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Analysis of Business Risk Measurement and Factors Influencing Plantation-Based Farming Cooperatives: Evidence from Guizhou Province, China

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Abstract: Plantation-based farming cooperatives are important carriers to promote agricultural and rural modernization and increase farmers' income. Their risk management is related not only to their own sustainable development but also to the practical interests of farmers. Based on the survey data of 226 sample cooperatives in Guizhou Province, this study measures the business risk of plantation-based farming cooperatives via factor analysis and empirically tests its influencing factors using a structural equation model. This research shows that there are different types of operational risks in plantation-based farming cooperatives, and the order of these risks is as follows: market risk (0.334) > policy risk (0.162) > natural risk (0.140) > technical risk (0.104) > management risk (0.097). In terms of the factors influencing business risk, the impact effect value of the economic environment is 0.522, making it the most important external interference factor. The technology environment and policy environment have a greater impact on business risk (effect values of 0.323 and 0.219, respectively). The effect of the social service environment (an effect value of 0.114) is relatively weak. The internal factor, operator characteristics, is the core factor (an effect value of 0.533) that affects the business risk of plantation-based farming cooperatives, which determines the development prospects of the cooperatives. Resource endowment is an important internal factor affecting the business risk of cooperatives (an effect value of 0.331). According to the conclusions of our research, some policy implications on how to promote the high-quality development of plantation-based farming cooperatives are presented, i.e., to refine the policy support for plantation-based farming cooperatives, optimize the economic environment of the agricultural market, further improve agricultural infrastructure, deepen the reform of the agricultural land transfer system, and improve the internal management level of cooperatives.

Keywords: plantation-based farming cooperative; business risk; influence factor; structural equation model

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1. Introduction

Agriculture is a fundamental industry for people's wellbeing and is the foundation of China's national economy. Currently, Chinese agriculture is in transformation: traditional small-scale farming can no longer meet the requirements of scale management and the modernization of agriculture [1], while plantation-based farming cooperatives and other new types of agricultural businesses have become key breakthrough points in advancing agricultural development and increasing farmers' incomes [2], and they have played important roles in promoting the efficient use of land resources [3], linking up production and the sales of agricultural produce [4] with rural governance [5,6]. In recent years, China has paid great attention to the development of farming cooperatives. Since 2008, when the No. 1 Central Document first instructed that public finance departments at all levels should increase their support for farming cooperatives, the management and development

of farming cooperatives have been matters of concern in the No. 1 Central Document for 16 years in a row. In 2023, the same document once again issued important instructions on developing farming cooperatives and increasing farmers' income, providing guidance for the further development of farming cooperatives. However, as the reform of the rural economic structure goes further, the business environment of farming cooperatives has become increasingly complex [7], with various risks becoming prominent, which have a great influence on the high-quality development of farming cooperatives as well as the achievement of common prosperity for all farmers. Therefore, research on the business risks of farming cooperatives has become an important topic in studying issues relating to agriculture, rural areas, and farmers.

Risk management theory is the theoretical basis of the risk management activities of market operators. In 1916, Fayol first introduced the concept of risk management into the enterprise management system in his book Industrial Management and General Management [8]. By the middle of the 20th century, risk management was included in the scope of enterprise management activities, and the academic community had begun to conduct systematic research [9]. In the subsequent development process, the research in this field can be divided into traditional risk management (TRM) and enterprise risk management (ERM), based on the differences in management concepts and management technologies. The theory of risk management is continuing to mature and develop, and it has been widely applied in the fields of economic, financial, and social development. The problem of agricultural risk has always been a difficult problem for agricultural development [10]. For a long time, the biggest concern of "relying on the weather" in agricultural production has been the decline in production caused by natural risks. Against the background of the continuous deepening of China's market-oriented reform and the reshaping of the world's trade patterns, the market risk of agricultural enterprises has also begun to increase. Under the requirements of the continuous improvement of agricultural science and technology, along with the practical needs of modern agricultural development, agricultural production technology risks and management risks are also becoming increasingly prominent. At the same time, since 2014, China's agricultural product price support policy has been gradually loosened, and the impact of policy risk on the income of agricultural operators cannot be ignored. New agricultural business entities such as plantation-based farming cooperatives are important forces in agricultural production at this stage, and they are also a type of agricultural enterprise [11]. Therefore, it is of great practical significance to discuss the production and management risks of plantation-based farming cooperatives based on risk management theory, which will promote the sustainable development of agricultural enterprises and boost the revitalization of rural industries.

Currently, theoretical research on farming cooperatives mostly focuses on business performance [12–16] and promoting the development of farming households [17–22]; it rarely studies the business risks faced by farming cooperatives. Among the research on farming cooperatives' risks, some scholars focus on the risk types faced by cooperatives. For example, Ligon believes that the risks faced by farming cooperatives mainly include yield risk, quality risk, basis risk, and price risk [23]. Dou et al. studied farming cooperatives in the city of Bengbu, Anhui Province, and classified the risks faced by farming cooperatives into three types: human capital risk, decision-making risk, and financial risk [24]. A few scholars have also conducted risk assessments on cooperatives. For example, Yang used factor analysis to assess the risk faced by fruit and vegetable cooperatives in Shaanxi Province; the study found that fruit and vegetable cooperatives in Shaanxi Province were at higher risk, and there were significant differences in the risk levels faced by cooperatives led by different business entities [25]. Zhang and Huang conducted a comparative analysis of the risks faced by traditional and modern cooperatives by studying 158 farming cooperatives in Zhejiang Province. The study found that the two types of cooperatives face very different risks, with traditional cooperatives facing greater competition and human capital risks, while modern cooperatives face greater decision-making and behavioral risks [26]. Some scholars have also summarized prevention strategies for the business risks of farming

cooperatives. Sandeep proposed that the prevention of cooperative capital risks should be achieved through sound organizational structure, strict regulation and management, and the optimization of the financial environment [27]. Stiglitz believes that the key to the healthy operation of cooperatives lies in ensuring sufficient working capital and meeting the funding needs of members [28]. Based on the perspective of financial risk, Tan et al. constructed a risk management mechanism involving multiple stakeholders, such as the government, cooperatives, and members, to mitigate the financial risks of cooperatives [29]. In addition, scholars have explored the factors affecting the business risks faced by farming cooperatives from different perspectives. Jia et al. studied farming cooperatives in Sichuan Province and found that financial security and product price stability were the main factors affecting the operation and development of cooperatives [30]. Donovan et al. analyzed the operation and performance of emerging cocoa cooperatives in Peru and found that financial capital was a key factor affecting their business risks [31]. Through studying farming cooperatives in China, Wang et al. found that the entrepreneurial spirit of the cooperative's leader is not only a key link between farming cooperatives and rural industrial development, but also an important factor affecting the business risks faced by cooperatives [32]. In complex risk assessment research, variable methods have been applied. Shi et al. used a structural equation model to analyze the factors influencing public acceptance of environmental risk [33]. Vaiyapuri et al. proposed an intelligent feature selection financial risk assessment model (IFSDL-FRA) based on deep learning for analyzing the financial risk of enterprises [34]. Zhou et al. developed a comprehensive risk assessment method based on FSPA and FCM, based on the risk of tunnel excavation in soil–rock mixed strata, which was well verified in a shield tunnel project in Guangzhou, China [35]. Based on the perspective of financial institutions, Yang et al. constructed a hierarchical structure model of risk factors using the analytic hierarchy process to evaluate the mortgage loan risk factors in rural land management [36].

