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The Driving Factors of Innovation Quality of Agricultural Enterprises—A Study Based on NCA and fsQCA Methods

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Abstract: Agricultural product processing enterprises are a significant cornerstone to support the improvement of agricultural economy. How to reinforce the main position of innovation of agricultural product processing enterprises, gather innovation factors, and improve the innovation quality of enterprises is an important question to answer. Based on the technology–organization–environment (TOE) theory, dynamic capability theory, organizational learning theory, and sustainable business model theory, this essay develops a comprehensive system for sustainable innovation quality, takes 36 agricultural processing enterprises in Liaoning province, China, as research samples, and applies necessary condition analysis (NCA) and fuzzy set qualitative comparative analysis (fsQCA) to recognize the driving factors of innovation quality in agricultural processing enterprises. The results show that: (1) a single driving factor is not a necessary condition for high innovation quality, but entrepreneurship and the enhancement of green technology capability have a more universal role in producing high innovation quality in agricultural product processing corporations; (2) a combination of four paths enables internal and external factors to couple and interact with each other to achieve high sustainable innovation quality in agricultural processing enterprises in Liaoning province, which can be further divided into two major categories. The first category is "entrepreneurship–government support driven path", in which entrepreneurship and government support are the main drivers, supplemented by green technology capability, organizational learning, and market demand; the second category is "green technology capability–market demand driven path", in which green technology capability and market demand are the main drivers, supplemented by organizational learning, entrepreneurship, and government support. This paper also identifies seven conditional configurations that lead to non-high innovation quality, which can be categorized as the technology-inhibited type, entrepreneurship-deprived type, and government and market-driven type. The discoveries of this paper have significant hypothetical and practical value for improving the innovation quality of agricultural enterprises.

Keywords: innovation quality; driving factors; configuration analysis; agricultural product processing enterprises; fsQCA; NCA

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1. Introduction

As the main body of the agriculture industry, agricultural product processing enterprises connect the market with traditional agriculture, playing a critical role in promoting economic prosperity and job creation. Liaoning province is a huge farming region in China, and the growth of agricultural product processing businesses is crucial for raising farmers' incomes, establishing a modern agriculture industrial system, and altering the direction of agricultural development. In recent years, the agricultural products processing industry in Liaoning province has been developing steadily. At the end of 2020, the province's agricultural products processing enterprises above the scale reached 1613, achieving a business income of CNY 296.36 billion, an increase of 6.6% per year [1]. Though agricultural product processing enterprises are seen as "potential stocks", due to their characteristics such as small scale, long production cycle, and low price elasticity, etc., they still lack core competitiveness. Most enterprises only focus on production and sales, while they are very conservative in research and development because of the high risks. This leads to high product similarity and many of the competitors are in a price war. Therefore, it is vital to raise the level of innovation quality in agricultural companies.

The key to high-quality innovation in enterprises lies in systematic and standardized management [2]. The improvement of innovation quality in agricultural product processing enterprises is a complex systemic project that requires the synergistic coupling of internal and external factors in order to obtain green technological capability and sustainable innovation capacity. The development of sustainable innovation quality can make enterprises create sustainable value. Therefore, it is essential to investigate the significant driving factors and analyze how to maintain a highly sustainable innovation quality.

Innovation quality, as an important indicator of a company's competitiveness, affects the efficiency and development of innovation. After Haner first presented the extensive idea of innovation quality, innovation quality has been widely discussed and researched by theoretical and academic circles [3]. Innovation quality is a combination of all innovations in three different fields: product, process, and business operation, which is finally revealed as the sum of product quality, process quality, and business quality management [3]. For product quality, scholars usually used the quantity, features, and functions of new products to measure [4], and the proportion of new item revenue to main operation revenue has also been used to assess the innovation quality in enterprises [5]. In addition, innovation quality has been redefined as the impact of innovation output and is evaluated by the quantity of citations of patents [6,7]. However, it is not accurate to measure the level of innovation quality only through patent output; we should choose a comprehensive index to measure innovation quality, including the quality of new products or services that have been innovated and recognized by the market [8], process quality, and business operations quality [9].

The literature review revealed that scholars have studied the driving factors of innovation quality mainly from two perspectives: firms and government. First, enterprises can save capital costs and develop innovative products or services that satisfy consumer demand to improve innovation quality. In view of resource allocation theory, improving innovation quality requires the accumulation and investment of innovation resources and the ability to carry out comprehensive processing of innovation resources [10]. Enterprises are the main body of innovation and stable financial support is an essential condition for improving innovation quality, so encouraging enterprises to expand their R&D expenditure is an effective initiative to improve innovation quality [11,12]. In addition, the entrepreneurs' willingness to innovate can subjectively determine innovation quality, and an empirical study has shown that entrepreneurship is key to improving innovation quality in high-tech industry [13]. When entrepreneurs have innovation consciousness and leadership, they will adopt innovation reward mechanisms to motivate staff to pay attention to innovation, which causes innovation quality to improve substantially [14]. Secondly, government plays a significant role in the process of enterprise innovation. Government funding has a positive effect on the quantity of innovation, and government policies can promote technological innovation in enterprises, hence expanding their innovation abilities [15].

According to the literature, we find that there is a complex connection between enterprise input, government support, and innovation quality. However, by deeply analyzing the agricultural product processing enterprises, there are still some gaps in the previous studies that need to be mined and deepened.

(1) The existing literature on innovation quality mostly focuses on service enterprises, emerging industry enterprises, and high-tech enterprises. It is important to examine the innovation quality of agricultural product processing enterprises because of the special characteristics of these businesses.

(2) There is insufficient analysis on the influences of external driving factors of enterprises on innovation quality. The current literature concentrates on the influences of government incentives in innovation quality, neglecting the role of the unpredictable external environment, such as the industry and market.
(3) Innovation quality is measured on a single basis. Most of the empirical studies have used patent citations, patent quantity, and new product sales ratios to measure innovation quality [16]. The agricultural product processing enterprises are heterogeneous in nature with other high-tech and industrial enterprises, this paper will measure innovation quality by the amount of product innovation quality, process innovation quality, and business innovation quality.
(4) The existing literature usually focuses on one or two factors, lacks an integrated study of the drivers of innovation quality in agricultural product processing enterprises, and does not analyze their cooperation. For this reason, this paper tries to construct a comprehensive framework to study sustainable innovation quality.

This paper investigates the complicated connections among the driving factors of innovation quality in Liaoning province in view of the TOE theory by using NCA and fsQCA methods and is committed to providing answers to the following questions: How can the effective combination of innovation quality driving factors improve innovation quality in agricultural product processing enterprises in Liaoning province? Are there any key driving factors? Are these driving factors necessary for high innovation quality?

The following theoretical contributions are made by this study. First, it enriches the exploration in the area of innovation quality. Most of the previous research focused on the direct or indirect role of a certain aspect of innovation quality in a qualitative or quantitative way. Based on configuration analysis, this paper takes agricultural product processing enterprises in Liaoning province as the research object, exploring the multiple driving factors of innovation quality.

