Game Analysis of Forestry Cooperative Organizations, Financial Institutions and Government during Financing and the application of computer internet

Wenqi Sun¹, Lu Sun²*

¹Northeast agricultural university, Harbin 150040, China
²Xiamen Universities of Technology, Xiamen 361024, China

sunlu800@126.com

Abstract

The establishment and development of forestry cooperative organization is need to be supported by financial loans of banks. In this paper, the problem of financial loans for forestry cooperative organization from banks was studied. The financial insurance institution and government were introduced into the process of financial loans of banks. To analyzing and resolving the contradiction between forestry cooperative organization and bank during the process of financial loans, complete information static game and complete information dynamic hybrid strategy game were used. Based on the game results, corresponding strategies for forestry cooperative organization, bank, financial insurance institution and government were proposed. The governance structure of forestry cooperative organizations should be strengthened and industrial structure should be optimized. In addition, forestry cooperative organizations need to continuously carry out technical innovation. For bank, the mortgage business should be developed. The government needs to strengthen the construction of credit system, strengthen the policy support, etc. Insurance institutions should have farsightedness, and their products should be diversified, gradient. Forestry cooperation organizations and insurance should make full use of the computer Internet to improve the sales of products on the Internet. At the same time, insurance companies need to innovate business on the computer Internet platform.

Keywords: Forestry cooperative organization, game analyzing, bank, financial insurance institution.

1. INTRODUCTION

The reform of collective forest right system has greatly improved the production enthusiasm of forest farmland and has played a positive role in the development of forestry economy. However, the reform of collective forest right system has also led to the decentralization of forest land, which has reduced the scale effect of collective forestry. The development of forestry cooperation organization has adapted the demand of large-scale forestry management after the reform of forest right system, which provides an important way for the combination of large-scale forest management and forestry production. The cooperation of the forestry cooperatives relies on not only the support of the government in providing policy but also the help of banks to provide loans. Because forestry cooperatives are relatively weak in their ability to accumulate funds, there are some difficulties in collateralization. And forestry production is constrained by the many natural factors such as climate and pests, which either reduce the probability of bank loans or increase the cost of cooperatives, thus hindering the long-term development of forestry cooperatives.

The problem of borrowing between the forestry cooperatives and the banking institutions is essentially a question of the game between the two sides. Through the game analysis to the borrowing behavior of the two cooperatives, it is difficult to find the equilibrium point of the two sides’ game, and it cannot ensure the high efficient and low risk operation of borrowing funds, also it is difficult to realize the win - win of the participant. In order to achieve a win-win between the forestry cooperatives and the banks, this paper introduces the financial and insurance institutions and the government, then based on the perspective of the game, it studies the forestry cooperatives, banks, financial and insurance institutions and the government, in order to achieve a four win-win situation.
2. RESEARCH PROGRESS OF FORESTRY COOPERATION ORGANIZATIONS AT HOME AND ABROAD

2.1 Research Progress of Foreign Forestry Cooperation Organizations

The research on forestry cooperation organization mainly focuses on the characteristics and influencing factors of cooperative management of private forest owners. (Ke et al., 2010; Ma et al., 2011; Zhang et al., 2009; Xie, 2011; Elwood, 1992). Over the past 20 years, the forestry cooperation organizations have made great progress in the world. The major forestry cooperatives include (Zhang et al., 2009): The Forest Cooperative in Japan, the Forestry Union in German, French Forestry Cooperative, Finnish Forest Cooperative, Canadian Forest Cooperative, Korean Forestry Association, Swedish and Norwegian Foresters Association and Farmer Forestry Cooperative in China. Although the formulation is different, but the essence is same. The Forestry Cooperative Organization is a voluntary organization of forest farmers who volunteered to join and carry out forestry activities, with the aim of improving their ability to respond to the market. After decades of development, the forest owner’s association has formed a global network system. Foreign Forest owner’s associations are formed by the forest owners spontaneously, with common subjective and objective conditions. The forest owners are willing to combine and help each other (Zhang et al., 2009; Xie, 2011). First of all, the forest business in the management has a certain degree of difficulty, which is an objective requirement. For example, the American Association of Foresters was established in 1941, when a large number of private forest were cut down but could not be restored in time, so some private forest owners set up the American Association of Foresters (Zhang et al., 2009). The main reason for the formation of forest assemblages in Japan is that the task of forest management is very heavy and the rural labor force cannot meet the needs of forest management. The reason for the development of the Nordic Association of Foresters is that the Nordic people are less than the woodland and the demand for technology and labor is increasing. Secondly, the will of forest owners to improve the forest land is the subjective condition for the existence of forest owners Association.

