

Research on Multi-Subject Collaborative Governance Mechanism of Low-Altitude Economy in Border Ethnic Minority Areas

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Abstract: The low-altitude economy, as an emerging economic form, is becoming a new engine driving the high-quality development of regions. The border ethnic minority areas have unique geographical advantages in the development of the low-altitude economy, but they also face special challenges such as insufficient governance capacity and difficulties in institutional coordination. This paper uses the theories of collaborative governance, policy network, and multi-center governance to construct a three-layer collaborative governance framework of "core layer - execution layer - participation layer", and systematically analyzes the composition of multiple stakeholders and their interests demands in the governance of the low-altitude economy in border ethnic minority areas. The research finds that the multi-stakeholder governance of the low-altitude economy in border ethnic minority areas faces difficulties such as institutional coordination, information sharing, interest coordination, capacity building, and safety supervision. Based on this, this paper proposes countermeasures and suggestions from aspects such as top-level design, infrastructure construction, talent cultivation, policy support, pilot demonstration, and mechanism guarantee. The aim is to expand the application of the collaborative governance theory in the low-altitude economy field and also provide references for the governance practice of the low-altitude economy in border ethnic minority areas.

Keywords: Border Ethnic Minority Areas; Low-Altitude Economy; Multi-Subject Collaborative Governance; Collaborative Governance Theory; Interest Demands

1. Introduction

The low-altitude economy is experiencing vigorous development and is gradually

becoming an important direction for cultivating new productive forces. Border ethnic minority areas, as the forefront of China's opening-up and an important barrier for ethnic unity, possess unique geographical advantages and strategic value in the development of the low-altitude economy [1]. Border provinces such as Guangxi, Inner Mongolia, Xinjiang, and Yunnan have all formulated implementation plans for the development of the low-altitude economy and are actively laying out new tracks for the low-altitude economy. However, the geographical environment, ethnic culture, and economic development level of border ethnic minority areas pose special challenges for the development of the low-altitude economy. How to establish a low-altitude economic collaborative governance mechanism that suits the characteristics of border ethnic minority areas has become an important issue that needs to be studied urgently [2]. Multi-subject collaborative governance is an effective path to solve complex public affairs problems [3]. In the development of the low-altitude economy in border ethnic minority areas, it involves multiple fields such as aviation management, transportation, emergency rescue, and ethnic affairs, and the necessity of coordinated governance is particularly prominent. Based on this, this paper focuses on the issue of multi-subject collaborative governance mechanisms for the low-altitude economy in border ethnic minority areas, using theoretical tools such as collaborative governance theory and policy network theory, to deeply analyze the composition of the entities involved in the collaborative governance of the low-altitude economy in border ethnic minority areas, the operation multi-subject mechanism, and the realization path, providing theoretical references and practical guidance for the healthy development and governance capacity improvement of the low-altitude economy in border ethnic minority areas.

2. Core Concepts and Theoretical Basis

2.1 Core Concepts

Low-altitude economy refers to a comprehensive economic form that operates within the low-altitude airspace, driven by various low-altitude flight activities, and integrates four major sectors: low-altitude manufacturing, low-altitude flight, low-altitude support, and low-altitude services [4]. Low-altitude economy features high technological content, high added value, and high growth potential. It encompasses multiple application scenarios such as unmanned aerial vehicle delivery, low-altitude tourism, aviation emergency rescue, agricultural and forestry pest control, and urban air transportation [5]. From an industrial chain perspective, low-altitude economy involves upstream activities such as aircraft research and development and air traffic control system development, midstream activities such as low-altitude flight services and operations, and downstream activities such as expansion and derivative services for various application scenarios [6]. From a value creation perspective, low-altitude economy creates economic value through technological innovation and service innovation, while also generating social value, such as improving logistics efficiency, enhancing public services, and promoting regional coordinated development [7].

Border ethnic minority areas refer to the regions where ethnic minorities live in compact communities along China's land borders, including the border areas of Guangxi, Inner Mongolia, Xinjiang, Xizang, Yunnan, Gansu, Heilongjiang, Jilin and other provinces and autonomous regions. These regions have the following characteristics. They have a special geographical location, mostly located in remote areas, with complex natural conditions and relatively lagging transportation infrastructure. They have diverse ethnic compositions, hosting numerous ethnic minorities and preserving unique ethnic cultural traditions. They hold significant strategic importance, serving as both a strategic barrier for maintaining national security and an important gateway for opening up to the outside world. Their economic development is relatively backward, facing challenges such as inadequate infrastructure, severe brain drain, and lagging industrial development [8].