Secondly, the research focuses on the internal dimensions of innovation quality. Most scholars prefer to use innovation quality as a mediating variable or explanatory variable, and choose the amount of patents, the number of patent references, etc., for the dimensions. This paper analyzes innovation quality as an outcome variable. Considering the differentiated development and industry specificity of agricultural product processing enterprises in Liaoning province, the innovation quality sub-dimension is refined.

Finally, this study of the driving factors of innovation quality can help agricultural product processing enterprises in Liaoning province improve their innovation quality and, to a certain extent, can positively guide them to make correct and reasonable innovation decisions.

2. Theoretical Foundations

2.1. TOE Theory

The TOE theory framework is a theoretical explanation for technology adoption and diffusion from internal and external conditions of the firm, which has received much attention from scholars [17]. Specifically, the TOE framework explores the factors influencing the adoption and diffusion of emerging technology at three levels: technological, organizational, and environmental. The technological level includes technological capability, technological management, technological resources, etc.; the organizational level includes organizational climate, organizational structure, top management team, etc. [18], and the environmental level focuses more on the impacts of outside variables of enterprises, such as market, policy, and pressure, etc. [19]. With the continuous development of the TOE framework, scholars have given it new meanings and made appropriate adjustments according to the research objects and actual situations, and it has been applied in many aspects, such as risk management, government website construction, and resumption of work and production [20,21]. Although the TOE framework has been recognized by scholars, it still needs to be improved. On the one hand, as a highly general theoretical framework, the selection of relevant factors should be adjusted according to the actual situation, especially when exploring new problems, new objects, and new scenarios, further refinement and demonstration are needed. On the other hand, the previous studies focused on the respective effects of the organization, the technology, and the environment in the TOE framework, but lacked consideration of the linkage between the three levels of factors. In fact, it is easier to explain the complexity of the research results by considering the relationships among multiple conditions. Based on this, theoretical and practical implications of the analysis on the effects of the technical, organizational, and environmental factors on innovation quality are enormous.

The TOE theoretical framework has shown its applicability in many research directions, and it also has significant advantages to discuss innovation quality from the three aspects: technology, organization, and environment. Firstly, innovation quality mainly refers to the breakthrough of key core technologies of firms, which are highly original and exploratory in nature. Therefore, the difference in technology level is an important factor leading to the difference in sustainable innovation quality. Secondly, the innovation quality should be improved within the company itself, and organizational learning has a significant impact on sustainable innovation. High innovation quality is characterized by high complexity, high risk and long cycle, so the organizational level is also worth focusing on for high innovation quality. Finally, the innovation quality is not only affected by internal technical and organizational factors, but also by external factors. Therefore, the TOE framework is used to build an integrated framework for analyzing the factors that affect the innovation quality of firms from internal and external levels, including technology, organization, and environment.

2.2. Dynamic Capability Theory

According to the dynamic capability theory, an organization can integrate, construct, and reconfigure internal and external resources to develop a new ability to adjust to the quickly varying environment. When companies can reinvent their capabilities, such as adopting green technologies to match the needs of changing environments, they will outperform their competitors. Pavlous and EI Sawy constructed a framework for dynamic capability models. According to the framework, enterprises can do the following: (1) identify, interpret, and look for opportunities from internal and external stimuli; (2) use learning capabilities to decide which managerial capabilities must be reconfigured, remodeled, or reconfigured to create new information; and (3) utilize coordination capacities to realize and use reconfigured operational capabilities [22].

There are two primary exploration viewpoints on dynamic abilities: the cognitive perspective and the process perspective. Researchers with the cognitive perspective contend that enterprises with dynamic capacities can distinguish risks and chances, adjust to its economic circumstances, and preclude the stiffness and inertia of the organization [23,24]. Enterprises' green technological capabilities also need to keep pace with the times, using available resources to continuously update technological capabilities and enhance sustainable innovation quality. Researchers with the process perspective view dynamic capability as an enterprise's practice or process and as a tool that can appear in a special and recognizable process [25]. In the process of practice, enterprises should identify market opportunities, utilize green technology to enable new products and services, and promote green technology capabilities while improving quality. Furthermore, the present context of sustainable development, open innovation, high-quality development, and the COVID-19 epidemic has given a new situation of dynamic capability for agricultural product processing enterprises, and research on dynamic capability under specific circumstances has turned into a hot topic at present.

2.3. Organizational Learning Theory

The organizational learning theory was initially introduced by Argyris and Schon, who argued that individuals' interactions in the inner environment have an effect on the firm [26,27]. As indicated by early investigations, researchers contended that organizational structural change driven by management affairs is the way of learning [28]. In the mid-1990s, a widely held view was that different organizations could gain from past successes and failures, and predict impending challenges [29,30]. Research on organizational learning has revealed that there are two general search views on organizational learning: the capability and the process view. Researchers who hold the capability view think that organizations are obliged to quickly react to alterations in the exterior environment and endeavor to be learning organizations [31]. Academics who hold the process view argue that organizational learning is the process of information handling by organizations, containing information acquirement, consolidation, distribution, utilization, and creation [32].

Nonetheless, the current exploration actually has a few limits. For example, in the past literature, relevant research was limited to internal enterprises, while the role of external organizations was not well understood. Nelson and Winter et al. argue that the learning behavior of corporations is conditioned by the internal and external environments and internal organizational elements [33] and, therefore, the learning behavior of firms is not only a response to past "memory" but also external incentives from the organization. This paper takes agricultural product processing firms as the research sample and discusses the internal mechanism of organizational learning in them. For agricultural product processing enterprises, the dynamic process of organizational learning is a multi-level process, including mental and social processes [34]. It contains the assimilation and consolidation of knowledge, and the shifting, sharing, applying, creating, and storing of new knowledge.

2.4. Sustainable Business Model (SBM)

Enterprise sustainable development plays a big role in the process of socially sustainable development, but is also an important way for a society to develop sustainably. The sustainable business model is a long-term advancement mode on the basis of the burden on the environment and resources. In essence, it means that enterprises develop new business ideas or models to cope with environmental pollution, land desertification, resource depletion, and other problems related to the environment [35]. Schaltegger et al. [36] defined SBM as a useful tool for depicting, meditating, guiding, and communicating: (1) an organization's sustainable value to its clients and all other parties involved; (2) how it makes and conveys this value; (3) how it generates financial value while preserving or regenerating the social, economic, and ecological capital found inside its administrative borders.

More and more entrepreneurs are working to develop business models that are not only financially viable but also contribute positively to society and the natural environment [36]. Scholars have conducted in-depth analyses and research on sustainable business models from theoretical perspectives such as business model innovation [37], innovation management, collective action theory, contingency theory [38], entrepreneurial ecosystem [39], institution theory [40], resource based theory [41], and technology acceptance model [42].