2.2 Research Progress of Domestic Forestry Cooperation Organizations

2.2.1 Establishment and Management of Forestry Organizations

The research on forestry cooperative organizations in China focuses on the causes, problems, operating mechanisms and internal management of forestry organizations, and puts forward some suggestions for the development of forestry cooperative organizations (Zuo et al., 2011; Xie, 2010). For the formation of forestry cooperative organizations, scholars study them from different angles, such as marketization, institutional changes, forestry and the weak position of forest farmers, the main purpose of occupying the forest for Chinese farmers. For the study of forestry cooperation organizations, the relevant articles published before 2010 are relatively few. The study of Zuo Ting shows that the establishment of forestry cooperatives is mainly led or guided by the forestry sector, or based on the original resources and traditional management of the village, or driven and organized by few people in the village. Xie Hesheng evaluated the development of three different forms of forestry cooperation organizations, including forestry professional cooperatives, forestry professional associations and family equity cooperative forest farms, so as to obtain the orientation of China's forestry cooperation organizations. The emergence of forestry cooperation organizations has greatly promoted the process of collective forest tenure reform, consolidated the results of forest reform and promoted the development of collective forestry.

2.2.2 Benefit Distribution and Willingness to Cooperate in Forestry Organizations

At present, China's forest farmers' cooperation is in its infancy, so there are various contradictions and problems inevitably. The contradiction of benefits distribution between forestry cooperatives and members mainly exists in the village forest. Wang Gitano’s research shows that forest farmers have exposed many problems in the process of cooperation, including the lack of professional knowledge, the lack of enthusiasm for production due to lack of forest resources, the lack of efficiency man and the poor management level. Yang study shows that, before and after participating in cooperatives, the improvement of the actual living standard of farmers is consistent with their perception of living standard. The level of economic development has little effect on the perception of production costs, and generally farmers agree that various costs of forestry production have increased. However, the economic level has a significant impact on perceived earnings and perceived economic compensation. Forest farmers are more concerned about the survival problem. If their basic life cannot be guaranteed, in a certain period of time, the focus of their attention is bound to the real economic benefits and the level of government subsidies.
2.2.3 Financial Support Issues in the Development and Expansion of Forestry Cooperatives

For example, there is much forest agriculture in Heilongjiang Province, the forest management area is more than 30 million hectares, the forest land is more than 20 million hectares, the forest coverage rate is about 44%, and the production of forest products is in the forefront of the country. In the market economy, the market competitiveness of forest products depends not only on its inherent advantages, but also on the organizational advantages of forestry operators (Cong, 2014). After the clarification of collective property rights, Forestry in Heilongjiang Province has gradually developed into diversification of business, thus a large number of forestry professional cooperatives emerged (Ma et al., 2014; Cong, 2014). The development of cooperatives is more dependent on the promotion of funds. The survey found that lack of funds is a common phenomenon. Cooperatives have little loans and they are also hard to loan. Some forestry cooperatives even maintain their operational needs through internal fundraising. Forestry production cycle is long, which determines that its early investment is large and its capital chain is long. Therefore, the funds are an urgent problem to be solved.

At present, there are many problems in the development of forestry professional cooperatives in Heilongjiang Province. For example, the scale of organization is not enough, the economic strength is weak, the standardized management level is not high, the professional talents are scarce, the government funds are weak and the internal operation is unreasonable. This hindered the operation efficiency of forestry cooperative organizations; also it is one of the important reasons for hindering the rapid development of the industry after the reform of collective forest rights.