In conclusion, the results of research on farming cooperatives are of great significance in promoting the development of cooperatives and in helping enrich the theories related to agricultural industrial development and agricultural production cooperation. However, there is still room for further exploration in the following areas: (1) Most research on cooperatives focuses on their performance and operation, and only a few studies have considered the business risks faced by cooperatives. (2) The existing literature only focuses on certain individual aspects when studying risk prevention strategies and the factors affecting the business risk faced by cooperatives; there is not enough holistic analysis from various perspectives. (3) Existing research has mostly carried out general studies on cooperatives, ignoring the differences between different types of cooperatives. There is even more room left for exploring the risk measurement and influence factors of plantation-based cooperatives. In view of this, based on the field survey data of 226 plantation-based cooperatives in Guizhou Province, China, this article comprehensively constructs an assessment indicator system for the business risks of plantation-based farming cooperatives, discusses the main factors affecting business risks, measures business risks through factor analysis, and analyzes the influential factors using a structural equation model. Based on the research results, this article proposes methods and suggestions to promote the high-quality development of plantation-based farming cooperatives from the perspective of influential factors, in order to provide a theoretical reference for cooperatives and other emerging agricultural business entities to improve their risk prevention capabilities and enhance their performance.

This paper makes the following two contributions: First, the research perspective focuses on a specific type of cooperative, analyzing the business risk issues faced by plantation-based farming cooperatives and providing a useful supplement for the relevant research on the business risk faced by agricultural enterprises. Second, this study comprehensively discusses the factors influencing the business risk faced by plantation-based farming cooperatives in the internal and external dimensions and six aspects, breaking through the limitations of most existing studies (which analyze the business risk faced

by cooperatives based on one aspect) and providing reference for the comprehensive management of cooperatives.

2. Materials and Methods

2.1. Construction of an Assessment Indicator System for Business Risks

Currently, the risk assessment standards vary between different cooperatives. This is mainly for two reasons: one is the uncertainty of risks due to uncertainties during agricultural operation and production, and the other is the exceptionality of produce and regional differences. Therefore, this article refers to the results of research conducted by other scholars [37–39] and takes survey results into consideration, constructing an assessment indicator system for the business risks faced by plantation-based farming cooperatives based on natural risks, market risks, management risks, technical risks, and policy risks (Table 1).

Table 1. Assessment indicator system for the business risk faced by plantation-based farming cooperatives and data characteristics.

Primary Class Index	Secondary Class Index	Symbol	Min	Max	Mean	S.D.	One Sample *t*-Test
Natural risk	Losses due to extreme weather conditions, including droughts and floods	a_1	1	5	3.798	0.954	46.514 ***
	Losses due to plant diseases and insect pests	a_2	1	5	3.593	0.883	30.362 ***
Market risk	Losses due to a low degree of matching between produce and market requirements	b_1	1	5	3.163	0.912	5.733 **
	Losses due to changes in produce prices	b_2	1	5	3.146	1.036	−8.4398 **
Management risk	Losses due to inexperienced managers	c_1	1	5	3.476	0.995	21.259 ***
	Losses due to lack of innovation of managers	c_2	1	5	3.102	0.827	19.636 ***
Technical risk	Losses due to lack of agricultural technological personnel	d_1	1	5	3.116	0.871	14.219 **
	Losses due to unmatched technologies and operational requirements	d_2	1	5	3.354	0.927	12.663 ***
Policy risk	Losses due to inadequate policy support	e_1	1	5	3.661	0.913	19.316 ***
	Losses due to financial difficulties	e2	1	5	3.815	0.898	27.628 ***

Notes: *** indicates statistical significance at the 1% level; ** indicates statistical significance at the 5% level.

1. Natural risk: There are many uncertainties and uncontrollable factors in agricultural operations, mostly due to their natural attributes. On one hand, extreme weather events such as droughts and floods are highly destructive to agricultural production and can easily lead to reduced crop yields; on the other hand, crops are susceptible to diseases or insect pests, which can harm the quality and yields of crops. Therefore, in this article, losses due to extreme whether events (including droughts and floods) or caused by diseases and insect pests are listed as natural risk indicators.
2. Market risk: The plantation-based farming cooperative is a market entity, and its input and output are closely related to the market [40]. Therefore, losses due to the mismatch between agricultural produce and market demands, along with losses due to the fluctuations in produce market prices, are set as the specific indicators of market risk. Whether the produce meets market demands largely determines its market competitiveness, and fluctuations in produce prices have a major impact on the management efficiency of cooperatives, which can then affect the future operations and development of cooperatives.
3. Management risk: Losses due to inexperienced managers and lack of innovation were selected as specific indicators for management risk. On one hand, cooperatives are mostly run by migrant workers who return home to start a business, larger growers, village cadres, and farmers, all of whom lack experience in operating cooperatives. This can easily cause management risk. On the other hand, innovation is the primary

driving force for development, which requires cooperative managers to have a strong capability to innovate and an adventurous spirit. However, during the survey, we found that some of the managers are less educated, some are vulnerable due to their age, and some are stuck in the small farmer's way of thinking. All of these managers lack the spirit of innovation, curbing the development of cooperatives.

4. Technical risk: Losses due to the lack of agricultural technical personnel or caused by the mismatch between agricultural technologies and operating requirements were set as technical risk indicators. Science and technology constitute the primary productive forces. The application of agricultural technology requires technological professionals, and there is increasing demand for qualified technical personnel. However, due to poor infrastructure and low payment, there is an outflow of talent in rural areas, and it is difficult to recruit talent, leading to a lack of agricultural technical talent in rural areas and the possibility of technical risk. At the same time, whether technology can meet the operating requirements of cooperatives also determines the technical risk faced by cooperatives [41].
5. Policy risk: Losses due to inadequate policy support and by financial difficulties were set as policy risk indicators. Policy support reflects how much attention the relevant departments pay to farming cooperatives, while financial status reflects whether the cooperative is well funded and if the relevant financing policies and mechanisms are sound. According to the survey, at present, China's agricultural insurance still has problems, including imperfect mechanisms, limited scope of insurance coverage, and limited categories of insurance. The insurance demands of these cooperatives cannot be met. Furthermore, financial difficulties and unsound mechanisms also make it difficult for cooperatives to expand the scale of their operations, as well as bringing more business risks.

2.2. Latent Variables of Influencing Factors and Research Hypothesis

1. Policy environment: The policy environment can effectively promote the development of emerging business entities, including cooperatives [42]. In recent years, China has been paying attention to the development of farmers' cooperatives. In Several Opinions on Improving Farmer Cooperative Regulation, issued by the Ministry of Agriculture and Rural Affairs, as well as Financial Regulations of Farmers' Professional Cooperative, jointly issued by the Ministry of Finance and the Ministry of Agriculture and Rural Affairs, it is stressed that farming cooperatives need to enjoy support in terms of fiscal projects, financial services, and talent support polices. At the provincial level, Guizhou Province has also introduced targeted measures to improve the development of farming cooperatives. The Department of Agriculture and Rural Affairs and other departments of Guizhou Province jointly formulated the Implementing Program for Jointly Improving High-quality Development of Farmer Cooperatives, Opinions on Promoting High-quality Development of Farmer Cooperatives, and other relevant documents, all of which play an important role in promoting the rapid development of local farming cooperatives. From a practical standpoint, the development of farming cooperatives cannot be divorced from the policy environment, laws, and regulations [43]. Government support for emerging agricultural entities is beneficial to agricultural resource allocation and good for entities to develop a comparative edge, thus gaining additional profits. Based on the above, this article puts forward the following hypothesis:

H1. *The policy environment has a positive impact on the business risk avoidance of plantation-based farming cooperatives.*

2. Economic environment: The economist Schultz believes that the economic environment has a significant impact on agricultural production [44]. Changes in the economic environment will directly affect decision-making behavior in agricultural production [45]. On one hand, produce prices and their stability are important factors

that affect the development of cooperatives. Produce prices determine the willingness of plantations and the behavioral choices of the cooperative. A stable produce price is the foundation of a sustainable economy and market stability, and it is also the key factor in the adjustment of the cooperative's product structure. On the other hand, whether or not it is easy to raise funds is also an important factor affecting the development of cooperatives. The range of financial institution types in rural areas is limited, the risk-sharing mechanism for agricultural loans is unsound, and cooperatives are short of collateral for loans. All of these factors have a negative impact on cooperatives' scale of production and market management, increasing the business risk. Furthermore, the stability of marketing channels has a significant impact on agricultural operations. The more stable the marketing channel, the lower the business risk faced by cooperatives will become [46]. Based on the above, this article proposes the following hypothesis:

H2. *The economic environment has a positive impact on the business risk avoidance of plantation-based farming cooperatives.*

3. Social service environment: Social services are the basic path to improve agricultural efficiency [47]. The development of plantation-based farming cooperatives needs the support of agricultural social services that have wide coverage and are highly efficient. Effective social services can provide support for cooperatives in their operation and production, improve their capacity for development, and make them the foundation for connecting modern agriculture and agricultural economic organization. From the standpoint of institutional economics, outsourcing in agricultural production is a practice through which agricultural entities share land management rights with social service providers by buying the latter's services. Such practices will definitely improve agricultural production efficiency and increase the economic benefits for agricultural entities [48]. Mechanized production can improve production efficiency and reduce production costs in agriculture, but the purchase and maintenance of agricultural machinery is very expensive. Therefore, the leasing of agricultural equipment is a good way to reduce costs and increase benefits for business entities. Logistics is important for the storage and transportation of agricultural products from production to consumption. Therefore, the social service environment has a major impact on agricultural operations and production. Based on the above, this article proposes the following hypothesis:

H3. *Social services have a positive impact on the business risk avoidance of plantation-based farming cooperatives*.

4. Technical environment: Agricultural technology is the primary driving force of agricultural development. Advanced productive forces can increase agricultural outputs, improve production efficiency, and increase managers' incomes by reducing the cost of production. Advanced agricultural technology is also the main driver for promoting plantation-based farming cooperatives. The application of agricultural technology and employment of technical talents have major impacts on the production and operations of plantation-based farming cooperatives. Moreover, different geographical conditions and different crops have different technological requirements. Therefore, whether the technology meets the cooperatives' operational requirements also has an impact on the business risk. Based on above, this article proposes the following hypothesis:

H4. *The technical environment has a positive impact on the business risk avoidance of plantation-based farming cooperatives.*

5. Self-resource endowment: In a market economy, the external environment will affect the business risk, and internal conditions are also a key factor for the successful operation of businesses [49]. The internal conditions of plantation-based farming cooperatives that can affect business risks mainly include the cooperative's scale of operation, years in operation, and the level of industrial organization. According to existing research, scholars generally believe that the scale of land management has a major impact on the development of agricultural businesses. The larger the scale of operations, the higher the risk level [50]. The longer the years in operation, the better the operating efficiency and the lower the level of business risk [51]. Improving the level of industrial organization of cooperatives can not only reduce market transaction costs but also spread risks to other members of the organization, thus reducing the business risk faced by the entity itself [52]. Based on the above, the following hypothesis is proposed:

H5. *Self-resource endowment has a positive impact on the business risk avoidance of plantation-based farming cooperatives*.

6. Manager characteristics: As the core members of cooperatives, managers' business capabilities and managerial expertise are crucial to the development of cooperatives. Usually, managers with higher levels of education and knowledge tend to be more far-sighted. They are prone to running cooperatives through modern management methods and agricultural technology, and they tend to make operational decisions and solve problems via an economic way of thinking [53]. Furthermore, the age of managers has a major impact on their management philosophy and operational decisions. Younger managers tend to make risky and innovative decisions, while older managers are less advantaged in learning and making risky choices, which has an impact on their operations [54]. Finally, cooperatives' operation is similar to that of an enterprise, so the leadership abilities of entrepreneurs—including firm enterprise belief, pioneering and innovative spirit, strong competitiveness, and tolerance—are also essential to the successful operation of cooperatives. Therefore, whether managers have an entrepreneurial spirit has an impact on the operation of cooperatives. Based on the above, the following hypothesis is proposed:

H6. *Manager characteristics have a positive impact on the business risk avoidance of plantation-based farming cooperatives*.

In summary, this article constructs a structural model of the factors influencing plantation-based farming cooperatives' business risk (Figure 1). The policy environment, economic environment, social service environment, technical environment, self-resource endowment, and manager characteristics are exogenous latent variables, and business risk is an endogenous latent variable.

2.3. Variable Selection for Influencing Factors

Based on the production and operation characteristics of plantation-based farming cooperatives, we drew upon existing research [55–57] and designed an item for measuring the factors influencing cooperatives' business risk, which covers 6 latent variables (policy environment, economic environment, social service environment, technical environment, self-resource endowment, and manager characteristics) and 18 observational variables. The questionnaire uses a five-point Likert scale. The specific meanings of the variables and descriptive statistics are shown in Table 2.

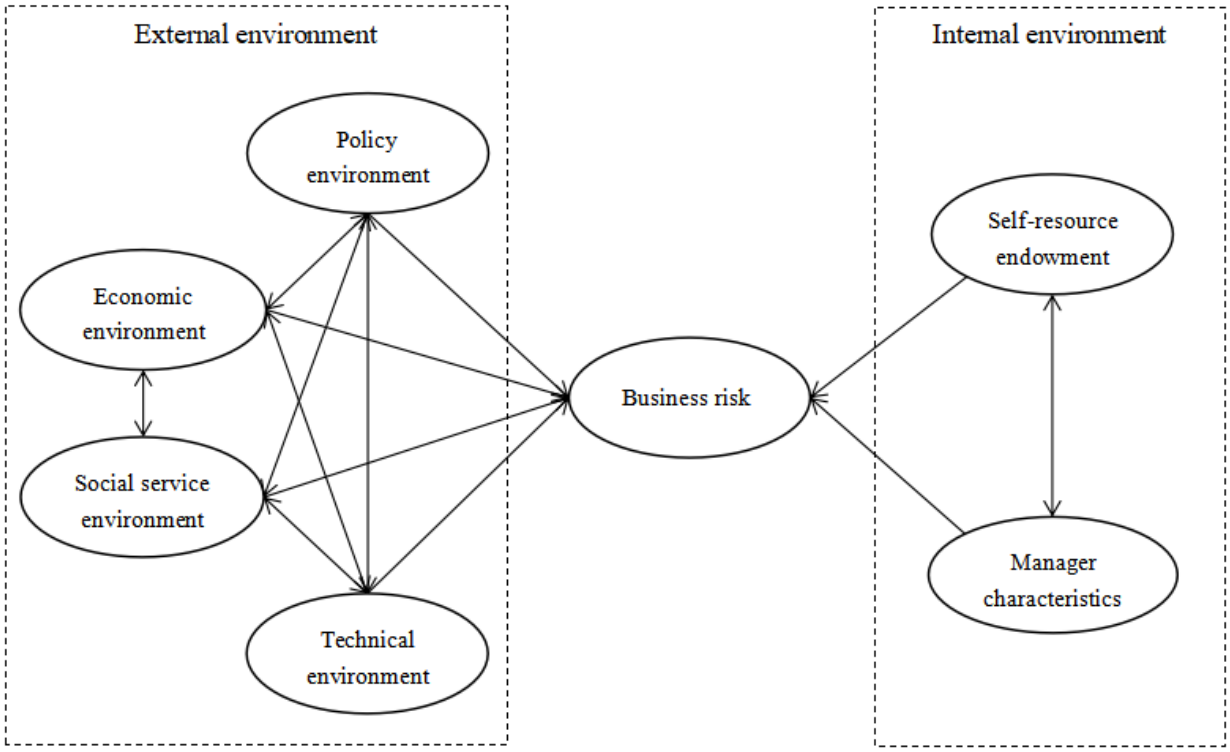

Figure 1. Structural model of factors influencing plantation-based farming cooperatives' business risk.