Entrepreneurship is considered as a potential panacea for today's most pressing social challenges. Especially in the early stage of industrial transformation, compared with other organizations, entrepreneurial enterprises are more likely to pursue sustainability [43]. In order to have a meaningful impact on society, such firms need to develop extendable business models and technology is an enabler of innovation and entrepreneurship. Adopting new technology can boost productivity and effectiveness and thus can be a competitive advantage of the enterprises. Technology allows for the conversion of inputs into outputs. Adopting (and adapting) new green technologies is the key for firms to expand their business operations and compete with larger and more resourceful firms. The needs of the consumers can be met through new technology, and new technology can also help enterprises reduce production and operating costs, create new value, and expand business capabilities. Entrepreneurs can utilize technologies to improve the capacity to investigate novel trends and business models and to contact new customers, leading to high competitiveness, innovation and flexibility.

3. Model

3.1. The Relationship between Driving Factors and Innovation Quality

(1) Green technology capability and innovation quality

The green technology capability of agricultural product processing enterprises is essential to enhance sustainable innovation quality. It is generally believed that innovation in green technology and innovation capacity are correlated [44]. Technology's sophisticated and scientific character directly or indirectly affects innovation efficiency and energy consumption, and has a certain impact on the innovation quality of enterprises. Enterprises need to use the external environment as a channel to grasp frontier technology and information, integrate their own internal conditions with it, and then reserve the frontier technology, accumulate relevant knowledge, and develop new technology. Green technology capability is based on general technology capability, adhering to the idea of green and sustainable development, combining concepts and capabilities, and is a crucial metric to estimate the overall innovation level of enterprises and the efficiency of environmental governance [45].

(2) Organizational learning and innovation quality

Organizational learning is an important means of innovation quality improvement. To adapt to the complicated and evolving outside environment and improve the competitiveness of enterprises, enterprises constantly adjust their learning mode and learning methods. By acquiring, sharing, and applying knowledge, enterprises can gradually improve the working mode and promote healthy development between the organization and its members, which is important for enhancing organizational performance and innovation quality [46]. Therefore, organizational learning can positively promote innovation quality.

(3) Entrepreneurship and innovation quality

The presence of entrepreneurship is essential for the survival and long-term development of a company. As the main force of sustainable innovation, entrepreneurs are known as "market makers" for their ability to create new and original products, adjust the use of scarce resources, and make strategic decisions that fit the realities of enterprises. According to Makri & Scandura, when entrepreneurs have a sense of innovation, they adopt innovation incentives to motivate the entire enterprise to pay more attention to innovation, resulting in a significant increase in innovation quality [14]. Thus entrepreneurship has a positive impact on innovation quality.

(4) Government support and innovation quality

For agricultural product processing enterprises, government support is essential to achieve rapid economic growth and continuous technological innovation. Government support policies reflect the direction and goals of the market economy. Compared with other agriculture enterprises, those that receive government support are better able to grasp the current economic and market trends, grasp the forms of market innovation and change, and are more likely to innovate. The government encourages agricultural enterprises to combine local agricultural resources and supports agricultural product processing enterprises to launch special products. Moreover, the local government will choose more agricultural product processing enterprises in need as suppliers when purchasing. Secondly, the government guides agricultural product processing enterprises to position their business goals and offers policy support such as taxation, subsidies, and loans to further promote them to improve innovation quality. Dai W and Liu Y argued that government support is a necessary way for enterprises to innovate, so government support can positively promote innovation quality [47].

(5) Market demand and innovation quality

Market demand is the main driver of innovation in agricultural product processing enterprises, and market needs and consumer expectations determine the direction and level of innovation quality. The existing literature is inadequate in analyzing the driving influences of external drivers of firms on innovation quality, and mostly explores the influence of government incentives on innovation quality from the government's perspective, ignoring the role of the unpredictable external environment such as industry and market. So market demand can positively influence innovation quality.

In summary, the existing literature has explored the driving mechanism of internal and external factors to promote innovation quality. Based on configuration perspective and TOE theory, this paper constructs a theoretical model to explain the complex paths and mechanisms of innovation quality improvement through four paths.

3.2. Necessary and Sufficient Causal Relationship between Internal and External Driving Factors and Innovation Quality

Innovation quality reflects a company's capacity to innovate in improving management and processes and in providing new products and services of higher quality than its main competitors. This kind of multi-factor complex reality "cannot usually be represented by linear or even multivariate relations." This study methodically incorporates internal and external driving forces into a framework from the configuration point of view and considers the configuration effects of innovation quality drivers, which is helpful to reveal the complex relationship between each driver and innovation quality.

First, from the viewpoint of complex systems, new technologies are a combination of existing technologies and there is interaction between new technologies and the market and government [48]. In other words, technological advances alone cannot promote innovation quality, and it is necessary to consider the coordination of internal and external factors in order to fully promote innovation quality.

Second, the market's demand and technical capacity are mutually supportive of one another. In the 1980s, scholars began to believe that technological advancement and the drive of demandare complementary [33]. The main mechanisms by which demand drives technological innovation in firms are: higher sales volumes can finance high-cost research and development and innovation activities [49] and optimistic expectations of demand reduce uncertainty about the benefits of research and development [50]. When the market expands, the potential profitability of innovation grows [51]. Piva and Vivarelli, by examining 216 Italian firms' longitudinal data, found that sales have a significant impact in driving R&D, and the demand-pulling effect is related to the firm's own characteristics [52].

Third, green technology capacity, entrepreneurship, and innovation capacity cooperate with each other. Green technology innovation is an important means to solve the problem of innovation quality and achieve sustainable development [36]. Enterprises' green technology innovation can save resources and reduce environmental pollution, and its social benefits are higher than their own benefits. However, the cost of green technology innovation is higher, and its own costs may be higher than social costs. Therefore, to encourage business innovation in green technologies, the government must develop some environmental legislation. In addition, as entrepreneurs are the main force of innovation, they can obtain sustainable competitive advantages through green technology in the market. The constantly updated and iterative technological progress also makes all enterprises (regardless of industry) pay attention to entrepreneurship, which not only guides the development orientation for the enterprises, but also leads enterprises to gain competitive advantages and improve sustainable innovation quality. This is particularly important for agricultural product processing enterprises. It can be seen that the unilateral factors have limited contribution in improving the overall innovation quality in agricultural product processing enterprises.

In conclusion, an ideal high innovation quality is one in which all internal and external factors are all at a high level. However, due to different influences of resource endowment, technology, and talents, there is a certain imbalance in the development of production factors among different enterprises. This leads to the difference in the complexity and consistency of enterprise innovation quality. Theoretically, a single factor is not sufficient to promote the high innovation quality. In summary, this paper focuses on two causal relationships: (1) Which driving factors are necessary to achieve high innovation quality, and to what extent? (2) How do these internal and external factors couple to achieve high innovation quality in agricultural product processing enterprises in Liaoning province? This essay examines the various pathways from the viewpoint of configuration and analyzes the complex influencing mechanisms that promote innovation quality. In Figure 1, the theoretical model is displayed.