3. GAME ANALYSIS OF THE FOUR PARTS WIN-WIN MECHANISM

3.1 No Government and Financial Insurance to Participate

Assuming that the bank's loan is \( T \), the loan interest rate is \( s_1 \), then when the cooperative organization fully fulfills the agreed repayment, the bank's income is \( T \cdot s_1 \). With the support of the loan funds, cooperative organization obtains the yield \( s_2 \), so the cooperative organization's income is \( T \cdot s_2 \). If the union defaults, the bank's income is \( T \cdot (1 + s_1) \), and the income of the cooperative is \( T \cdot s_2 + T \). If the bank does not lend the money, the cooperative organization chooses the credit repayment. At this time, the bank can lend the money to other institutions or individuals to obtain certain interest. Of course, there may be no one loan, then at this time the bank's income is 0. It can be assumed that the proceeds at this time are \( C \) and \( C \) should be less than \( T \cdot s_1 \). While the cooperative organization cannot get a loan, resulting in the loss of income \( T \cdot s_2 \). The fourth case, the bank chose to refuse loans, cooperative organizations choose to default, the two sides did not have intention to cooperate, thus there does not exist any loss, both sides' income are 0.

Table 1 Cooperative Organization in the process of applying for loan game matrix

<table>
<thead>
<tr>
<th>Cooperative organization</th>
<th>Repayment</th>
<th>Breach of contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank loan</td>
<td>( T \cdot s_1, T \cdot s_2 )</td>
<td>( -T \cdot (1 + s_1), T \cdot s_2 + T )</td>
</tr>
<tr>
<td>Not loan</td>
<td>( C, -T \cdot s_2 )</td>
<td>0, 0</td>
</tr>
</tbody>
</table>

Obviously, the bank's best strategy is to choose loan to get the maximum benefit. However, for cooperatives, regardless of whether the bank chooses a loan or not, his best strategy is breach of contract. Therefore, at this time, banks and cooperatives cannot achieve a balance. Taking into account the best strategy of cooperatives is breach of contract, so the bank can only retreat to choose the next loan. Due to the lack of credit collateral, the possibility of cooperative breaches is greatly increased. Even if the cooperative is willing to repay because of its own moral constraints, but natural disasters, climatic conditions and other factors will affect the yield of cooperatives, so cooperatives often have to choose to default. From the game analysis of this pure strategy we can see that the above forestry cooperatives and the bank game does not exist Nash equilibrium. No matter how to choose, the interests of both sides cannot always be consistent. So, it is not a pure strategy game, but a mixed strategy game under the complete information. Forestry cooperatives and banks will be in accordance with a certain proportion, randomly select one from these two pure strategies as its practical action.

3.2 Government and Financial Insurance Participate

The following is an analysis of the mixed strategy game under the complete information, in the meantime, because of the participation of government and finance and insurance, the game forms a dynamic structure,
which constitutes a dynamic game of mixed strategy under the complete information. It is assumed that the cooperative organization applies for a loan; the insurance company’s action space is [participation, non-participation]. Among them, the insurance company subsidize the organization’s business risk (mainly non-human causes, such as natural disasters, etc.), so the probability of their participation is $P_1$, the probability of not participating is $1-P_1$. The action space of Cooperative organization is [loan, no loan]. The probability of a cooperative organization applying for a loan is $P_2$, and the probability of not applying for credit is $1-P_2$. Bank’s action space is [lending, not lending]. In the case of the insurance company to support, the probability of bank lending is $P_3$. Under the condition of the insurance companies do not support, the probability of lending is $P_4$. Here $P_3 > P_4$.

In the loan application stage, if the cooperative organization does not apply for a loan, then the income of the three parties is 0; If the cooperative organization applies for a loan but the bank does not lend, then the income of the three parties is 0; If the cooperatives apply for a loan, the insurance company chooses to participate, the bank chooses the loan, then the income of cooperative organization, bank and insurance company is as follows. In order to simplify the calculation, assuming that each cooperative organization is involved in insurance, the annual premium paid is the same $H$, the income of the insurance company is $H*n*y$, $n$ is the number of cooperatives participating in the insurance, and $y$ is the number of years in which the cooperatives pay insurance. The insurance company's compensation for the $F$. The income of the insurance company is $H*n*y - F$. The income of the cooperative organization is $T_{s2}$, the bank's income is $T_{s1} + F - K$, $K$ is the default risk of the cooperatives in the repayment process, and $F$ is the compensation for the insurance company. If the insurance company does not participate in the case of a cooperative organization applying for a loan, the income of the cooperative organization is $T_{s2} - w$, $w$ is the cost of the loan that needs to be increased without the participation of the insurance company. The bank's income is $T_{s1} - K$. The income of the insurance company is 0.