Table 2. Indicator system and scale of business risk faced by plantation-based farming cooperatives.

Latent Variable	Observational Variable	Serial No.	Variable Declaration	Mean	S.D.
Policy environment	Subsidies acquired by cooperatives	PE1	0–50,000 RMB = 1, 50,000–100,000 RMB = 2, 100,000–150,000 RMB = 3, 150,000–200,000 RMB = 4, 200,000 RMB and above = 5	2.881	0.889
	Implementation of relevant policies	PE2	Very poor = 1, poor = 2, normal = 3, good = 4, very good = 5	3.233	0.896
	Land transfer	PE3	Hard = 1, difficult = 2, normal = 3, easy = 4, very easy = 5	3.184	0.922
Economic environment	Price stability of agricultural products	EE1	Very bad = 1, bad = 2, normal = 3, good = 4, very good = 5	2.901	1.045
	Fund raising	EE2	Hard = 1, difficult = 2, normal = 3, easy = 4, very easy = 5	3.022	0.841
	Stability of marketing channel	EE3	Highly unstable = 1, unstable = 2, normal = 3, stable = 4, highly stable = 5	3.669	0.903
Social service environment	Outsourcing of agricultural production	SSE1	Hardly ever = 1, few = 2, normal = 3, frequent = 4, very frequent = 5	2.912	0.857
	Machinery leasing	SSE2	Hardly ever = 1, few = 2, normal = 3, frequent = 4, very frequent = 5	2.907	0.915
	Logistics of production	SSE3	Very poor = 1, poor = 2, normal = 3, sound = 4, very sound = 5	3.652	0.941
Technical environment	Modern agricultural technology	TE1	Very poor = 1, poor = 2, average = 3, good = 4, very good = 5	2.851	0.801
	Matching between technology and cooperative operation	TE2	Highly unmatched = 1, unmatched = 2, normal = 3, matched = 4, highly matched = 5	3.13	0.916
	Agricultural technological talent resources	TE3	Very scarce = 1, scarce = 2, average = 3, abundant = 4, very abundant = 5	2.952	0.849

Table 2. *Cont.*

Latent Variable	Observational Variable	Serial No.	Variable Declaration	Mean	S.D.
Self-resource endowment	Scale of land management	CE1	Below 16.47 acres = 1, 16.47–49.42 acres = 2, 49.42–82.37 acres = 3, 82.37–115.32 acres = 4, 115.32 acres and above = 5	3.685	0.969
	Operating years of cooperative	CE2	Less than 1 year = 1, 1–3 years = 2, 3–5 years = 3, 5–7 years = 4, above 7 years = 5	3.603	0.992
	Level of industrial organization	CE3	Very low = 1, low = 2, average = 3, high = 4, very high = 5	3.232	1.027
Manager characteristics	Age	MC1	60 years or older = 1, 50–59 years old = 2, 40–49 years old = 3, 30–39 years old = 4, below 30 years old = 5	2.671	1.215
	Level of education	MC2	Primary school level and below = 1, junior high-school level = 2, senior high-school and vocational high-school level = 3, junior college level = 4, undergraduate and above = 5	2.839	0.83
	Entrepreneurial spirit	MC3	Very inadequate = 1, inadequate = 2, average = 3, adequate = 4, very adequate = 5	3.756	0.981

2.4. Research Methods

2.4.1. Factor Analysis Method

When measuring the business risk faced by plantation-based farming cooperatives, in addition to the construction of the index system, it is also necessary to determine the weight of the index. When determining the index weight, the analytic hierarchy process, Delphi method, and factor analysis method are the main methods used. Among them, when using the Delphi method and analytic hierarchy process to set the index weight value, it is mainly through experts or a few representatives, meaning that these methods are strongly subjective and are often not suitable for the measurement of large-sample data. The factor analysis method can combine qualitative analysis with quantitative analysis to determine the weight more scientifically and reasonably. At the same time, the factor analysis method is widely used in risk assessment. For example, Chen et al. used the factor analysis method to measure the risk of P2P online lending platforms [58]. Zhang et al. used the factor analysis method to evaluate and analyze the environmental risk types faced by countries along the "belt and road" [59]. Liu et al. used the factor analysis method to identify the business risk faced by family farms, and they discussed the manifestations of different risks on family farms [1]. Therefore, this paper uses factor analysis to analyze the sample data to discuss the business risk faced by plantation-based farming cooperatives.

Factor analysis is a method that puts several related variables into the same category and then assigns a new specific meaning to each category that can be taken as a new factor. Various complex variables can be represented by smaller numbers of new factors, while the information of previous variables will not be distorted In this way, researchers can study the relationships between original variables in a less complicated way [60]. In carrying out factor analysis, we first need to carry out testing of the validity and reliability of observed business risk values facing plantation-based farming cooperatives to see if they are suitable for factor analysis. Then, principal component analysis (PCA) can be used to select the characteristic values greater than one as common factors. Through calculation, the cumulative variance contribution rate can be obtained. Then, by using the maximum variance orthogonal rotation method, the weight value of each factor is acquired, based on which each factor can be weighted. Finally, the composite scores are obtained, based on which the business risk faced by plantation-based farming cooperatives can be evaluated.

2.4.2. Structural Equation Model

Structural equation modeling (SEM) is an important quantitative statistical method in the field of behavioral social sciences. In social science research, it is difficult to obtain

latent variables through direct measurement, and it is difficult to explain the relationships between latent variables. Structural equation modeling can better solve this problem. At the same time, the characteristics of structural equation modeling also make it suitable for exploring factor analysis, path analysis, and other models, and it can consider the relationships between multiple variables at the same time, meaning that it has strong flexibility and interpretability. In this study, (1) the potential variables of the factors influencing cooperatives' business risk could not be measured directly, so they needed to be reflected through the observation variables. (2) The factors influencing plantation-based farming cooperatives include multiple variables. (3) In this paper, the structural equation model is used to explore the factors influencing plantation-based farming cooperatives. Therefore, the structural equation model is more suitable for this study.

Structural equation modeling includes a structural model and a measurement model. The structural model describes hypothetical relations among latent variables and then analyzes and demonstrates possible relations; in contrast, the measurement model first makes assumptions about measurement indicators and latent variables, and then it analyzes and demonstrates relations between the two based on the assumptions [61]. The model equations are as follows:

$$\eta = B\eta + \Gamma\zeta + \zeta \tag{1}$$

Formula (1) is a structural equation, where η is the coefficient matrix of the endogenous latent variable, Γ is the exogenous latent variable matrix, ζ is the influence of η, and ζ is the coefficient matrix of the exogenous latent variable.

$$Y = \Lambda Y\eta + \varepsilon \tag{2}$$

$$X = \Lambda X\zeta + \delta \tag{3}$$

Formulae (2) and (3) are equations for measuring endogenous latent variables and exogenous latent variables, respectively. They represent the relationship between endogenous latent variable η and endogenous manifest variable Y, as well as between exogenous latent variable ζ and exogenous manifest variable X. Y and X are the measured variable matrices of η and ζ, respectively; η is the endogenous latent variable matrix, and ζ is the exogenous latent variable matrix.