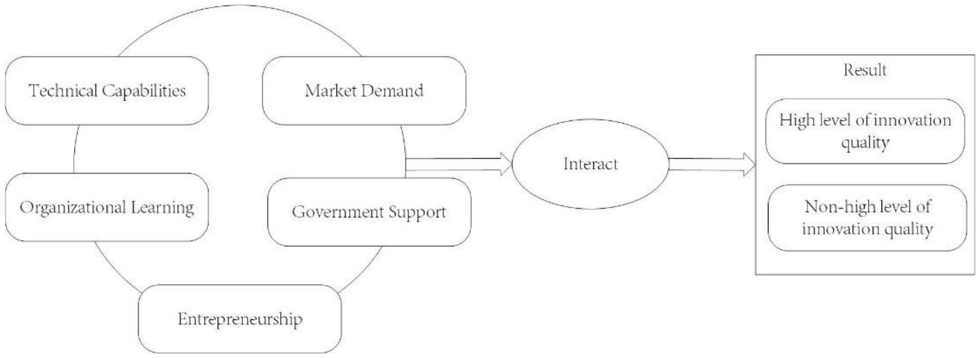

Figure 1. Research Framework.

4. Data and Methods

4.1. Samples and Data

Based on the research purpose, this study utilizes a survey methodology to look into the factors which drive agricultural product processing firms in Liaoning province to innovate with high quality. The survey method is a basic research method commonly used in scientific research. It can provide us with first-hand materials and data about research topics, help us understand the status quo of innovation quality of agricultural product processing enterprises in Liaoning province, and provide us with a new understanding of the driving factors of innovation quality based on analysis, synthesis, comparison, and induction.

This paper takes the agricultural product processing enterprises in Liaoning province as the research object, and these enterprises are mainly located in Dalian, Chaoyang, and Yingkou, etc. In terms of the basic information of the enterprises, most of the agricultural product processing enterprises in the sample mainly belong to agricultural and sideline food processing industries. Regarding the establishment time of enterprises, 12 firms were established in less than 3 years, accounting for 33.3% in total, which is the highest proportion. In terms of enterprise size, most enterprises have 50–100 employees and 101–200 employees, and there were only 9 companies with assets of $1 million or more, accounting for 25 percent of the sample, indicating that most of the surveyed objects are relatively mature small and medium-sized businesses. Most of the respondents have worked in enterprises for 3–5 years. The information of the 36 survey samples is displayed in Table 1.

All of the information used in this study is from surveys. Utilizing the mature scale items from relevant domestic and foreign literature, this paper designed a questionnaire titled "Investigation on Innovation Quality of Agricultural Product Processing Enterprises in Liaoning Province". The questionnaire consists of three sections: the first section contains the fundamental data about the firms and responders, including the name, establishing time, number of employees, total assets, and other information of the surveyed agricultural product processing enterprise, as well as the position and service years of the respondents; the second part measures the innovation quality of agricultural product processing enterprises, including product innovation quality, process innovation quality, and management innovation quality, and there are 12 questions; and the third part measures the driving factors of the innovation quality of agricultural product processing enterprises, including green technology capability, organizational learning, entrepreneurship, government support, and market demand, involving a total of 21 questions. We provided questionnaires to middle and senior management of businesses to ensure the survey's quality, and the questionnaires were distributed from July 2022 to August 2022, lasting nearly 2 months. There were 40 questionnaires distributed, among which 38 were recovered. There are two ways that the questionnaires were distributed: (1) During the enterprise visit, paper questionnaires were distributed; 10 questionnaires were distributed and 10 were recovered, which were all valid. (2) Using the relationship between the university and the enterprises, we distributed the questionnaires to the management of the enterprises by creating an electronic questionnaire, which was sent through social media platforms such as Wechat, QQ, and email. A total of 30 copies were distributed and 28 were recovered, with 26 valid ones. According to the results of the questionnaire, missing items, reverse questions, time to answer, and whether the self-report seriously answered were considered for screening. Finally, with a 90% effective recovery rate, 36 valid surveys were identified.

Table 1. Sample characteristics.

Index	Characteristics	Sample	Sample Proportion
Establish Year	Less than 3 years	12	33.3%
	3–5 years	9	25%
	6–9 years	7	19.5%
	Over 9 years	8	22.2%
	Total	36	100%
Total Assets	Less than 500,000	13	36.1%
	500,000–1 million	14	38.9%
	1 million–3 million	2	5.6%
	More than 3 million	7	19.4%
	Total	36	100%
Number of Employees	Less than 50	6	16.7%
	50–100	9	25%
	101–200	13	36.1%
	Over 200	8	22.2%
	Total	36	100%
Working Years	Less than 3 years	7	19.4%
	3–5 years	23	63.9%
	6–8 years	2	5.6%
	Over 8 years	4	11.1%
	Total	36	100%

4.2. Research Analysis

We chose fsQCA and NCA for data analysis. fsQCA is a qualitative comparative analysis (QCA) method developed by sociologist Charles C. Ragin, and it is a "causal narrative" method different from the traditional statistical analysis method, which can analyze "multiple concurrent causation" by identifying the causes of specific circumstances that produce the same result [53]. The basic idea of configuration analysis is that the performance of any function is not caused by a single factor, but by a combination of multiple factors, and these causal complexities are exactly what configuration analysis seeks to solve.

QCA is a method to study the adequacy and necessity of causality based on the idea of set theory, which is a combination of qualitative and quantitative methods. Its qualitative feature is that it takes case as the unit of analysis, but different from qualitative studies such as grounded and case studies, QCA can accommodate data of large sample cases and conduct scientific analysis. Its quantitative feature is reflected in the calibration and operation of the index data corresponding to causal variables on the basis of the Boolean algorithm, so as to obtain the necessary conditions and sufficient configuration, and provide diversified equivalent paths for the theory and practice of the research problem [54]. Therefore, it provides new ways to solve complex causal relationships. The research could explore the "causal system", which reveals the intricate connections between a series of fundamental mechanisms that do not usually show a direct link between individual factors and their outcomes but rather the links between them and their outcomes. QCA can reflect the intricate relationships between multiple factors.

NCA can be used to verify the necessary conditions of QCA. It is a new necessary condition analysis method based on complex causal relationships. Unlike QCA, NCA can estimate the effect size and bottleneck level of the necessary conditions in addition to identifying the prerequisites for the result variables [55]. At present, the QCA method was developed in China. It is not only applied in the fields of economics and management, but also has achieved fruitful results in the fields of public administration, medicine, information science and communication, and is acknowledged by numerous prestigious journals [56]. To investigate the essential and sufficient complex causality, the management circle started combining NCA with QCA under the advice of the editor-in-chief of the *Journal of International Business Studies* [57].

It can be seen from the literature review of sustainable innovation quality that the existing research only explains the relationship between a certain element of an enterprise and innovation quality, but the causal relationship among the elements and innovation quality is complex and not a simple symmetrical relationship. Therefore, this paper chooses the combination of QCA and NCA. It analyzes the improving paths of innovation quality of agricultural product processing enterprises under the five-dimensional configuration of technological capability, organizational learning, entrepreneurship, government support, and market demand with QCA, and calculates the bottleneck standard of innovation quality more accurately with NCA.