Based on the above assumptions, you can get the game tree in the loan process, as shown in Figure 1.

Figure 1. The game tree of insurance companies and government in the process of formation and development of forestry cooperative organization

As a result of the government's support, the possibility of $H*n*y-F + v > 0$ has increased significantly, which has increased the enthusiasm of the insurance companies to participate. On the other hand, the government's investment policy is not always able to achieve good social benefits. When guiding insurance companies and banks to participate in the development of forestry cooperation organizations, this requires the government to establish a good credit system for forestry cooperative organizations, improve the corresponding supporting system, and actively cultivate the forestry cooperative organizations credit rating. The government will be interlocking with various agencies and build an information sharing mechanism in order to get a transparent and credible platform.

4. CONCLUSION

4.1 Management Strategy of Forestry Cooperation Organization

Firstly, forestry cooperatives should strive to regulate their own governance structures. Because there are many problems in the cooperative organization, such as the operation is not standardized, the system is not perfect,
especially the authenticity of financial information is relatively low, and the management of members is relatively loose, so banks are very cautious about the cooperative organization's credit, often not loans, or less loans. Therefore, the operators of cooperative organizations must strive to standardize their own governance structure, establish and improve the system, constantly improve transparency, strengthen communication and contact with banks, and strive to highlight the cooperative advantages and characteristics of cooperatives, realizistically reflect the operation of cooperatives. Cooperatives should adhere to a reputational priority development concept, establish a good image of keeping promise and establish a long-term cooperative relationship with the bank for long-term financial support.

Secondly, forestry cooperation organizations need to identify industrial projects and carry out technological innovation. Natural resources are regional and cannot be copied, in this condition we can produce non-replicable products, so as to effectively improve the economic efficiency and comprehensive strength, improve the profitability of cooperatives S2, which greatly improve the bank's willingness to lend. Industry is mainly forestry production and global tourism. (1) In the forestry production, carry out technological innovation and improve product competitiveness. At present, most products of the cooperatives have low technological content and relatively simple product structure. For a long time, if there is no technological breakthrough and lack of core competitiveness in technology, cooperatives will soon be defeated by other competitors. Cooperatives need to carry out production and operation of mechanization and large-scale, focus on processing and enhance the brand. At the same time, strive to win the support of the state in terms of capital, technology and so on. Promoting global tourism is a strategic stage of China's tourism development, also is a far-reaching change. Global tourism is a panoramic view and full coverage of the tourism industry, also is a scientific tourism system of resource optimization, space orderly, rich products and industry developed. Among them, the forest ecotourism is developing rapidly, and also is a hot topic in the current tourism industry. The forest is no longer providing wood but to improve the environment and provide the public with open space. Forest ecotourism is becoming more and more important for people, which has become an important part of the world tourism and modern forestry.

Thirdly, forestry cooperatives and insurance companies need to cooperate effectively. The participation of insurance companies provides the conditions for bank loans. In the short term, cooperatives participating in insurance improve the operating costs, but for a long time to see, this behavior reduces the risk of cooperative business and the long-term operating pressure of cooperatives.

Finally, forestry cooperation organizations need to expand the scale, attract talent and expand sales network. With the initial establishment and development of cooperatives, cooperatives need to try to implement the strategy of going out. This strategy can use the local cheap labor and certain natural conditions to further expand the scale, or develop a joint way to increase the number of cooperatives, thereby enhancing the enthusiasm of insurance companies to participate. At present, in attracting talent and expanding sales network, some cooperatives' managers have low management qualifications and technical staff is not high-end talent, also cooperatives lack some talent who understand technology, modern business management and marketing. In addition, the sales outlets of the cooperatives are scattered, and there is no good market layout, which is bound to affect the development of forestry cooperatives, also naturally reduce the loan will of banks and other financial institutions.

