An Empirical Study of Policy-oriented Agricultural Insurance Diffusion Based on Social Network

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Keywords: policy-oriented agricultural insurance; social network; key nodes; link path

Abstract: As a kind of property insurance, agricultural insurance plays an important role in avoiding natural risks, ensuring agricultural production and stabilizing farmers' income. In the process of implementation, agricultural insurance is facing the dilemma of mismatch between agricultural insurance products and farmers' needs, which restricts the development of agricultural insurance. Based on the analysis object of farmers' plant insurance in 2019 in Baiquan County, Qiqihar City, Heilongjiang Province and analytical method of descriptive statistical analysis, the paper attempts to explore the three basic elements of "point", "edge" and "structure" involved in the social network, and provide a social network recommendation strategy for the effective implementation of policy-oriented agricultural insurance by identifying the key farmers, diffusion links and network structures related.

1. Introduction

As a kind of property insurance, agricultural insurance plays an important role in avoiding natural risks, ensuring agricultural production and stabilizing farmers' income. Since the reform and opening up, the agricultural insurance system in China has roughly experienced the recovery and trial run in the early stage of the market-oriented reform (1982-1992), the gradual contraction after the market-oriented reform (1992-2003), and the rapid expansion of the policy-oriented agricultural insurance coverage of commercial operation (2004-2013) [1]. The implementation of the Regulations on Agricultural Insurance in 2013 marks the institutionalization of agricultural insurance, and the proposal of "improving the agricultural insurance system" also marks that the agricultural insurance system has entered a new era of supply side reform of agricultural insurance facing the needs of various agricultural business entities. At this stage, price insurance, index insurance, income insurance, futures + insurance, and catastrophe insurance have emerged one after another. Agricultural insurance policy has begun to develop in a diversified way, highlighting its core position in the agricultural support and protection system.

On the other hand, in the process of implementation, agricultural insurance is facing the dilemma of mismatch between agricultural insurance products and farmers' needs, which restricts the development of agricultural insurance. Generally speaking, the agricultural operators with different scales and natures often bear different levels and categories of agricultural production risks, resulting in obvious differences in their requirements and attitudes towards agricultural insurance. For example, compared with the risk management of agricultural insurance, small farmers tend to support agricultural income, while big farmers prefer risk management so as to meet the needs of risk transfer[2]. At present, there are many problems in the implementation of agricultural insurance in China, such as low level of security and single insurance product, which can neither meet the needs of small-scale farmers for agricultural income support, nor meet the requirements of large-scale farmers to transfer risks, resulting in the imbalance between supply and demand in the implementation of agricultural insurance system, which are mainly reflected in the following aspects: First, the policy of agricultural insurance is divorced from the transformation of agricultural modernization, and the reform of agricultural insurance obviously lags behind the practice of rural agricultural development. Second, it is difficult to form the agricultural insurance market without

  DOI: 10.25236/icbdem.2020.005

government subsidies and premiums due to the limited role of the market[2-4]. Third, agricultural insurance has the opposite functions to achieve and setting policy objectives, and its proportion in the agricultural net income or family net income is too low, because most farmers buy insurance to obtain government subsidies. To change the imbalance of supply and demand in the implementation of agricultural insurance is of great theoretical and practical significance for deepening agricultural reform and increasing farmers' income.

In Article 6 of the Regulations on Agricultural Insurance, it is pointed out that "the relevant departments, institutions of the State Council and local people's governments at all levels and their relevant departments shall take various forms to strengthen the publicity of agricultural insurance, improve the insurance awareness of farmers and agricultural production and operation organizations, and organize and guide farmers and agricultural production and operation organizations to actively participate in agricultural insurance". The crux of the imbalance between supply and demand of agricultural insurance lies in the ignorance of the main body of insurance, farmers in the implementation of agricultural insurance. Although the Implementation Measures of Policy-oriented Agricultural Insurance has been issued in all regions, they have not really involved in the local or regional agricultural production structure, thus neglecting the needs of farmers. At the same time, everyone is in a relationship network (Social Network), and plays different roles in different networks. Social networks change not only the way of communication, but also the way of information diffusion, thus it needs rethink that whether the current social network of towns and administrative villages can be used to let farmers know, get familiar with, and then actively participate in, and find the match point between the supply of agricultural insurance products and their demand, so as to put forward targeted agricultural insurance supply strategies and recommended paths. Therefore, the recommendation strategies for the agricultural insurance based on the social network of farmers are systematically studies in this paper based on the social network of farmers, starting from the three basic elements of the network - "point", "edge" and "structure". Based on this, it attempts to provide a social network recommendation strategy for the effective implementation of policy-oriented agricultural insurance by identifying the key farmers, diffusion links and network structures related, involving the following: (1) looking for the key farmers in the implementation of agricultural insurance from the point of view of nodes in the network; (2) guiding the key farmers to select the recommended objects from the point of view of the network. (3) finding out the utility maximum recommended network structure from the perspective of the overall network structure.