4.3. Variables

The result variables were primarily measured from three aspects: containing product innovation quality, process innovation quality, and business innovation quality, involving 12 questions. Based on the driving factors of sustainable innovation quality of enterprises, the conditional variables include five aspects: green technology capability, organizational learning, entrepreneurship, government support, and market demand, involving 19 questions. We asked the respondents to rate each item based on how they felt about it. In this study, a 5-point Likert scale is used, with 1 denoting complete disagreement and 5 denoting perfect agreement. The following is a list of the measurements made for each variable in this study.

4.3.1. Result Variables

The concept of innovation quality is multidimensional and the measurement methods are different due to the different dimensions of its definition. In this study, the measurement items of innovation quality are mainly derived from foreign social innovation quality questionnaires. According to Yang Liguo (2007) and Zhang Mingdou (2019), the measurement of innovation quality is divided into three dimensions, which are product innovation quality, process innovation quality, and management innovation quality.

4.3.2. Condition Variables

(1) Green technology capability

Referring to Terziovski and Glssop and Chen Yun [58] and Li Jin, we designed the measurement dimension of green technology capability, which involves 4 items. To build technology capability on the basis of product innovation, enterprises need to master frontier technology and information through the external environment and integrate their own internal conditions with it, so as to reserve frontier technology, accumulate relevant knowledge, and produce new technology. In this paper, we believe that the green technology capability of agricultural product processing enterprises is fundamental for innovation quality. Green technology capability also requires a certain amount of financial capability to support the innovation of research institutions and personnel, so it is closely related to innovation quality.

(2) Organizational learning

Using the organizational learning metrics developed by Gilsing, Nooteboom [59], and Yalcinkaya, three questions were designed in this paper. In designing the questions, more attention was paid to the business's capacity to invest in mature green technologies, and the firm's ability to enhance innovative skills that it did not possess before through organizational learning. The enterprise can spread some of its own local successful practices within the enterprise and benefit from them.

(3) Entrepreneurship

In this paper, we referred to the measurement scales of Covin [60], Lumpkin [61], He Xiaogang [62], and Guo Weijie [63] to measure entrepreneurship, which involves four questions. This variable examines whether top managers have good innovative ideas and planning, accurately identifies the market position of the enterprise, and requires managers to be unique in communicating with employees in a timely manner, motivating them, and delegating authority and responsibility to competent employees.

(4) Government Support

Based on the measurement of government support by Porter and Maye, Su Jin, and Nan, this paper designed three questions. As long as the government directly or indirectly subsidizes the enterprise to carry out innovation activities, it indicates that the enterprise has received government support in terms of high-quality innovation. For example, enterprises strive to become suppliers in government procurement or receive tax incentives from the local government for their innovative activities.

(5) Market Demand

Referring to Jing Ningning [64], Su Jin, and Song Zhenggang [65], this study designed 5 items to measure market demand. We analyzed whether the enterprise has the ability to incorporate the consumer into the innovation process and continuously meet customer needs in improving the innovation quality. In detail, we examined whether the enterprise can constantly improve customer satisfaction through the perception of customer needs.

5. Results and Discussion

5.1. Necessary Condition Analysis by NCA

NCA divides the unobserved area from the observable area by constructing the ceiling line in the x–y scatter plot, and estimates the necessity (insufficient) of the x variable by whether there is a ceiling zone over the upper limit line. In a scatter diagram, the maximum value in y (the result variable) corresponding to the minimum value of x (the condition variable) is traced, and the law is followed by analogy to the right along the abscissa, and finally the x–y upper line is drawn with reference to all tracing points. Depending on the category of variables, NCA mainly uses two upper limit analysis techniques. The ceiling envelopment (CE) is used to analyze the binary or discrete variables with a variable of less than 5, and for discrete or continuous variables with multiple variable levels (level $\geq$ 5), the ceiling regression (CR) is used [55].

NCA ceiling line analysis varies from traditional linear regression in several ways. First, the linear regression is based on the criterion of a better fit by crossing as many scatter points as possible, but NCA's analysis of the ceiling line is on the basis of the criterion of distinguishing between blank areas and observed areas. Second, the necessary conditions acquired from the NCA analysis do not necessarily have an important linear relationship with the result variable. In this article, the x–y scatter diagram is constructed by using both CE and CR approaches, and Table 2 displays the results of NCA.

Table 2. Results of NCA.

Conditions	Methods	Accuracy	Ceiling Zone	Scope	Effect	*p*-Value
Green technology	CR	88.9%	0.149	0.81	0.184	0.009
Capability	CE	100%	0.223	0.81	0.276	0.000
organizational	CR	100%	0.018	0.81	0.022	0.629
learning	CE	100%	0.036	0.81	0.044	0.405
Entrepreneurship	CR	90%	0.198	0.81	0.245	0.017
	CE	100%	0.233	0.81	0.288	0.000
Government	CR	88.9%	0.157	0.81	0.194	0.048
support	CE	100%	0.061	0.81	0.076	0.141
Market demand	CR	77.8%	0.151	0.81	0.186	0.016
	CE	100%	0.084	0.81	0.103	0.010

NCA stipulates that the prerequisites must meet two requirements: (1) The effect size should not be less than the threshold value (d = 0.1) and (2) the permutation testing by using Monte Carlo simulations should reveal a substantial effect [55]. From Table 2, it can be seen that green technology capability, entrepreneurship, government support, and market demand meet the first criterion, and green technology capability meets the second criterion. However, the accuracy of green technology capability is only 88.9%, which cannot satisfy the condition of <95%, so none of them meet the relevant criteria that constitute the necessary conditions. None of these elements are required for high-quality innovation [55]. According to the NCA results, no single factor is necessary to improve innovation quality.

The bottleneck level is examined using the CR estimate method because all variables are continuous and the results are shown in Table 3. Table 3 further indicates the bottleneck effect size of the necessary conditions, stating the minimal percentage that the condition variable must meet in order for the result variable y to achieve a specific percentage level within the observed range [55]. Table 3 demonstrates that each condition variable has a different degree of necessity (insufficiency) for the purpose of achieving sustainable innovation quality at 70% or above. For example, to reach 100% of the innovation quality in the total observed range, green technology capability must reach at least 97.4% level, organizational learning at least 4.4% level, entrepreneurship at least 75.5% level, and government support and market demand 90.5% and 77.2% levels, respectively. To meet 10% of the innovation quality level, only organizational learning is necessary, and all other conditions are unnecessary, indicating that organizational learning is the basic prerequisite for sustainable innovation quality.

Table 3. NCA necessary condition bottleneck level analysis/%.