2.2 Theoretical Basis

The collaborative governance theory provides a core analytical framework for studying the multi-subject collaborative governance of low-altitude economy in border ethnic minority areas. The collaborative governance theory holds that in the governance of complex public affairs, a single entity is unable to bear all the governance responsibilities alone; instead, it is necessary to achieve the governance goals through the coordinated cooperation of multiple entities [9]. The conditions for the realization of collaborative governance include the formation of a common goal, institutionalized cooperation mechanisms, trust relationships among entities, and effective coordination mechanisms, etc. In the governance of low-altitude economy in border ethnic minority areas, the collaborative governance theory provides theoretical guidance for analyzing the role positioning, interrelationships, and cooperation mechanisms of multiple entities [10].

The policy network theory provides an analytical perspective for understanding the interaction relationships among the main actors in the low-altitude economic governance of border ethnic minority areas. The policy network theory holds that public policy formulation and implementation take place within a network composed of multiple actors, and these actors form complex network relationships through resource dependence and interest bargaining [11]. In the low-altitude economic governance, there are multiple actors such as the air force, the civil aviation authority, local governments, industry enterprises, industry associations, and research institutions. Each actor has different resource endowments and interest demands, and through resource exchange and interactive negotiation, a policy network is formed. In the low-altitude economic governance of border ethnic minority areas, the policy network theory is helpful for analyzing the network positions, resource endowments, and interaction patterns of multiple actors, providing a basis for optimizing the governance structure [12].

The multi-center governance theory provides theoretical support for exploring the institutional arrangements for low-altitude economic governance in ethnic minority areas of the border regions. The multi-center governance theory holds that in the governance of public affairs, there are multiple decision-making

centers, which operate relatively independently under certain rules while also influencing and adjusting each other [13]. The multi-center governance emphasizes the importance of institutional design and achieves effective coordination among multiple decision-making centers through reasonable rule arrangements. In the low-altitude economic governance of ethnic minority areas in the border regions, the multi-center governance theory provides theoretical references for designing hierarchical and classified governance models and clarifying the power and responsibility boundaries of each level of governance entities [14].

3. Analysis of Governance Subjects and Interest Demands of Low-Altitude Economy in Border Ethnic Minority Areas

3.1 Identification and Classification of Multi-Governance Subjects

The low-altitude economic governance in border ethnic minority areas involves multiple stakeholders. Based on their roles and functions within the governance system, it can be divided into three categories: core governance entities, direct interest entities, and auxiliary participation entities [15]. The core governance entities include all levels of government. The highest-level government assumes the functions of strategic planning, institutional provision, and macro coordination. Provincial governments are responsible for formulating regional low-altitude economic development plans, introducing supporting policies, and coordinating resource allocation; municipal and county-level governments are responsible for the implementation of specific projects, the provision of public services, and market supervision [16]. Direct interest entities include low-altitude economic enterprises and industry associations. Low-altitude economic enterprises are the direct participants in governance, serving as both policy implementers and market innovation entities. Industry associations, as representatives of the interests of enterprises, play a bridging and connecting role between the government and enterprises, participating in policy negotiations and standard formulation [17]. Auxiliary participation entities include research institutions, social organizations, and local residents. Research institutions provide technical support and intellectual assistance for low-altitude economic governance, participating

in the formulation of technical standards, talent cultivation, and policy consultation. Social organizations represent specific public interests and participate in governance supervision and public opinion expression. Local residents in border ethnic minority areas are both beneficiaries of low-altitude economic development and may be affected by flight activities. Their interests need to be reflected in the governance process. Village collective organizations and cooperatives in ethnic minority areas have significant influence in land use and cultural protection [18].

3.2 Analysis of Interest Demands

The core interest demands of the highest government are the balance between national security and development interests. National security interests require ensuring the orderly management of low-altitude airspace and the safety and controllability of flight activities; development interests require promoting the growth of low-altitude economic industries and regional coordinated development [19]. In border ethnic minority areas, national security interests also involve border stability and ethnic unity, which pose higher requirements for governance. The interests of local governments in border ethnic minority areas are to balance regional development and local stability. In border ethnic minority areas, local governments also need to pay attention to ethnic unity and cultural protection, seeking a balance between development and protection. The interests of local governments have characteristics of locality and temporality, and tend to pursue short-term visible development results. The interests of low-altitude economic enterprises are market expansion and profit maximization. Enterprises aim to reduce operating costs, expand market share, and enhance brand influence. The interests of industry associations are industry development and the enhancement of their own influence. Industry associations hope to become effective communication channels between the government and enterprises in governance. Scientific research institution of interests is the academic influence and resources, including scientific research project funds, research data and achievements transformation opportunities, etc [20]. The interests of local people are improvement of life and participation in development. Ethnic people in border areas also focus on cultural heritage

protection and the inheritance of ethnic characteristics, hoping to reflect their dominant position in development.

