6	South Eastern	17	41	26	84
7	Mekong Delta	8	23	36	67
Total		86	210	207	503

3.3. Data Processing

The study employs a quantitative method, with data collected, cleaned, and processed using SPSS and AMOS software, version 22.0. First, the study evaluated the reliability of the scale based on the following criteria: a

Cronbach's Alpha coefficient exceeding 0.7, item-total correlation above 0.3, and if Cronbach's Alpha if Item Deleted is higher than the Cronbach's Alpha coefficient, that particular observed variable should be reconsidered. Next, exploratory factor analysis (EFA) was conducted to evaluate the convergent and discriminant validity of the scale's variables and indicators. The criteria for EFA included factor loadings above 0.5, a Kaiser-Meyer-Olkin (KMO) coefficient between 0.5 and 1, a significance value below 0.05, and a percentage of variance explained exceeding 50%. Additionally, it meets the criteria for convergent validity, where the observed variables converge on the same factor, and discriminant validity, where the observed variables are associated with a single factor and distinguish it from others. Factor rotation was conducted using the Varimax method. After that, the study utilized AMOS software to evaluate the model's fit with the research data through confirmatory factor analysis (CFA). Finally, the research hypotheses were tested using structural equation modeling (SEM) with the following criteria: a chi-square to degrees of freedom ratio below 5 (Hair et al., 2010); a significance level of $p < 0.05$; Goodness of Fit Index (GFI), Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI) values above 0.8 (Segars & Grover, 1993); and Root Mean Square Error of Approximation (RMSEA) below 0.08 (Taylor, Sharland, Cronin, & Bullard, 1993).

4. RESEARCH RESULTS AND DISCUSSION

4.1. Testing the Reliability of the Scale

The test analysis results confirm the reliability of the scale and the adequacy of the data for analysis. All variables exhibited Cronbach's alpha coefficients above 0.7, and the total variable correlation coefficients exceeded 0.3. At the same time, the value of Cronbach's alpha if an item is deleted is smaller than the Cronbach's alpha of the total variable.

Table 3 describes the assessment of the reliability of the scale.

Table 3. Assess the reliability of the scale.

No.	Variable	Code	Cronbach's Alpha
1	Value chain linkage	VCL	0.910
2	Integration in the value chain linkage	ICL	0.909
3	Sharing information between members	SIM	0.838
4	Market orientation	MAO	0.871
5	Sustainable development of agricultural economy	SDA	0.818

4.2. EFA Analysis

After testing the reliability of the scale, the study conducted an exploratory factor analysis (EFA). EFA was performed on the independent, intermediate, and dependent variables. All analyses of variable groups were conducted twice. Specifically, during the initial analysis, indicators ICL2 and SDA6 were removed because they did not meet the criteria for convergent and discriminant validity. In the second analysis, the results indicated that the data met all required criteria. Factor loadings exceeded 0.5, and the Kaiser-Meyer-Olkin (KMO) coefficients were 0.879 and 0.865, both within the acceptable range of 0.5 to 1.0. The significance values (p-values) were 0.000, demonstrating statistical significance ($p < 0.05$). Additionally, the percentages of variance explained were 64.489% and 67.669%, both surpassing the 50% threshold. Furthermore, the criteria for convergent and discriminant validity were satisfied.

Table 4 presents the results of exploratory factor analysis (EFA).

Table 4. Exploratory factor analysis (EFA) results.

EFA analysis		KMO coefficient	P-value	Variance extracted (%)	Factor loading	Conclusion
Independent variables and intermediate variables	1st time	0.863	0	64.306	All > 0.5	Remove ICL2 indicator
	2nd time	0.879	0	64.489	All > 0.5	Meet the requirements
Dependent variable	1st time	0.849	0	74.094	All > 0.5	Remove SDA6 indicator
	2nd time	0.865	0	67.669	All > 0.5	Meet the requirements

4.3. CFA Analysis

Convergent validity ensures that indicators within the same scale of a theoretical structure are strongly related, whereas discriminant validity confirms that different concepts within the theoretical structure are not strongly related. To provide convincing evidence of the convergent and discriminant validity of the theoretical structure, the study conducted a confirmatory factor analysis (CFA). The results demonstrated the suitability of the measurement model, with all indicators meeting the required criteria. Specifically, the fit indices were as follows: Chi-square: 1515.767; Degrees of Freedom (df): 364; Chi-square to df ratio: 4.159 (less than 5); P-value: 0.000; Goodness of Fit Index (GFI): 0.852 (greater than 0.8); Tucker-Lewis Index (TLI): 0.860 (greater than 0.8); Comparative Fit Index (CFI): 0.874 (greater than 0.8); Root Mean Square Error of Approximation (RMSEA): 0.079 (less than 0.08).