Innovation Quality	Technical Capabilities	Organizational Learning	Entrepreneurship	Government Support	Market Demand
0	NN	NN	NN	NN	NN
10	NN	0.4	NN	NN	NN
20	NN	0.9	NN	NN	NN
30	NN	1.3	NN	NN	NN
40	NN	1.8	5.6	NN	NN
50	NN	2.2	17.3	NN	NN
60	NN	2.7	28.9	5.9	13.1
70	19.9	3.1	40.5	27.1	29.1
80	45.7	3.6	52.2	48.2	45.1
90	71.6	4.0	63.8	69.4	61.2
100	97.4	4.4	75.5	90.5	77.2

Note: The table uses a cap regression analysis CR; NN indicates not necessary.

5.2. Necessary Condition Analysis by QCA

This study examines the necessary conditions for innovation quality and the results are displayed in Table 4. Consistency and coverage can be respectively expressed as the validity and explanatory power. Consistency indicates the rate of cases that display a special result in the set of cases with the relating conditions, and coverage indicates the extent of cases to cover the appropriate condition and specific outcome. The consistency threshold is 0.9, and the condition variable considered to be an essential condition if its consistency is higher than 0.9. Table 4 shows the necessity results of ante-dependent variables by fsQCA3.0. The research finds that the consistency of a single factor is beneath 0.9, showing that a single factor is not necessary for increasing the quality of innovation in agricultural product processing firms, which is consistent with the results of NCA.

Table 4. Analysis of necessary conditions for QCA.

	Variable Name	Consistency	Coverage
1	Technical capacity	0.858101	0.882759
2	~Technical capacity	0.380447	0.366129
3	Organizational learning	0.717318	0.710177
4	~Organizational learning	0.559776	0.559152
5	Entrepreneurship	0.892179	0.762655
6	~Entrepreneurship	0.330726	0.393094
7	Government support	0.820112	0.757091
8	~Government support	0.450279	0.485250
9	Market requirement	0.727374	0.782452
1	~Market requirement	0.497207	0.459711

5.3. Casual Configuration Analysis

5.3.1. Sufficiency Analysis of High Innovation Quality

This paper uses fsQCA3.0 to examine the conditional configurations that lead to high innovation quality, and there are three kinds of solutions, such as complex solutions (without logical residue), intermediate solutions (with simple logical residue), and present solutions (with simple and complex logical residue). The intermediate solution is finally reported in order to avoid the conditions from being simplified by the reductive solution. The core condition is the simultaneous occurrence of the reduced solution and the intermediate solution and the auxiliary condition is the condition that just the intermediate solution takes place [66]. In order to eliminate interference from "simultaneous subset relation" and to ensure the configuration's interpretation strength, the case frequency threshold is set at 1, the PRI (subset relation consistency) threshold is set at 0.75, and the original consistency threshold is set at 0.8. The configuration based on the two solutions is shown in Table 5.

Table 5. High innovation quality group analysis results.

	Configuration Results			
Condition Variables	**S1**	**S2**	**S3**	**S4**
Green technology capability	•	⊗	●	●
Organizational learning		•	•	⊗
Entrepreneurship	●	●	•	
Government support	●	●	⊗	•
Market demand	⊗	•	●	●
Original coverage	0.43319	0.274302	0.305587	0.42514
Unique coverage	0.212849	0.088268	0.112849	0.197765
Consistency	0.92823	0.914339	0.954625	0.93639
Total consistency	0.931818			
Total coverage	0.847486			

Note: ● indicates the existence of core conditions, • indicates the existence of edge conditions, ⊗ indicates the absence of edge conditions.

From Table 5, path S1 and path S2 are driven by "entrepreneurship–government support", while path S3 and path S4 are driven by "green technology capability–market demand". The "entrepreneurship–government support driven" path makes up for the low market demand and technology capability. By comparing path S1 and path S2, it can be found that the antecedent conditions of low market demand are added to path S1, and path S2 adds the antecedent condition of low technology capability, which indicates that when the market demand is at a lower level or technology capability is insufficient, improving entrepreneurship and increasing government support can drive innovation quality to a high level. The "green technology capability–market demand driven" path makes up for the low government support and organizational learning. By comparing path S3 and path S4, it can be found that the antecedent condition of low government support is added to path S3, and the antecedent condition of low organizational learning is added to path S4, which indicates that no matter how strong organizational learning and government support are, as long as the market demand is captured and the high-tech capability is available, the goal of high innovation quality can still be achieved.

(1) Path S1: Green technology capability * entrepreneurship * government support * ~ market demand. It has high entrepreneurship and government support as the core conditions, and low green technology and no market demand as the auxiliary conditions. Most of the agricultural product processing enterprises that conform to configuration path S1 (the consistency is 0.92823) pay attention to the improvement of green technology capability. In the face of fierce competition and relatively small market demand, if the government attaches importance to the long-term development of agricultural product processing enterprises, increasing support will greatly encourage the leaders of the enterprises to change the status quo and improve innovation quality. This path can be summarized as "entrepreneurship–government support driven path". A typical case is Beikui Eco Brewery Co., Ltd. (Yingkou, China). The local government, in accordance with the documents issued by Liaoning province, vigorously promotes the development of agricultural enterprises. At the same time, the entrepreneurs of Beikui Eco Brewery Co. Ltd. have high innovation quality development. The entrepreneurs of Beikui Ecological Brewing Co., Ltd. have keenly grasped the current development direction and fully realized that improving the quality of innovation is the key to enhancing the competitiveness of enterprises. The company continuously innovates in ecological brewing to promote high-quality development of their enterprise.

(2) Path S2: Green technology capability * organizational learning * entrepreneurship * government support * market demand. This path takes high entrepreneurship and government support as the core conditions, low green technology, high organizational learning, and high market demand as auxiliary conditions. The entrepreneurs of agricultural product processing enterprises that meet the configuration path S2 (the consistency is 0.914339) have a certain sense of innovation and keen leadership, and the local government gives strong support to these enterprises. Therefore, despite a considerable market demand, the enterprises carry out internal organizational learning to increase innovation skills that they did not have before and seize current opportunities to improve their ability to use mature green technologies. This path can be summarized in the same way as the first path, that is "entrepreneurship–government support driven path", in which organizational learning and market demand are auxiliary factors.

(3) Path S3: Green technology capability * organizational learning * entrepreneurship * ~government support * market demand. This path uses high green technology capability and market demand as core conditions, and low government support and high organizational learning and entrepreneurship as auxiliary conditions. The enterprises that conform to path S3 (the consistency is 0.954625) have high R&D awareness and capability, and lack strong government support. At the same time, entrepreneurs with certain innovation awareness and leadership usually establish the developing direction based on the market environment and consumer demand, and then organize learning, adjust the strategy, and increase innovation efforts to produce high innovation quality. This path can be summa-

rized as "green technology capability–market demand driven path", with organizational learning and entrepreneurship as auxiliary factors.