4.2 Advice to Banks

Firstly, before the loan, strengthen the exchange of information with the cooperation organizations. Before the loan, the bank should thoroughly investigate and understand the operation of the cooperative organization, the credit situation and the ability to repay the loan, be familiar with the advantages and disadvantages of the cooperative organization, also fully assess the loan risk, and in the case of risk control, fully use the national policies to provide loans to support the development of cooperatives. After the loan, the bank should always pay attention to the use of funds of the cooperative organization to ensure the safety of funds; establish a cooperative organization credit system, strengthen communication between insurance companies and government. And build up a long-term cooperative relation with good credit cooperatives, which is conducive to the understanding of banks for cooperative organizations and reduce the risk of loans.

Secondly, banks should solve the problem of cooperative loan collateral. Most of the cooperative loans are difficult because the mortgage and security is difficult; cooperative with its own strength is often difficult to meet the bank's mortgage requirements. In this regard, banks need to innovate the form of mortgage, expand the scope of the mortgage; you can mortgage forestry property rights, forestry management rights and proceeds.
These properties can be mortgaged as collateral for farmer’s professional cooperatives, such as product orders, production equipment, forest rights, real estate, rural homestead, and means of transport, land use rights and land contract management rights. At the same time, banks can use the policy support, improve the service mechanism, make full use of insurance companies, security agencies guarantee, cooperation between the organization and other means to strengthen cooperation with the government, cooperatives, insurance companies, security agencies.

4.3 Recommendations to the Government

Firstly, the government should speed up the establishment of cooperative organizations credit system and the credit market which is open, fair and fair competition. The government needs to integrate resources, build cooperative credit platform, actively cultivate cooperative credit rating market, encourage the establishment of an independent external rating agencies, establish a credit information collection, a credit rating system and a discouragement mechanism suitable for the characteristics of cooperative organizations, Strengthen the information disclosure of cooperative organizations, standardize the mechanism of market information transmission, and actively promote the application of the credit system in the bank credit management. Through scientific and objective assessment of the cooperative organization credit rating, fully grasp the management situation and the development prospects of the cooperative organization, discriminate cooperatives of different credit rating, and choose a good cooperative to give credit support. The normative governance framework is a necessary condition for obtaining a higher credit rating. Those management practices and high credit rating organizations are more likely to obtain bank credit support, which is bound to encourage other cooperatives to develop normatively and carry out self-improvement.

Secondly, the government should give full play to the guiding role of policy. The government should encourage the establishment of forestry cooperation organizations. The previous results show that when the number of forestry cooperatives is small, the cooperative organizations that buy insurance are less natural, so the insurance companies are willing to participate in the lower enthusiasm. If there is a large number of forestry cooperation organizations established, then the insurance company will have greater enthusiasm to participate in the forestry cooperation organization of insurance. In addition, the government should use tax cuts, discounts and subsidies to guide cooperative organizations to change the mode of development, enhance the industrial level, encourage cooperative organizations to innovate independently, adopt advanced technology, improve product quality and production efficiency, and lay a good foundation for the long-term development of forestry cooperative organizations. Pay attention to play the leading role of leading enterprises in forestry, focusing on supporting leading enterprises and capable people to participate in the formation of professional cooperation organizations to guide and help individual farmers to carry out standardized production, to achieve positive interaction and cooperate in the market. The local government may set up a leading group of forestry professional cooperation organizations to formulate opinions on the construction of farmer’s professional cooperatives and evaluate the incentive measures. It is stipulated that the professional cooperative organizations that meet the requirements of standardization can become professional cooperative demonstration schools and so on.

Thirdly, the government should strengthen policy support and speed up infrastructure construction. Those farmers’ forestry professional cooperatives and cooperative forest which meet the small or micro enterprises can enjoy the relevant state support policies. Those economic products which comply with the relevant provisions of the tax-related should be in accordance with the law to enjoy the preferential policies. Support qualified forestry enterprises to apply for national support funds. Focusing on the support of the forest economy in ecologically fragile areas, minority areas and remote areas. The government should increase the investment in infrastructure related to forest economy, integrate it into the infrastructure planning and give priority to the construction of the new rural construction, speed up the construction of infrastructure such as roads, water conservancy, communication and electric power and effectively solve the problem of weak forest infrastructure development.