2. Data Sources and Requirements Related to Plant Insurance

2.1 Data sources

In theory, because of the resource endowment of "more people and less land" in rural areas of China, the ability of small farmers to resist risks is poor, which is the main service object of agricultural insurance. In China, as a kind of policy insurance, agricultural insurance needs the strong support in policy and capital from the government, so as to transfer part of financial revenue to agriculture, increase the household income of farmers to improve their enthusiasm for agricultural production, and ensure the stable development of agriculture in China, so it also needs to shoulder the function of income support. Therefore, in this paper, the farmers' plant insurance in 2019 in Baiquan County, Qiqihar City, Heilongjiang Province is selected as the analysis object.

Baiquan County is located in the transition zone between Xiaoxing'an Mountain and Songnen Plain, west of the middle part of Heilongjiang Province, 125°30′to 126°31′E, 47°20′ to 47°55′N, with Tongken River as the boundary, facing hailun city and Bei'an city in the East, Mingshui County in the south, Yi'an County in the west, Keshan County and Kedong County in the north. In 2012, the total population of Baiquan County was 596,000, including the rural population of 508,000, and 11 ethnic groups including Han, Man, Hui and Chao. Baiquan County is located in the middle and high latitude, East Bank of Eurasia. It is characterized by the continental monsoon climate in the middle temperate zone. The annual average rainfall is 490mm, the annual average

accumulated temperature is 2,454.5 ℃, the annual average sunshine is 2,730 hours, and the frost free period is 122 days. Baiquan County covers an area of 3,599.15 square kilometers, including 375,300 mu of cultivated land, 178,000 mu of grassland and 80,000 mu of water area. The crops there mainly include corn, rice, soybean, wheat, potato, etc. The reason why Baiquan County is chosen is because it is a typical agricultural county, and the crops planted are relatively single, so it is convenient to find out the law and make a better correlation analysis.

In 2019, the policy-oriented agricultural insurance in Baiquan County covers 187 administrative villages in 16 townships, with 244 policies, 18,532 insured households, 817,296.86 mu of insured area, and a total premium of 14,806,849.94 yuan, including general, poverty alleviation and disaster policy-guided agricultural insurances. The types of agricultural products involved include corn, rice and soybean, totaling 99, 37 and 108 policies, respectively. The details are shown in the table below:

Table 1 Insurance situation of farmers in Baiquan County

Types	Number of policies	Number of insured households	Insured area	Premium income
Corn	79	2600	161764.33	4044108.25
Rice	29	204	27775.57	694389.25
Soybean	92	3980	331864.14	5309826.24

According to the insurance situation of policy agricultural insurance in Baiquan County, the descriptive statistical analysis is used in this paper to explore the three basic elements of "point", "edge" and "structure" involved in the social network of policy agricultural insurance diffusion, so as to answer the questions of subject, audience and methods of recommendation.