(4) Path S4: Green technology capability * organizational learning * government support * market demand. This path takes high green technology capability and market demand as the core conditions, and low organizational learning and high government support as auxiliary conditions. Agricultural product processing enterprises that meet the configuration path S4 (the consistency is 0.936039) have a high awareness and ability of technology research and development. Under the strong support of the government, they can still show a high level of innovation quality even if they do not carry out organizational learning when facing the market and consumer demand is too large. High technological R&D awareness and capability indicate that enterprises focus on innovation development and have the intrinsic motivation to carry out innovation activities; greater market demand is an effective guarantee for agricultural product processing enterprises to carry out innovation; government support indirectly promotes enterprises to improve innovation quality as an auxiliary condition and plays a positive role. This path can be summarized as the "green technology capability–market demand driven path", with government support as an auxiliary factor. A typical enterprise is Jinyi Meat Processing Co. (Linyi, China), which has invested heavily in green technologies such as equipment and R&D personnel, and the government has strengthened tax incentives and other policies. On the other hand, when faced with large market demand, the enterprise can respond in time and implement production and R&D programs in line with the current situation, achieving high quality development and innovation.

Based on the configuration analysis, we further demonstrate that individual innovation driving factors are not necessary for high innovation quality. Though previous literature pointed out that green technology capability [45], organizational learning [46], entrepreneurship [14], government support [47], and market demand [64] have a positive effect on the level of innovation quality, the findings show that individual driving factors are not necessary. This paper argues that there is a mutual influence between the internal and external factors of high innovation quality, consequently, it is desired to carry out a more organized study on the influence and mechanism of high innovation quality. For example, while S1 and S2 show that government support plays a key role in high innovation quality, S3 shows that high green technology capacity coupled with high market demand, complemented by organizational learning and entrepreneurship, can also contribute to high innovation quality in the absence of government support.

The driving factors of innovation quality in agricultural product processing enterprises are comprehensive, with multi-channels, rather than a single optimal balance [65]. The internal and external driving factors of innovation quality are interdependent rather than independent. The influence of each factor on the result variables may exist in a number of equal and desirable equilibrium states, in accordance with the complex system view [55]. Therefore, due to the differences in the path dependence of resource endowment such as technology and talent, the agricultural product processing enterprises face great challenges. Therefore, they can improve their innovation quality through different combinations of green technology, organizational learning, government support, and market demand and entrepreneurship, so as to form diversified paths of high-quality innovation development.

Agricultural product processing enterprises that adopt the first type of driving path (path S1 and path S2) emphasize the importance of government support and entrepreneurship to improve innovation quality. They believe that the willingness of entrepreneurs to innovate can subjectively determine innovation quality rather than the source of knowledge. This is consistent with the research of Bo Jiang [13] and Goldberg [15], where government incentives can promote innovation in enterprises, which is conducive to improving their innovation quality. Bo Jiang [13] studied innovation quality in high-tech industries and found that the key element is to establish an entrepreneurial innovation spirit. We found through the configuration analysis that high entrepreneurship is more likely to obtain government support and improve the innovation quality of enterprises.

Agricultural businesses that adopt the second type of driving paths (path S3 and path S4) emphasize the importance of green technology capability and market demand in enhancing innovation quality. They believe that developing new products and services using green technologies in response to market demand can improve innovation quality, rather than through entrepreneurship and organizational learning. This is in line with the findings of Citizen Zhao and Chung He [12]. They argue that increasing R&D investment in technology based on demand is a proven initiative to improve innovation quality. Market demand is more conducive to the improvement of green technology capability to achieve higher quality. In addition, the enterprises that adopt this driving path also emphasize some complementary role of organizational learning, entrepreneurship, or government support.

5.3.2. Sufficiency Analysis of Non-High Innovation Quality

The conditional configurations that result in low innovation quality in agricultural product processing businesses in Liaoning province are also examined in this article and there are seven conditional configurations, NS1, NS2, NS3, NS4, NS5, NS6, and NS7 shown in Table 6.

Table 6. Results of Non-high Innovation Quality Configuration Analysis.

	Configuration Results						
Conditional Variables	**NS1**	**NS2**	**NS3**	**NS4**	**NS5**	**NS6**	**NS7**
Technical capabilities	⊗	⊗		•	⊗		⊗
Organizational learning		⊗	⊗	⊗	⊗	•	•
Entrepreneurship		⊗	⊗	•	⊗	⊗	•
Government support	⊗		•	•	•	⊗	•
Market demand	⊗	⊗	•	⊗		⊗	•
Original coverage	0.616022	0.457459	0.314917	0.214365	0.377901	0.372376	0.264088
Unique coverage	0.1221	0.0254144	0.022652	0.0187845	0	0.0314918	0.0243095
Consistency	0.991111	1	0.848214	0.803312	0.966102	1	0.89013
Total consistency				0.854975			
Total coverage				0.840332			

Note: • = peripheral casual condition (present). ⊗ = peripheral casual condition (absent). ⊗ Blank spaces indicate "do not care".

According to the result of NS1, the innovation quality of agricultural product processing enterprises will not be high if they lack high green technology capability, government support, and market demand. According to the result of NS2, if there is a lack of high green technology capability and entrepreneurship, and a slight lack of organizational learning and market demand, the innovation quality will not be high. According to the result of NS3, if there is a lack of high entrepreneurship and organizational learning, even if there is some government support and market demand, the innovation quality will not be high. According to the result of NS4, if organizational learning and market demand are lacking, the innovation quality will not be improved even if there is high green technology capability, entrepreneurship, and government support. The results of NS5 and NS6 configurations are consistent with the common sense that in the absence of a high level of green technology capability, organizational learning, and entrepreneurship, innovation quality cannot be improved by government support alone. With insufficient levels of entrepreneurship, government support, and market demand, high innovation quality cannot be formed by inputs from organizational learning alone either. The result of NS7 even reveals the role of green technology capability in improving innovation quality. In the absence of high technology capability, innovation quality will not be high even if organizational learning, entrepreneurship, and government support are strong and market demand is high.

5.4. Robustness Tests

In this paper, by altering the consistency criterion, the robustness of the findings was tested [66,67]. The consistency threshold was raised from 0.80 to 0.85, the frequency of occurrence threshold was set to 1, and the PRI value was raised from 0.75 to 0.8. By running the fsQCA3.0 software, the results show that the single consistency and overall consistency of the antecedent variables are higher than 0.9, the new configuration path is a subset of the original configuration path, and the configuration does not change substantially according to Table 7. Therefore, the findings can be considered to be robust.

Table 7. Results of the Configuration Analysis of Increasing the Consistency Threshold and PRI Values.

Conditional Variables	**Configuration Results**		
	Configuration 1	**Configuration 2**	**Configuration 3**
Green technology Capability	●	●	●
Organizational learning	●	•	⊗
Entrepreneurship	●	●	●
Government support	•	⊗	•
Market demand	⊗	●	●
Original coverage	0.41676	0.305587	0.355307
Unique coverage	0.198883	0.112849	0.129609
Consistency	0.9467	0.954625	0.968037
Total consistency		0.966292	
Total coverage		0.672626	

Note: ● indicates the existence of core conditions, • indicates the existence of edge conditions, ⊗ indicates the absence of edge conditions.