Fourthly, the government should continue to promote financial reform, and continuously enhance the ability of the financial industry to serve the real economy. Through the mechanism and institutional innovation, build a diversified financial system that matches the economic and social development, and continuously improve financial services. Actively guide the financial sector to participate in the development of cooperative organizations, especially insurance companies. The incorporation of insurance companies is conducive to improving the guarantee system of cooperatives, which can effectively improve the security of loans, increase the probability of banks recovering losses and increase the willingness of bank loans. Develop the legal provisions of the cooperative organization loans, clarify the role and functions of banks in supporting the development of cooperative organizations; develop incentives of trustworthy repayment for the cooperative
organization to improve the willingness of the cooperative organization to repay the loan; implement financial channels, in which the government supports cooperative loans, to ensure financial support. Develop a system that the government departments support the bank to recover the loss, in order to reduce bank recourse costs and improve bank recourse income.

4.4 Recommendations for Insurance Companies

Firstly, the insurance companies should pay attention to the development of forestry cooperative organizations and have "hyperopia". The development of farmer forestry professional cooperation organization is an important form to adhere to the family contract management and promote mutual cooperation. The establishment of the Farmers’ Forestry Professional Cooperative Organization can effectively solve many problems in the forestry production and management activities. For example, the government cannot solve the problem, the department cannot solve the problem, the farmers cannot solve the problem or it is not cost-effective to do. Also, it can effectively solve the problem of high transaction cost and risk cost which is used for connecting the small business of thousands of households with the ever-changing large market. The development of forestry professional cooperatives is conducive to break the small-scale family, decentralize management pattern, play the advantages of scale operation; is conducive to the development of forest products processing and circulation industry, promote the forestry industry structure adjustment, accelerate the development of modern forestry process, raise the level of consumption of farmers, such as the purchase of cars and life insurance, indirectly increase the income of insurance companies.

Secondly, the insurance content should be diversified, refined and gradient. The development levels of forestry cooperative organizations and product type have personalized characteristics. In view of the diversity of forestry cooperative organizations, insurance companies can develop a variety of insurance packages to meet the needs of different forestry cooperative organizations. Insurance content should be more refined to minimize the risk, so that forestry enterprises and insurance companies will be in a win-win situation. At the same time, according to the scale and the operating conditions of forestry cooperation organizations, implement gradient insurance program, try to avoid the emergence of systemic risk, also the forestry cooperative organizations can obtain the best insurance program to achieve a virtuous circle.

Forestry cooperation organizations and insurance should make full use of the computer Internet to improve the sales of products on the Internet. At the same time, insurance companies need to innovate business on the computer Internet platform. Insurance companies can reduce risk through the Internet.

5. CONCLUSION

The problem of borrowing between the forestry cooperatives and the banking institutions is essentially a question of the game between the two sides. In the game analysis of pure strategy, the game of forestry cooperatives and banks does not exist Nash equilibrium. When the game model is extended to the dynamic strategy of the hybrid strategy under the complete information, the participation of the insurance company can improve the willingness of the cooperative organization loan, and the government's participation can further improve the participation intention of the insurance company and finally realize the win-win situation of the four parties. For forestry cooperation organizations, they should strive to regulate their own governance structure; to identify the industry, to carry out technological innovation, to carry out forestry production + forest tourism-oriented business model; and to cooperate effectively with insurance companies; to expand the scale and attract talent and expand sales network. For banks, before the loan they should strengthen the exchange of information with the cooperation organization; and solve the cooperative loan problem, you can implement the forestry property pledge, forestry management rights and the right to pledge loans. For the government, the government should speed up the establishment of cooperative organizations credit system and the credit market which is open, fair and fair competition; give full play to the guiding role of policy; strengthen policy support and speed up infrastructure construction; continue to promote financial reform, and continuously enhance the ability of the financial industry to serve the real economy. For insurance companies, the insurance companies should pay attention to the development of forestry cooperative organizations and have "hyperopia"; the insurance content should be diversified, refined and gradient.
ACKNOWLEDGMENTS

We thank the Heilongjiang Provincial Philosophy and Social Science Fund Project (14D005) for financially supporting this work.

REFERENCES

Wang G.T. (2012). The willingness and the influence factors of Beijing forest farmers participating in forestry cooperation organization, Beijing University of Forestry.