2.5. Data Sources

In order to enhance the significance of this research, our research team adopted a field research method. In June 2021 and October 2022, 97 villages from 9 counties (districts) in Guizhou Province, including Kaiyang, Bozhou, Meitan, Suiyang, Qixingguan, Dafang, Huishui, Luodian, and Fuquan, were selected for field research on plantation-based farming cooperatives, so as to further confirm their production and operations. The research area is shown in Figure 2. The surveyed cooperatives are from different terrains in eastern, southern, western, and northern Guizhou Province and are at different levels of economic development, which can better reflect the average level of plantation-based farming cooperatives in Guizhou Province. A total of 238 questionnaires were distributed during the survey, and after excluding 12 invalid samples, 226 were actually valid, with a questionnaire effectiveness rate of 95.0%. The main contents of the questionnaire included basic information about the cooperative, information about managers, the revenues of the cooperative, received policy benefits, funding, business scale, disaster occurrences, the application of agricultural technology, labor factors, the infrastructure of the village, the provision of social services, etc.

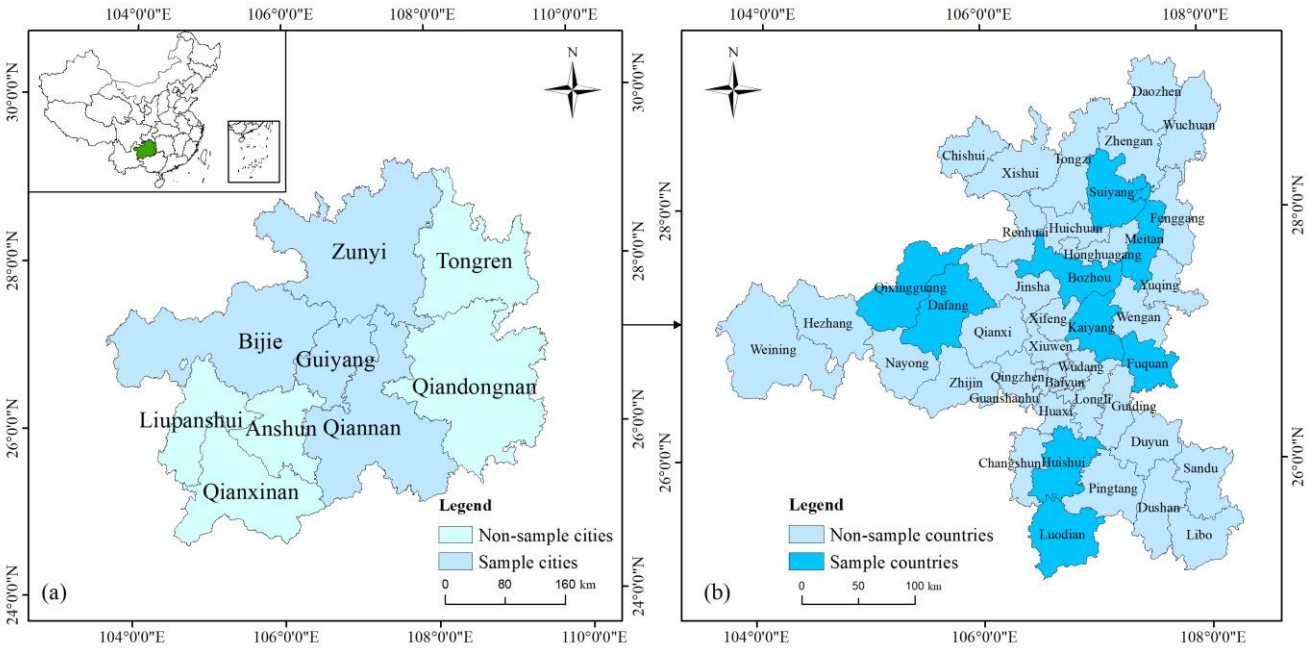

Figure 2. (**a**,**b**) Study area map.

3. Results and Analysis

3.1. Measurement Analysis of the Business Risk Faced by Plantation-Based Farming Cooperatives

3.1.1. Validity and Reliability Testing

Cronbach's α is a common reliability test indicator. When Cronbach's α is greater than 0.6, sample data can be considered reliable [62]. The KMO test and Bartlett's test of sphericity are commonly used validity test indicators, and they determine whether the data conform to factor analysis. When the KMO value is greater than 0.6 and the statistical significance of the results of Bartlett's sphericity test is less than 0.05 (p-value < 0.05), the correlation between sample data is strong and suitable for factor analysis [63]. Through testing and analysis with SPSS 22.0 software, we found that the Cronbach's α value of the sample data in this article was 0.809, indicating strong stability among various evaluation indicators and high data reliability. The KMO value was 0.746, and the statistical significance of the Bartlett's sphericity test results was 0.000 < 0.05, indicating good data validity and suitability for further factor analysis.

3.1.2. Factor Analysis

According to the results of the analysis using SPSS 22.0 software, the first five feature values were extracted as representative indicators. After dividing the characteristic values of each factor by the sum of the factor characteristic values, the result was multiplied by the maximum cumulative variance contribution rate in the matrix to obtain the variance contribution rate of that factor. Then, the cumulative variance contribution rate was added to test the explanatory ability of the common factor. This article uses the maximum variance orthogonal rotation method to transform the factor load matrix, obtaining the load coefficients of each indicator, as shown in Table 3. Through the variance contribution rates and cumulative variance contribution rates of the five common factors, it can be seen that the overall explanatory power of the selected indicators for the business risk faced by plantation-based farming cooperatives is 83.7%, indicating that the indicator settings are reasonable, and that these common factors can largely cover the information in various specific indicators. From Table 3, it can be seen that the correlation degree of the first five common factors in the business risk faced by cooperatives is as follows: market risk (33.376%) > policy risk (16.162%) > natural risk (14.029%) > technical risk (10.421%) > management risk (9.744%).

Table 3. Factor analysis results of the business risk evaluation system.

Evaluation Indicator	Variable	Market Risk	Policy Risk	Natural Risk	Technical Risk	Management Risk
Market risk	b_1	0.921	0.178	0.143	0.061	0.133
	b_2	0.902	0.099	0.051	0.139	0.141
Policy risk	e_1	0.183	0.917	0.134	0.086	0.183
	e_2	0.145	0.904	0.185	0.15	0.044
Natural risk	a_1	0.103	0.158	0.911	0.08	0.137
	a_2	0.112	0.183	0.906	0.061	0.152
Technical risk	d_1	0.162	0.156	0.082	0.873	0.191
	d_2	0.093	0.069	0.067	0.906	0.014
Management risk	c_1	0.079	0.09	0.154	0.069	0.852
	c_2	0.154	0.089	0.133	0.072	0.819
Cumulative variance contribution rate (%)	-	33.376	49.538	63.567	73.988	83.732

We scored the five common factors extracted and used the variance contribution rate of each factor obtained through varimax rotation as the weight. After obtaining the weights, the corresponding scores for each factor were weighted to obtain a comprehensive score. The calculation formula was as follows [64]:

$$F = (33.4F_1 + 16.2F_2 + 14.0F_3 + 10.4F_4 + 9.7F_5)/83.7 \quad (4)$$

By ranking the comprehensive business risk scores of 226 cooperatives in Guizhou Province and referring to Deng's method [64], this article divides the comprehensive score values into five different evaluation levels, i.e., below −0.5, −0.5 to −0.2, −0.2 to 0.2, 0.2 to 0.5, and above 0.5. A comprehensive score greater than 0.5 indicates an extremely high level of business risk for the cooperative, a score between 0.2 and 0.5 indicates a high level of business risk for the cooperative, a comprehensive score between −0.2 and 0.2 indicates a moderate level of business risk for the cooperative, a comprehensive score between −0.5 and −0.2 indicates a low level of business risk, and a comprehensive score below −0.5 indicates an extremely low level of business risk. The distribution of scores for the business risk evaluation factors of the selected sample cooperatives is shown in Table 4.