3.3 Framework of Collaborative Governance

Based on the analysis of the main body and the logic of interest coordination, this paper constructs a three-level collaborative governance framework of "core layer - execution layer - participation layer". The core layer consists of all levels of government, responsible for strategic decision-making and institutional provision. The execution layer is composed of low-altitude economic enterprises and industry associations, responsible for market operation and industry self-discipline. The participation layer is made up of research institutions, social organizations and local people, responsible for intellectual support, social supervision and interest expression. The three levels are interconnected through institutionalized coordination mechanisms: the core layer and the execution layer interact through policy tools and market supervision; the core layer and the participation layer are linked through information disclosure and public participation; the execution layer and the participation layer are connected through service provision and social responsibility. The realization of the three-level collaboration requires an effective operational mechanism as a guarantee.

4. Dilemmas and Causes of Multi-Subject Governance of Low-Altitude Economy in Border Ethnic Minority Areas

4.1 Dilemmas

The institutional coordination dilemma is the primary challenge faced by multi-subject governance [2]. Low-altitude economic governance involves multiple fields such as aviation management, radio management, urban planning, and safety supervision. The institutional rules in different fields overlap, conflict with each other, or even contradict each other. The information sharing dilemma restricts the effective cooperation of multiple subjects [21]. Currently, the informatization level of low-altitude economic governance is generally low, and a unified information sharing platform has not been established. There are serious information barriers between the government and enterprises, among government departments, and between enterprises. Information circulation

is not smooth. The coordination dilemma of interest is the core problem of multi-subject governance [4]. The interests of different parties vary or even conflict, making coordination difficult. It is hard to find the intersection point of diverse interests, and the space for compromise and concession among all parties is limited. When it comes to sensitive issues such as resource allocation and interest distribution, the conflict of interests is particularly prominent. The capacity building dilemma restricts the improvement of governance efficiency [6]. Border ethnic areas are relatively lacking in governance capacity elements such as talents, technology, and funds. The security supervision dilemma is a unique challenge for border ethnic areas. The geographical environment of border areas is complex, the use of airspace is special, and cross-border flight risks coexist, making security supervision difficult. The low-altitude flight activities in border areas involve national defense security, and the requirements for the accuracy and timeliness of supervision are higher [16].

4.2 Causes of Dilemmas

The institutional cause is the fundamental cause of the dilemma [17]. Firstly, the top-level institutional design is not perfect. The construction of relevant legal and regulatory systems for the low-altitude economy lags behind, and there is a lack of institutional supply. Secondly, the market access system is not flexible enough. The current market access rules do not fully take into account the special circumstances of border ethnic regions, and the "one-size-fits-all" management model does not meet the needs of regional development.

The resource cause is the material basis of the dilemma [18]. Firstly, there is a shortage of financial resources. The financial self-sufficiency capacity of border ethnic areas is weak, and the funds available for the construction of low-altitude economic infrastructure and the improvement of governance capabilities are limited. Secondly, there is a lack of human resources. The working and living conditions in border areas are harsh, and the attractiveness to professional talents is insufficient. The problem of "difficulty in attracting and retaining talents" is particularly prominent. The local talent training system is not complete, and the talent reserve is insufficient. Thirdly, there is a weakness in technical

resources. The construction of information infrastructure is lagging behind, and the application of digital governance methods is insufficient. The research and application capabilities of advanced technology equipment are limited.

The cause of regional characteristics is the special background of the dilemma [22]. Firstly, the geographical environment is unique. The border ethnic areas are mostly located in remote areas, with complex natural conditions, inconvenient transportation, and restricted information flow, which naturally pose difficulties for governance. Special terrains such as plateaus, mountains, and deserts pose challenges to low-altitude flights and supervision. Secondly, the ethnic composition is diverse. Many ethnic minorities live together, with diverse ethnic cultural traditions and complex governance models. The special social structure and customs of ethnic areas place differentiated requirements on governance methods. Thirdly, the location conditions are special. The special location of border areas involves national defense security and diplomatic relations, making governance more sensitive and complex. The ability cause is the internal factor of the dilemma [23]. Firstly, there is a lack of governance experience. The low-altitude economic development in border ethnic areas is in its infancy, and local governments lack relevant governance experience. Their governance concepts and methods are relatively traditional. Secondly, there is a limited learning ability. There are differences between border areas and developed regions in terms of information acquisition and knowledge update. The ability to learn and apply new concepts and technologies is insufficient. Thirdly, there is a lack of innovation ability. Exploration in areas such as governance model innovation and institutional innovation is insufficient. They mostly rely on superior deployment and borrowing experiences from other places.