4.4. SEM Linear Structure Model Analysis

In order to test the hypotheses, the study conducted a structural equation modeling (SEM) analysis. The results indicate that the composite indicators are satisfactory. Specifically, the fit indices were as follows: Chi-square was 1473.527 with 362 degrees of freedom, resulting in a Chi-square to degrees of freedom ratio of 4.071 (less than 5). The Goodness of Fit Index (GFI) was 0.855, the Tucker-Lewis Index (TLI) was 0.863, and the Comparative Fit Index (CFI) was 0.878, all exceeding the threshold of 0.8. Additionally, the Root Mean Square Error of Approximation (RMSEA) was 0.078, which is below the acceptable limit of 0.08. The results of the model estimation confirm the suitability of the research model. Out of nine hypotheses, five were accepted (H1, H2, H6, H7, and H9), while four were rejected (H3, H4, H5, and H8). Specifically, the study accepts the H1 hypothesis based on a regression weight of 0.293 (greater than 0) and a significance level in the p-test of less than 0.05. Thus, the study has demonstrated that value chain linkage positively impacts the sustainable development of the agricultural economy in the context of industrialization and modernization in Vietnam. This result aligns with previous studies by Marsden and Murdoch (2006), Klerkx et al. (2012), Gliessman (2014), and Bryan et al. (2016).

Similarly, hypothesis H2 is accepted, with a significance level in the p-test of less than 0.05 and a positive regression weight of 0.093. Thus, value chain linkage in agriculture has a positive impact on the integration in the value chain linkage. This result corresponds to the previous research findings by Mentzer et al. (2001); Chen and Paulraj (2004) and Tallon et al. (2013). Meanwhile, since the significance level in the p-test is greater than 0.05, hypotheses H3, H4, and H5 are all rejected. Thus, the research results indicate that value chain linkage does not impact information sharing among members. Simultaneously, neither integration within the supply chain nor information sharing among members has influenced the sustainable development of the agricultural economy in the context of industrialization and modernization in Vietnam.

Hypotheses H6 and H7 examine the impact of value chain linkage on market orientation and the effect of market orientation on sustainable agricultural economic development. The study results indicate that both hypotheses H6 and H7 are accepted, as the significance levels in the tests are less than 0.05, with regression weights of 0.294 and 0.382, respectively. This indicates that value chain linkage positively influences market orientation, which, in turn, contributes to the sustainable development of the agricultural economy in the context of industrialization and modernization in Vietnam. In other words, the research results demonstrate the mediating role of market orientation in the relationship between value chain linkage and sustainable agricultural economic development.

Additionally, the results of the study rejected hypothesis H8, as the significance level in the test was 0.591 (greater than 0.05), while hypothesis H9 was accepted due to a significant level in the test and a positive regression weight of 0.513. Thus, while the research indicates that integration within the linkage chain does not impact information sharing among members, market orientation has been shown to positively influence information sharing among members of the agricultural value chain in the context of industrialization and modernization in Vietnam. This result aligns with previous studies by Denison and Spreitzer (1991) and Cameron and Quinn (1999).

Thus, with the acceptance of five hypotheses and the rejection of four hypotheses, the study has demonstrated valuable contributions both theoretically and practically. Theoretically, the study has shown that value chain linkage not only has a direct impact but also an indirect impact on the sustainable development of the agricultural economy through the mediating variable of market orientation. In practical terms, the study's results offer valuable insights for policymakers, business managers, and agricultural organizations, as well as for professionals in related fields. These findings can assist in developing effective policies and solutions for managing organizational activities aimed at achieving sustainable agricultural economic development in the context of industrialization and modernization in Vietnam, as well as in other countries in the region and worldwide.

Table 5 presents the results of SEM analysis for the relationships in the model.