6. Conclusions and Suggestions

6.1. Conclusions

This paper explores the driving factors of innovation quality in agricultural product processing enterprises by using fsQCA and NCA methods with 36 enterprises. The conclusions are as follows:

(1) According to the above results, which are able to respond to the causal relationship studied in the previous chapters, the single driving factor has a limited contribution to improve the overall innovation quality of agricultural product processing enterprises and does not act as the necessary condition for excellent innovation quality. Entrepreneurship and green technology capability play a broader part in fostering innovation quality in agricultural product processing enterprises.

(2) The paper identifies four path combinations of internal and external factors to couple and interact with each other to achieve high innovation quality in agricultural product processing enterprises in Liaoning province, which can be further divided into two categories: entrepreneurship–government support driven and technical capability–market demand driven.

The first type of business requires a high level of entrepreneurship and strong government support to generate high innovation quality, which can compensate for the disadvantages of low green technology capability, inadequate organizational learning, and small market demand of agricultural product processing enterprises. For enterprises, entrepreneurs are the driving force leading innovation development, so they must be encouraged to continuously invest in innovation. However, entrepreneurship can also be influenced by the external environment, for example, the strong support of government will prompt entrepreneurs to innovate in production and increase enterprises' basic competitiveness. Thus, in the fierce market competition, the development of enterprises is guaranteed by internal (entrepreneurship) and external factors (government support), and the combination of internal and external driving factors is conducive to obtain a high level of innovation quality in agricultural product processing enterprises.

The second type of enterprise attaches great importance to the green technology capability and market demand, which promotes the improvement of innovation quality. The combined effect with other factors cannot be ignored with respect to encouraging enterprises to improve innovation quality. For example, the marginal conditions of path S3 are organizational learning and entrepreneurship. When government support is insufficient, agricultural product processing enterprises can improve the quality of sustainable innovation as long as they improve technology capacity, expand market demand, and develop entrepreneurship and organizational learning coordinately. The marginal condition of path S4 is government support. When organizational learning and entrepreneurship are insufficient, the combination of technology capability, market demand, and government support can promote enterprises to produce high innovation quality.

(3) Organizational learning is a key bottleneck for innovation quality. The NCA method shows that only organizational learning is necessary to achieve 10% of the innovation quality level through the CR estimation method, and other conditions are unnecessary, indicating that organizational learning is the basic necessary condition for innovation quality. While in order to achieve an innovation quality of 70 percent and above, all the condition variables are necessary.
(4) There are seven conditional configurations that lead to non-high innovation quality. The paper finds that the vast majority of non-high innovation quality paths show the central role of green technology capability and entrepreneurship, that is, in the absence of high green technology capability or high entrepreneurship, the innovation quality is not high even though the other conditions exist. Other configurations, such as NS1 and NS6, require government support and market demand to play a central role in addition to green technology capability and entrepreneurship.
(5) There is a causal imbalance between high level innovation quality and non-high-level innovation quality in agricultural product processing enterprises in Liaoning province, which means that the opposite of high-level innovation quality construction is certainly not an adequate condition to prompt non-significant level innovation quality.

6.2. Suggestions

6.2.1. Internal Level

First, the enterprises should focus on the effective allocation of technological innovation. In agricultural product processing enterprises in Liaoning, the products are mostly in the primary processing stage, with low technological level, profit level, and small market share. coupled with the influence of natural conditions, the production is uncertain, and the market price fluctuates significantly, along with operation risks. Thus enterprises should be clear that technology capability is the source to guarantee long-term development, and reserve more resources than expected in R&D personnel and equipment to cope with possible emergencies in the long-term innovation process, so as to minimize the failure of innovation behaviors due to forecast deviations. By improving technology capability, the agricultural product processing enterprises can increase the income, expand the market share, and guarantee the competitive advantage [68]. At the same time, new products should be produced in a standardized manner. In the raw material processing, the production should be in strict accordance with international quality standards, and the enterprises should strengthen the monitoring of material processing, and dispose of unqualified new products to ensure product quality.

Second, innovative entrepreneurship should be established. Enterprises in the market usually face concrete problems in competition in capital management, technological innovation, product features, etc., as well as abstract problems such as cultural power, the inner quality of entrepreneurs, and so on. While entrepreneurs are the main actors of agricultural product processing enterprises to make production decisions, and they have a non-negligible influence on enterprises' innovation quality in aspects of strategic choices, production decision, development expectation, daily management, and cultural construction. The orientation of development and the form of management are the inevitable products of entrepreneurs' continuous innovation and practice. When there is an opportunity to promote the development of enterprises, innovative entrepreneurs tend to seize the opportunity to move forward; conversely, the entrepreneurs with low knowledge, learning ability, and innovation consciousness are not equipped to assess the management strategy and development direction and cannot plan from a long-term perspective. Therefore, agricultural product processing entrepreneurs need to break the framework of thinking, refuse to stand stagnant, accept new things, broaden their horizons, gradually form innovative ideas, and guide the innovative development of enterprises. Reward policies should be made to encourage enterprises to make appropriate innovations and create an atmosphere of positive innovation, so that employees can input innovative ideas in their work to finally guarantee the improvement of innovation quality of agricultural product processing enterprises.

6.2.2. External Level

First, from the government's perspective, policies should be formulated and implemented to improve the innovation quality of agricultural product processing enterprises in Liaoning province. Agricultural product processing enterprises are faced with large initial investment, low return rate, long capital turnover cycle, and are usually affected by natural conditions, so they absolutely need government support to achieve development. Therefore, the government should be clear of macro-control orientation, and encourage the agricultural product processing enterprises to pay more attention to R&D and innovation through providing R&D subsidies, supporting infrastructure renovation, offering credit guarantees, loan subsidies, tax preferences, and so on [69]. In addition, the government should effectively implement the support policies of the state and governments at all levels for agricultural product processing enterprises and increase supervision of use of funds to ensure rational use. In addition to the relevant policy and support, the government should also take various measures to improve the innovation environment of agricultural product processing enterprises, provide a good market competition environment, and choose more innovative enterprises as suppliers in government procurement, which can prompt enterprises to pay more attention to innovation, so as to achieve the goal to promote innovation quality. At the same time, local governments can integrate enterprises, markets, and research institutions in an appropriate way to promote innovative activities and further strengthen innovation quality.

With the market and customer demand providing guidance, agricultural product processing enterprises should clarify the direction of innovation, improve the innovation strategy, and accelerate the production of new products. An enterprise with good developing prospects is not only supported by advanced technology and equipment, innovative products, and funds for R&D, but also by the ability of its innovative products to be accepted by the market and to meet the needs of customers. Therefore, in order to achieve high-quality development, enterprises need to take the market environment and the real demands of customers as the primary objective, take market exploration and market segmentation as the guide, and obtain the latest information on current market environment and customer needs, so as to be able to develop corresponding marketing plans and make production-related R&D decisions.

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