5. Suggestions

Improve the top-level institutional design. It is suggested to accelerate the formulation of special laws and regulations for the low-altitude economy, enhancing the authority and systematic nature of the institutional supply. Clarify the division of powers among different levels of government in the governance of the low-altitude economy, and grant greater

autonomy for reform to border ethnic regions. Establish a cross-departmental coordination mechanism, integrating the forces of the development and reform departments, civil aviation, air force, and public security, to form a governance synergy. Based on the characteristics of border ethnic regions, formulate differentiated policies to avoid "one-size-fits-all" management. Strengthen infrastructure construction. Increase investment in low-altitude economic infrastructure in border ethnic areas, and improve hardware facilities such as low-altitude flight service stations, take-off and landing fields, and charging facilities. Promote the construction of new infrastructure such as 5G networks and the Internet of Things, providing technical support for the digital governance of the low-altitude economy. Coordinate the planning of low-altitude route networks, and handle the relationship between low-altitude flights and military aviation, as well as general aviation. Carry out application demonstrations such as low-altitude logistics and low-altitude tourism in areas with conditions.

Strengthen the construction of the talent pool. Support universities in ethnic minority areas to establish low-altitude economy-related majors or directions, and cultivate local talents. Improve the talent introduction policies, and attract professional talents to work in border areas through measures such as housing subsidies and preferential treatment for children's education. Establish a talent exchange mechanism with developed regions, and enhance the quality of local talents through methods such as temporary assignments and project cooperation. Make use of the roles of veterans and returning young people, and cultivate practical operational talents. Innovative policy support system. Implement tax preferential policies, incorporate the low-altitude economy into the encouraged industries list of the western region. Increase financial support, establish a special fund for the development of the low-altitude economy in border ethnic areas. Innovate financial support methods, encourage financial institutions to develop credit products suitable for the characteristics of the low-altitude economy. Improve government procurement policies, give priority to purchasing low-altitude economic service products from border ethnic areas.

Establish a pilot demonstration mechanism. Support border provinces such as Guangxi, Inner Mongolia, Xinjiang, and Yunnan in conducting

pilot projects for coordinated governance of low-altitude economy, exploring replicable and scalable experience models. Encourage local governments to collaborate with leading enterprises to carry out pilot projects for low-altitude logistics and low-altitude emergency rescue and other application scenarios. Establish a pilot assessment mechanism to promptly summarize successful practices and lessons learned.

Improve the mechanism guarantee system. Establish a low-altitude economy statistical monitoring system to provide data support for policy formulation and effect evaluation. Improve the assessment and evaluation mechanism, incorporate low-altitude economic development into the government performance assessment of border ethnic regions. Strengthen supervision and inspection to ensure the implementation of all policies and measures. Enhance publicity and guidance to increase the awareness and acceptance of the public and society towards low-altitude economy.

6. Conclusion

This article focuses on the issue of multi-subject collaborative governance mechanism for low-altitude economy in border ethnic areas. Using theoretical tools such as collaborative governance theory and policy network theory, a systematic study is conducted, and the following main conclusions are drawn.

The governance of low-altitude economy in border ethnic areas involves multiple parties. The core governance entities include all levels of government, the direct interest entities include low-altitude economy enterprises and industry associations, and the auxiliary participating entities include research institutions, social organizations, and local residents. Different entities have differentiated interests and resource endowments, and through resource dependence, information communication, and interest bargaining, complex interaction relationships are formed.

The multi-subject governance of low-altitude economy in border ethnic areas faces five major dilemmas. The institutional coordination dilemma is manifested as the intersection of conflicting institutional rules and insufficient coordination of central-local relations; the information sharing dilemma is manifested as severe information barriers and prominent data islands; the interest coordination dilemma is

manifested as multiple interest conflicts and an incomplete distribution mechanism; the capacity building dilemma is manifested as a lack of talents and technologies and insufficient governance experience; the safety supervision dilemma is manifested as insufficient regulatory coverage and weak emergency response capabilities.

The collaborative governance operation mechanism consists of five mechanisms. The coordination and linkage mechanism addresses the issues of vertical and horizontal institutional coordination; the information sharing mechanism breaks down information barriers and promotes data circulation; the interest coordination mechanism balances the interests of multiple stakeholders; the incentive and restraint mechanism guides the behavioral choices of each entity; the emergency management mechanism guarantees the safety bottom line. These mechanisms cooperate with each other to jointly support the effective operation of multi-subject collaborative governance.

To promote multi-subject collaborative governance of low-altitude economy in border ethnic areas, systematic measures are needed. Improve the top-level institutional design, grant local greater autonomy; strengthen infrastructure construction to lay a solid foundation for development; enhance talent team building to improve the intellectual support capacity; innovate the policy support system to form a favorable policy environment; establish pilot and demonstration mechanisms to explore replicable experiences; and improve the mechanism guarantee system to ensure the implementation and effectiveness of policies.

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