Table 5. Results of SEM analysis for relationships in the model.

Hypothesis	Relationship	Weight	S.E. (Standard error)	C.R. (Criteria ratio)	P	Conclusion
H1	SDA <-- VCL	0.293	0.034	8.685	0.000	Accepted
H2	ICL <-- VCL	0.093	0.028	3.371	0.000	Accepted
H3	SDA <-- ICL	-0.014	0.068	-0.212	0.832	Rejected
H4	SIM <-- VCL	0.021	0.038	0.557	0.578	Rejected
H5	SDA <-- SIM	0.023	0.053	0.445	0.656	Rejected
H6	MAO <-- VCL	0.294	0.032	9.232	0.000	Accepted
H7	SDA <-- MAO	0.382	0.079	4.846	0.000	Accepted
H8	SIM <-- ICL	0.043	0.079	0.538	0.591	Rejected
H9	SIM <-- MAO	0.513	0.087	5.894	0.000	Accepted

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusion

Based on the theoretical framework and related literature, the study conducted modeling and hypothesis testing using a structural equation modeling (SEM) approach. The research results demonstrate that the contributions are significant in both theoretical and practical contexts. Theoretically, the study demonstrates that value chain linkage not only has a direct positive impact but also an indirect effect on the sustainable development of the agricultural economy through the mediating variable of market orientation, within the context of industrialization and modernization in Vietnam. In addition to value chain linkage in agriculture, it has also been shown to have a positive impact on integration within the value chain linkage. At the same time, market orientation has a positive impact on information sharing among members of the agricultural value chain. In practical terms, the study's results offer valuable insights for policymakers, business managers, and agricultural organizations, as well as for professionals in related fields. These findings can assist in developing effective policies and solutions for managing organizational activities focused on achieving sustainable agricultural economic development in the context of industrialization and modernization in Vietnam, as well as in other countries in the region and worldwide.

5.2. Recommendations

Based on the results, the study presents several recommendations for promoting the sustainable development of the agricultural economy in Vietnam within the context of industrialization and modernization.

First, organizations involved in agricultural value chains should enhance their linkages with one another to establish sustainable value chains that encompass processing, production, and product consumption. It is essential to minimize risks across all activities by strengthening the connections between farmer organizations, cooperatives, businesses, and local authorities.

Enhance the role of intellectuals in researching and developing valuable, highly applicable scientific products for both production and consumption. Additionally, to facilitate enterprise operations and strengthen connections between organizations, the government should continue to improve mechanisms and policies that enable businesses

to take a leading role in production and consumption linkages. At the same time, the government should aim to support a stable output market, creating conditions that facilitate smooth and effective linkages between the production and consumption of agricultural products.

Second, with a market-oriented culture, agricultural business organizations should enhance their market orientation to establish sustainable and long-term relationships with various business organizations across all fields related to agriculture. It is essential to integrate cultural diplomacy with economic diplomacy in investment promotion activities and market development for agricultural products. Accelerate the development of commercial and service areas to attract customers and investors interested in exploring and purchasing agricultural products in Vietnam.

5.3. Limitations and Future Research

Besides its valuable contributions, this study also has certain limitations. The first is the convenient sampling method used in the study. This is a sampling method based on greater "exposure" and "convenience" in research. Therefore, although there has been a relative stratification among business organizations and agricultural cooperatives in Vietnam's agro-ecological regions, this sampling method somewhat diminishes the representativeness of the sample used in the study.

Moreover, this research context is limited to a developing country such as Vietnam. Consequently, based on the results obtained, the study opens new avenues for exploring the relationship between value chain linkage and sustainable agricultural economic development, incorporating intermediate variables and other regulatory factors. Simultaneously, the scope of this study can be extended to other countries, particularly developed nations, which possess different economic and political institutions compared to developing countries like Vietnam.

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Institutional Review Board Statement: The study involved minimal risk and adhered to ethical guidelines for social science fieldwork. Formal approval from an Institutional Review Board was not required under the policies of Industrial University of Ho Chi Minh City, Vietnam. Informed verbal consent was obtained from all participants, and all data were anonymized to ensure participant confidentiality.
Transparency: The author states that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Data Availability Statement: Upon a reasonable request, the supporting data of this study can be provided by Dung Tuan Nguyen
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