Table 4. The distribution of scores for business risk evaluation factors.

Evaluation Scale	Comprehensive Score	Number	Percentage (%)
Extremely high risk	Above 0.5	43	19.0
High risk	0.2 to 0.5	63	27.9
Moderate risk	−0.2 to 0.2	39	17.3
Low risk	−0.5 to −0.2	48	21.2
Extremely low risk	Below −0.5	33	14.6

The highest score of the 226 samples in this article was 1.22, while the lowest score was −1.41. The number of samples with scores greater than 0.2 was 106, accounting for 46.9% of the total sample, indicating that most of the sampled cooperatives are at high risk levels, and that the overall level of business risk is high. Based on distribution, there were 43 plantation-based farming cooperatives with extremely high business risks, accounting for 19.0% of the total sample. There were 63 plantation-based farming cooperatives with high business risks, accounting for 27.9% of the total sample. There were 39 plantation-based farming cooperatives with moderate business risk, accounting for 17.3% of the total sample. Finally, there were 48 plantation-based farming cooperatives with low business risk and 33 plantation-based farming cooperatives with extremely low business risk, accounting for 21.2% and 14.6% of the total sample, respectively. Overall, the business risk faced by plantation-based farming cooperatives was at a relatively high level.

3.2. Analysis on the Factors Influencing the Business Risk Faced by Plantation-Based Farming Cooperatives

3.2.1. Reliability and Validity Testing

Before conducting empirical analysis, reliability and validity tests were conducted on the selected variable data. The test results are shown in Table 5. The Cronbach's α values of all indicators for the reliability tests were greater than the threshold (0.6), the Bartlett's sphericity test Sig. values for the validity tests were all 0.000, and the KMO values were all greater than the threshold (0.6), all of which indicate that the model data have good reliability and validity, and that the data quality passed the test.

Table 5. Testing of reliability and validity.

Latent Variable	Cronbach's α	KMO Measure	Bartlett's Sphericity Test		
			x^2	df	Sig
Total scale	0.765	0.780	721.860	45	0.000
Policy environment	0.723	0.698	1435.233	9	0.000
Economic Environment	0.686	0.621	2034.227	6	0.000
Social service environment	0.629	0.652	575.663	6	0.000
Technical environment	0.817	0.669	3653.219	3	0.000
Self-resource endowment	0.809	0.712	1576.355	6	0.000
Manager characteristics	0.763	0.715	1236.436	7	0.000
Business risk	0.756	0.715	986.217	3	0.000

3.2.2. Model Fit Test

A structural equation model was constructed using Amos 24 software to analyze the factors influencing the business risk faced by plantation-based farming cooperatives. After multiple fitting analyses and factor corrections, the final fit index was above the standard value (Table 6) according to existing standards [65,66]. It can be seen that the theoretical model has a good fit with the actual data.

Table 6. Model fit test.

	Fit Index	Reference Value	Model Value	Judgment Result
Absolute fit indices	x^2/df	<3.00	2.652	Pass
	RMSEA	<0.08	0.042	Pass
	RMR	<0.08	0.039	Pass
	GF	>0.90	0.925	Pass
	AGF	>0.90	0.992	Pass
Relative fit indices	RFI	>0.90	0.967	Pass
	IFI	>0.90	0.984	Pass
	NF	>0.90	0.978	Pass
	CF	>0.90	0.995	Pass
	TL	>0.90	0.989	Pass

3.2.3. Hypothesis Testing of Factors Influencing Business Risk

In this study, Amos 24.0 software was used to analyze the sample data through structural equation modeling. On the main interface of the Amos 24.0 software, seven potential variables are set, including six exogenous potential variables (policy environment, economic environment, social service environment, technology environment, cooperative resource endowment, and operator characteristics) and one endogenous potential variable (business risk). Additionally, 23 observation variables were set, and the arrow direction indicates the set residual variable. After multiple fitting analysis and factor correction, the standardized path coefficient diagram of the structural equation model of the factors influencing the business risk faced by plantation-based farming cooperatives was obtained, as shown in Figure 3, and the calculation results are shown in Table 7.

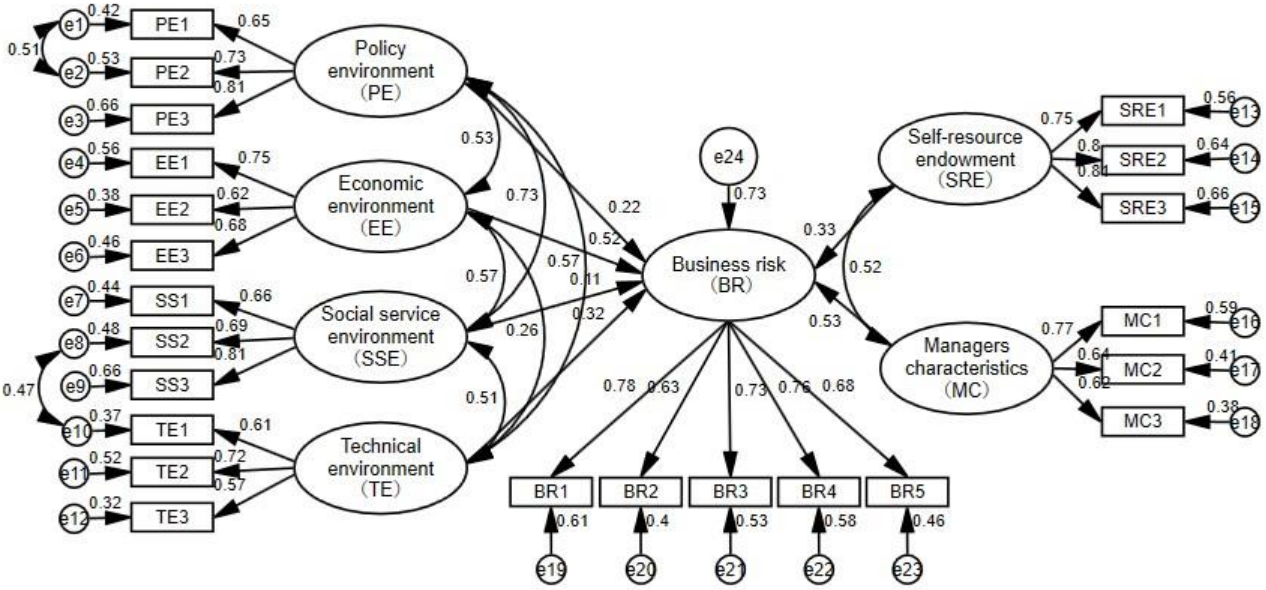

Figure 3. Structural equation model path and standardized path coefficient diagram.