2.2 Requirements for plant insurance

The insurance liability of planting industry includes natural disaster, biological disaster and accident. At present, there are two kinds of terms for the plant insurance with financial subsidies in Heilongjiang Province: one is the "model clause", which is applicable to all the insured; the other is the "exclusive clause", which is applicable to the new type of agricultural operation subjects (major professional households, family farms, farmers' cooperatives and leading enterprises of agricultural industrialization), which needs to (at the same time) meet the two conditions of covering an area of more than 10,000 mu and having insurable interests for the insured objects. Corn, rice, soybean and wheat are four crops subsidized by insurance premium for planting industry, and qualified counties (cities and districts) are encouraged to explore the pilot work of other crops subsidized by insurance premium. The insurance liability range of the products with the highest insurance amount of the "model clause" and the products with the "exclusive clause" of the new agricultural operation subject is expanded from the risks related to the "growth period" of the original guarantee crops to the risks related to the "emergence period", "growth period" and "harvest period" of the guarantee crops. Among them, the proportion of insurance subsidies is 40% from the central government, 25% from the provincial government, no less than 15% from the county (city, district), and no more than 20% from the insured farmers, leading enterprises and farmers' cooperatives. According to the relevant regulations, the planting insurance agency company shall formulate standardized, clear, acceptable and feasible rules for claims settlement, and unify the underwriting, survey and loss assessment and claim settlement service standards, and conduct survey, loss assessment and claim settlement in strict accordance with the insurance terms and business process in case of loss assessment and claim settlement. There shall be no claim cap, average claim, agreed claim and other agreements and behaviors in the insurance terms and actual operation. Besides, if the loss rate of the insured crops is more than 80%, it shall be regarded as the total loss. The insurance agency shall transfer the "zero cash" of the compensation to the account within 10 days after reaching an agreement with the insured on compensation for the insurance benefits. Insurance agencies should strengthen the construction of service system, and may entrust grass-roots agricultural technology promotion, finance and other institutions to assist in the handling of planting insurance business. On the basis of doing their own business well, the assistant organizations shall, actively assist the

insurance agencies to carry out the insurance services for the planting industry; sign a written cooperative contract with the insurance agency, clarify the rights and obligations of both parties, participate in the whole process of publicity, underwriting, loss determination and claim settlement, and practically safeguard the legitimate rights and interests of the insured farmers; reasonably agree with the insurance agency on the expenses according to law, strictly implement the management system of "separation between revenue and expenditure" for extra budgetary income, and strictly prohibit unauthorized collection and outlay. The premium, insurance amount and insurance rate of the "model clauses" and "exclusive clauses" are shown in Tables 2 and 3 below:

Table 2 Insurance premium, insured amount and insurance rate of "model clauses" outside reclamation area

Types of insurance	Premium per mu (yuan)	Insured amount per mu (yuan)	Rate
Corn	15	155	9.68%
	20	250	8.00%
	25	320	7.81%
Rice	15	220	6.82%
	20	360	5.56%
	25	470	5.32%
Soybean	15	155	9.68%
	18	200	9.00%
Wheat	15	180	8.33%
	18	220	8.18%

Table 3 Insurance premium, insured amount and insurance rate of "exclusive clauses" outside reclamation area

Types of insurance	Premium per mu (yuan)	Insured amount per mu (yuan)	Rate
Corn	22	320	6.88%
Rice	22	470	4.68%
Soybean	16	200	8.00%
Wheat	16	220	7.27%

3.Policy-Oriented Agricultural Insurance in Baiquan County

3.1 Basic information of plant insurance in Baiquan County

In 2019, there were 244 policy oriented agricultural insurance policies in Baiquan County, including 108 soybean planting cost insurance policies, 37 rice planting cost insurance policies, 95 corn planting cost insurance policies, 68 individual insurance policies, 176 group insurance policies. Among the 68 individual insurance policies, 45 were in the name of individuals, and the rest 23 were in the name of farmers' professional cooperatives or family farms. It is thus clear that the number of policies insured by groups is much higher than that insured by individuals, especially the number of policies insured in the name of individual accounts for 1 / 5 of the total number of policies. The specific insurance situation is shown in Table 4 below:

Table 4 Insurance situation of Baiquan County in 2019

Products	Number of policies in the name of individuals	Number of policies in the name of groups	Total
Soybean planting cost insurance	25	83	108
Rice planting cost insurance	20	17	37
Corn planting cost insurance	19	76	95
Corn planting catastrophe insurance	4		4
Total	68	176	244

In 2019, the total insured amount of individual insurance in Baiquan County was 17,963,375.3 yuan, the total net premium was 1,282,999.4 yuan, the total insured amount of group insurance was 170,422,480.2 yuan, the total net premium was 13,523,850.54 yuan, and the total net premium of group insurance was more than 10 times of the total net premium of individual insurance. It is thus clear that in addition to the group insurance dominating in the number of insurance policies, it is also much higher than the individual insurance in the amount of premium, and the distribution of the insurance amount and premium on specific products is shown in Table 5 below.