Table 7. Test results of the path relationships of the modified model.

Path			Parameter Estimate				
			Estimate		S.E.	C.R.	*p*-Value
			NSEC	SEC			
Business risk (BR)	←	Policy environment (PE)	0.313	0.219	0.055	6.418	***
Business risk (BR)	←	Economic environment (EE)	0.401	0.522	0.046	10.187	***
Business risk (BR)	←	Social service environment (SSE)	0.357	0.114	0.049	5.143	***
Business risk (BR)	←	Technical environment (TE)	0.617	0.323	0.078	8.475	***
Business risk (BR)	←	Self-resource endowment (SRE)	0.376	0.331	0.062	6.953	***
Business risk (BR)	←	Manager characteristics (MC)	0.504	0.533	0.053	7.352	***
PE1	←	PE	1	0.651			
PE2	←	PE	0.853	0.618	0.061	15.431	***
PE3	←	PE	1.133	0.682	0.065	17.012	***
EE1	←	EE	1	0.750			
EE2	←	EE	0.796	0.623	0.047	10.326	***
EE3	←	EE	0.861	0.677	0.063	11.865	***
SSE1	←	SSE	1	0.664			
SSE2	←	SSE	1.143	0.693	0.095	7.983	***
SSE3	←	SSE	1.326	0.808	0.089	8.461	***
TE1	←	TE	1	0.614			
TE2	←	TE	1.192	0.720	0.065	13.436	***
TE3	←	TE	0.963	0.573	0.051	15.763	***
SRE1	←	SRE	1	0.749			
SRE2	←	SRE	1.141	0.802	0.068	11.571	***
SRE3	←	SRE	1.356	0.811	0.066	14.316	***
MC1	←	MC	1	0.773			
MC2	←	MC	0.823	0.637	0.052	10.763	***
MC3	←	MC	0.745	0.622	0.061	8.357	***

Notes: NSEC is the non-standardized path coefficient; SEC is the standardized path coefficient; *p* *** indicates statistical significance at the 1% level.

In order to clarify the behavioral utility relationship between the influencing factors and the business risk faced by plantation-based farming cooperatives, this study tested the hypothesis path of the proposed model on the basis of model fitting evaluation and model modification, combined with the path relationship test results of the modified structural equation model of the factors influencing the business risk faced by plantation-

based farming cooperatives (Table 7) and the standardized path coefficient diagram of the modified model (Figure 3). The modified model parameters and model fitting indicators passed the test, and the analysis results show that all of our research hypotheses are valid.

3.2.4. Robustness Test

In this study, the stability of the research results was tested by reducing the number of samples and narrowing the scope of the study. 113 samples were randomly selected from the total sample and 138 samples were selected from the five survey areas of Kaiyang, Bozhou, Meitan, Suiyang, and Fuquan in the east to test, so as to verify the effectiveness and stability of the estimation results of the structural equation model. The analysis results show that in the results of the reduced sample model, the path test results are all positive and have a significant level, which is consistent with the results of the overall sample model. In the model of reducing the scope of research area, the path of policy environment is negative; The other path coefficients are positive, and the test results are roughly consistent with the overall sample model. Therefore, it can be judged that the estimation results of the structural equation model constructed in this paper are stable and reliable.

3.2.5. Analysis of Factors Influencing Business Risk

According to Table 7, the six latent variables of policy environment, economic environment, social service environment, technical environment, self-resource endowment, and manager characteristics all passed the significance test, and their standardized path coefficients were 0.219, 0.522, 0.114, 0.323, 0.331, and 0.533, respectively, verifying Hypotheses H1–H6. From the perspective of influential effects, the influence values of each factor influencing business risk are shown in Figure 4. Among them, the economic environment and manager characteristics have a strong influence, the technical environment and self-resource endowment have a moderate influence, and the policy environment and social service environment have a relatively weak influence on the business risk faced by plantation-based farming cooperatives.

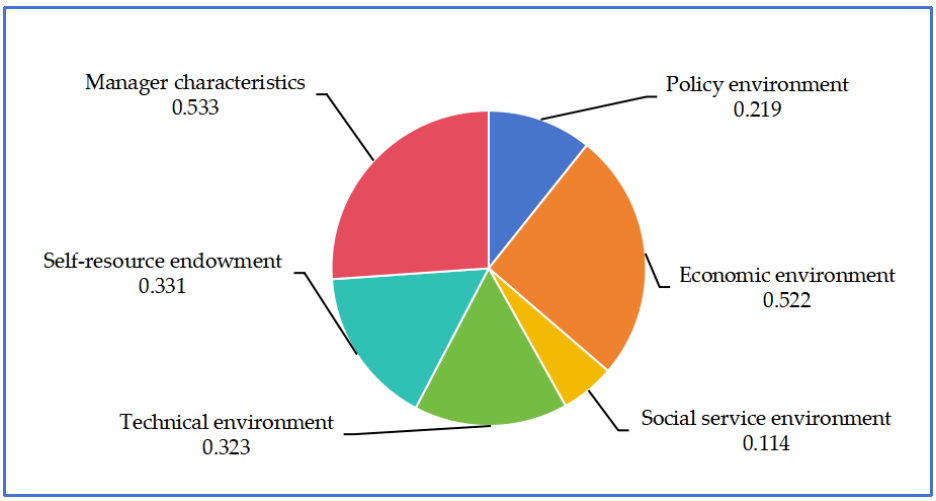

Figure 4. Influence of each factor on business risk.

According to the fit results of the modified model, the latent variable "Policy environment" has a significant positive impact on the business risk faced by plantation-based farming cooperatives. The standardized path load is 0.219, and hypothesis H1 can be verified. Firstly, government subsidies can not only provide direct financial support to cooperatives but also attract investment from industrial and commercial capital [67], thus promoting the development of cooperatives and reducing their business risk. Secondly, the more support from the government and the more practical implementation of resource factors, financial credit, and fiscal/tax systems, the more direct and indirect benefits cooperatives can receive. Presuming other market conditions are the same, cooperatives that

enjoy their policy advantages will have a significant comparative advantage in market competition, thereby reducing their business risk. Thirdly, moderate-scale operation is an important way to improve agricultural efficiency and increase income, and it is also the main form of operation for plantation-based farming cooperatives. Land transfer is the key to promoting moderate-scale operations [68]. Therefore, a proactive land transfer policy will promote the development of plantation-based farming cooperatives. The more convenient the land transfer, the lower the cost of factors paid by the cooperatives, and the easier it is to form moderate-scale operations. In this way, the resistance to the development of cooperatives will become smaller and the business risk will be reduced.

The "Economic environment" has a significant positive impact on the business risk faced by plantation-based farming cooperatives. The standardized path load is 0.522, and hypothesis H2 is verified. First, plantation-based farming cooperatives are suppliers in the produce market, and the produce price has a significant impact on cooperatives' planting willingness and behavioral choices. From the perspective of producers, the higher the product price, the stronger the enthusiasm of the producers. When other conditions are the same and the production costs are equal, producers are more willing to produce agricultural products with higher prices to obtain greater profits. At the same time, reasonable and stable prices are the foundation for ensuring a sustainable economy and market stability, and they are also crucial to the sound development of plantation-based farming cooperatives. The instability of produce prices due to market disruption and economic uncertainty will to some extent exacerbate the business risk faced by plantation-based farming cooperatives. Second, in terms of financial supply, diverse financing channels, convenient credit processes, and diverse guarantee methods can promote the improvement of the cooperative's financing environment. The better the financing environment, the less financial pressure the cooperatives will face, thereby reducing their business risks. Third, a stable and sustainable supply and marketing channel can reduce the transaction costs of produce. At the same time, a stable supply and marketing channel usually guarantees the stability of product prices through formal or informal contracts, reducing the uncertainty of product sales and, thus, reducing transaction risks. Therefore, the more favorable the economic environment, the lower the business risk faced by plantation-based farming cooperatives.

The "Social service environment" has a significant positive impact on the business risk faced by plantation-based farming cooperatives. The standardized path load is 0.114, and hypothesis H3 is verified. First, the more outsourcing in agricultural production processes, the more advanced the business philosophy of the managers. Such managers are inclined to innovate business models and, therefore, enjoy lower management risk. On the other hand, by outsourcing agricultural production, the professional technologies required in the corresponding processes will be provided by outsourcing service provider, which avoids losses due to the lack of professional techniques in the cooperative itself, thus reducing the technical risks. Second, the higher the frequency of agricultural machinery leasing, the higher the level of mechanization and the larger the operational scale of the cooperative. In this way, cooperatives can achieve better economies of scale, more economic benefits, become more stable in operation and, thus, reduce their business risk. In addition, the more complete the logistics system of agricultural products, the more modern the storage, transportation, preservation, packaging, and other facilities are, reducing the losses in these processes and improving efficiency. The commodity value of produce is increased, market realization is improved, and cooperatives enjoy more benefits and more sound development with lower business risks.

The "Technical environment" has a significant positive impact on the business risks faced by plantation-based farming cooperatives. The standardized path load is 0.323, and hypothesis H4 is verified. First, the deep promotion and application of modern agricultural technology have lifted farmers from the passive situation of relying solely on natural conditions in agriculture. By dispatching technical talents and fostering new agricultural group leaders, agricultural science and technology can be introduced into agricultural

production. Modern agricultural science and technology are used in a standardized and reasonable manner, thereby reducing the technical risk in cooperatives' operations. Second, the adaptability of agricultural technology to the operational needs of cooperatives determines the degree to which cooperatives adopt this technology. The higher the adaptability, the more active the cooperatives are in using this technology, Conversely, cooperatives may consider abandoning the use of this technology (the use of technology has certain costs as well). Finally, agricultural technical talents are the main force in promoting the transformation and application of scientific and technological achievements in agriculture. The technical guidance and application that they provide have improved the technical efficiency of cooperatives' production. From this perspective, the more abundant the resources of agricultural technical talents are, the higher the production efficiency of plantation-based farming cooperatives will become, thus generating a more stable technical environment and reducing business risk.

The "Self-resource endowment" has a significant positive impact on business risks faced by plantation-based farming cooperatives. The standardized path load is 0.331, and hypothesis H5 is verified. First, large-scale operations can improve land-use efficiency and increase income. Large-scale land operations indicate that the cooperative has strong profitability, sound development, and a strong ability to respond to business risks. Second, the longer the operation period of a cooperative, the more stable its development. This indicates that the cooperative has more experience in responding to and preventing various risks, making it more capable of bearing risk. Finally, industrial organizations can provide continuous supplementation of industrial components such as means of production and labor, enabling cooperatives to achieve high spillover effects in terms of economic benefits. At the same time, industrial organization can improve the efficiency of agricultural product circulation and reduce circulation costs, promote communication and cooperation between cooperatives and other business entities, and establish a stable and win–win supply and marketing relationship between cooperatives and other business entities. In this way, the stable supply of the agricultural materials required for cooperative production and stable marketing channels for produce sales can be ensured, thus reducing the business risk faced by plantation-based farming cooperatives.

The "Manager characteristics" have a significant positive impact on the business risk faced by plantation-based farming cooperatives. The standardized path load is 0.533, and hypothesis H6 is verified. First, young managers have a strong ability to learn and accept new things, and they are more willing to apply advanced science and technology to agricultural production, reducing the possibility of technological risks. At the same time, young managers are more skilled in accessing online information and can obtain market information more accurately and quickly. They can determine market demand, consumer preferences, and other information more fully, thereby reducing the possibility of market risk. Second, the higher the education level of the manager, the more comprehensive their understanding of relevant policies and market information, the more accurate their judgment of the development prospects of the agricultural product market, and the more scientific and reasonable their decision-making may be, reducing the possibility of management risks. Finally, entrepreneurs with firm development beliefs, a pioneering and innovative spirit, strong management capabilities, and the ability to resist pressure are more in line with the actual needs of the healthy development of cooperatives, thereby reducing the business risk faced by cooperatives.

4. Conclusions

4.1. Research Conclusions

This study used survey data from 226 plantation-based farming cooperatives in Guizhou Province to measure the business risk faced by plantation-based farming cooperatives through factor analysis, and we used structural equation models to explore their influencing factors. The results indicate that, firstly, the business risk faced by plantation-based farming cooperatives is at a relatively high level, with market risk being the biggest

threat, followed by policy risks and natural risks, and then by technical and management risks. Secondly, the business risk faced by plantation-based farming cooperatives is influenced by factors such as agricultural policies, the economic environment, social services, agricultural technology, cooperative resource endowment, and manager characteristics. Among these factors, the economic environment has the most significant impact and is the main external factor affecting the business risk faced by plantation-based farming cooperatives. Manager characteristics are internal core factors that affect the business risk faced by cooperatives. The impact of the technical environment and cooperative resource endowment is at a moderate level, while the impact of the social service environment on cooperative business risks is relatively small.

4.2. Policy Implications

Based on the above conclusions, this study proposes the following policy implications: First, it is necessary to refine the supporting policies for plantation-based farming cooperatives, such as by further improving the agricultural insurance mechanisms, innovating the insurance modes, providing subsidies in terms of coverage, types of insurance, and insurance standards, and encouraging cooperatives to actively purchase agricultural insurance to enhance their risk prevention ability. Second, we should optimize the agricultural market's economic environment. On the one hand, we should increase policy preferences for agricultural product processing enterprises, encourage agricultural processing enterprises to engage in business cooperation with cooperatives, and promote a win–win situation for both. On the other hand, relevant departments and institutions should actively create a good rural financial environment and provide flexible financing and loan services, such as the simplification of agricultural loan procedures and processes, along with reasonable reductions in and exemption of loan interest. Third, we should further strengthen the construction of agricultural infrastructure, make up for the shortcomings of agricultural production, and improve the production and management capacity of agricultural business entities. Fourth, we should deepen the reform of the rural land circulation system, further improve the rural land circulation service system, innovate the land circulation mechanisms, and promote the marketization of land circulation. At the same time, we should standardize land circulation behavior, protect the legitimate rights and interests of both parties, and reduce the uncertainty risk in land circulation transactions. Fifth, we should further improve the business level of operators, strengthen the training of operators' knowledge in agricultural science, technology, and operational management, and improve the theoretical level and practical ability of cooperatives' operation and management.

4.3. Limitations and Further Study

This study measures the levels of business risk faced by plantation-based farming cooperatives and comprehensively analyzes the factors affecting it, but there remain shortcomings that can be further improved upon in the future. There was a small sample area limitation in this study, preventing us from clearly reflecting the operational risk levels and regional differences among plantation-based farming cooperatives across a wider range. In the future, the study area could be further expanded to make the research content more in-depth and comprehensive. In addition, the plantation-based farming cooperatives discussed in this study could be used to further explore more precise and detailed type divisions (such as pure seed-planting type, planting and breeding combination type, crop-planting type, and cash-crop-planting type) and to further compare and analyze different types of cooperatives.

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