Table 5 Premium distribution

	Individual insurance		Group insurance	
Products	Total sum insured	Total net premium	Total sum insured	Total net premium
Soybean planting cost insurance	5793480	463478.4	103482232	8278578.56
Rice planting cost insurance	4994637.9	266026.75	8477110	456810
Corn planting cost insurance	5153398.4	402609.25	58463138.2	4788461.98
Corn planting catastrophe insurance	2021859	150885		
Total	17963375.3	1282999.4	170422480.2	13523850.54

Among the 68 individual insurance policies, the premium with central subsidy is 574,663.88 yuan, the premium with provincial subsidy is 320,749.88 yuan, the premium with county subsidy is 130,985.75 yuan, and the premium paid by the farmers is 256,599.89 yuan, among which those with central subsidy accounts for the largest proportion of 44.8%, the provincial subsidy accounts for 25%, the county subsidy accounts for 10.2%, and those paid by farmers accounts for 20%. Among the 176 group insurance policies, the premium with central subsidy is 5,802,935.74 yuan, the premium with provincial subsidy is 3,380,962.79 yuan, the premium with county subsidy is 1,635,181.9 yuan, and the premium paid by the farmers is 2,704,770.11 yuan, among which those with central subsidy accounts for the largest proportion of 42.9%, the provincial subsidy accounts for 25%, the county subsidy accounts for 12.1%, and those paid by farmers accounts for 20%. It is thus clear that, no matter in individual insurance or group insurance, the self paid premium of farmers accounts for 20% of the total premium, and the difference is mainly reflected in the amount of premium with central subsidy and county subsidy, and in group insurance, the proportion of county subsidy premium is larger.

Table 6 Subsidy and premium paid by farmers

Applicant	Premium with central subsidy	Premium with provincial subsidy	Premium with county subsidy	Premium paid by the farmers
Individual	574663.88	320749.88	130985.75	256599.89
Group	5802935.74	3380962.79	1635181.9	2704770.11
Total	6377599.62	3701712.67	1766167.65	2961370

3.2 The situation of farmers driven by plant insurance in Baiquan County

In 2019, the planting policy agricultural insurance in Baiquan County covers 18,529 farmers, including 11,700 soybean planting cost insurance, 297 rice planting cost insurance, 6,528 corn planting cost insurance, 4 corn planting disaster insurance, 68 individual insurance and 18461 group insurance. Thus it is clear that the number of farmers covered by group insurance is much higher than that of individual farmers. The details are shown in Table 7 below:

Table 7 Subsidy and self premium paid by farmers

Products	Number of policies in the name of individuals	Number of policies in the name of groups	Total
Soybean planting cost insurance	25	11675	11700
Rice planting cost insurance	20	277	297
Corn planting cost insurance	19	6509	6528
Corn planting catastrophe insurance	4		4
Total	68	18461	18529

Among the 176 insurance policies of group insurance, there are 84 by village committees, Township People's governments and village committees, covering 219.8 households on average. Among them, there are five insurance policies for Changzheng Village Committee of Dazhong Township in Baiquan County and Ziai Village Committee of Dazhong Township in Baiquan County, with 134 and 349 insured households respectively. The group insurances by the People's Government of Xinghua Township and the People's Government of Fengchan Township of Baiquan County cover the most farmers, each covering 711 households; while those by the People's Government, Yongning Villagers' Committee and Yongning Villagers' Committee of Xinghua Township, Changzheng Villagers' Committee of Dazhong Township, Hele Villagers' Committee and Zhandou Villagers' Committee of Sandao Town, Xinglong Villagers' Committee and Heli Villagers' Committee of Guofu Town in Baiquan County cover the least farmers, each covering 2 households. It is thus clear that although group insurance is adopted, there are great differences in the number of farmers covered by different groups.

4 Social Network Analysis of Policy-Oriented Agricultural Insurance in Baiquan County

4.1 Discussion on key nodes

According to the social network theory, the nodes in social network include the lead users and the following users. Compared with ordinary users, lead users have a higher leading advantage, which is mainly reflected by innovation and opinion leadership. Leading advantage status is the most prominent attribute of lead users, which is closely related to measurement factors such as adoption time in diffusion theory, and can help lead users effectively promote the diffusion of new products and play an important role in diffusion theory so that they are leading in demand, benefit expectation, new product value identification and self perception, and more willing to share product information and have a few consequences over ordinary users in adoption. When it is applied to the implementation of policy-oriented agricultural insurance, the lead users are those farmers who take the lead or organize others to insure, which should be the most concerned object of relevant institutions, because they not only have a full understanding of policy-oriented agricultural insurance, but also are the promoters of the subsequent network formation, that is, the core force for promotion of policy-oriented agricultural insurance. It is similar to the initial state of a dynamic system, and its choice has an important influence on the success of policy-oriented agricultural insurance recommendation and the implementation effect of policy-oriented agricultural insurance. Moreover, they can reduce the promotion risk of policy-oriented agricultural insurance and accelerate the spread of new policy-oriented agricultural insurance. Following farmers are those who accept the recommendation of the lead user and whose behavior is affected by the lead user. The confirmation of lead farmers involves the problem of who recommends, that is, the establishment of seed farmers, while the confirmation of following farmers involves the problem of who recommends, that is, the selection of the best recommended object.

The statistical data of planting policy agricultural insurance in Baiquan County shows that the policyholders of group insurance belong to the key node in the implementation of policy-oriented agricultural insurance, that is, the leading users or farmers who have an important impact on the diffusion of planting agricultural insurance through group insurance. At the same time, it should be noted that different leading users will bring different implementation effects. Here, the following six groups insurances are taken as an example to illustrate the differences of different key nodes in the implementation of policy-oriented agricultural insurance, as shown in Table 8 below:

First of all, although there are 176 group insurance policies in the sample, there are great differences between different lead farmers in driving the number of farmers or the number of farmers covered by the insurance policies. Among them, the group insurance covering the most farmers has reached 711 households, while that covering the least farmers has only 2 households, which shows that different lead farmers have great differences in the power of recommendation. Secondly, in the case of the same number of insured agricultural products and insured households, there are differences in the total net premium of group insurance organized by different

policyholders. For the same 711 insurance policies, the total net premium of group insurance of Xinghua Township People's Government in Baiquan County is 232,831.84 yuan, while that of Fengchan Township People's Government in Baiquan County is 408,212.32 yuan, nearly double the difference. Thirdly, the sample shows that the top 22 group insurance policies are organized by Township People's Government, and the farmers covered by Group Insurance conducted by Township People's Government are generally higher than other organizations. In general, policyholders from different organizations have an important impact on the number of farmers covered by group insurance and the total net premium. It is thus concluded that the selection of key nodes in the implementation of policy-oriented agricultural insurance has an important impact on the promotion and implementation effect of policy-oriented agricultural insurance. To solve the problem of selecting recommended objects is to find the most profitable directed link. In the following, how to realize the effective link between farmers of policy-oriented agricultural insurance will be discussed.

Table 8 Implementation effect of policy-oriented agricultural insurance brought by different lead farmers

Products	Organizers	Total premium	Total premium including tax	Total net premium	Number of insured households
Soybean	Xinghua Township People's Government in Baiquan County	2910398	232831.84	232831.84	711
Soybean	Fengchan Township People's Government in Baiquan County	5102654	408212.32	408212.32	711
Rice	Guanghui Villagers' Committee of Longquan Town in Baiquan County	1285800	102864	102864	57
Rice	Gonggu Villagers' Committee of Shangsheng Township in Baiquan County	771424	60267.5	60267.5	57
Corn	Changzheng Villagers' Committee of Dazhong Township in Baiquan County	107814	8625.12	8625.12	4
Corm	Changzheng Villagers' Committee of Dazhong Township in Baiquan County	103113.6	8055.75	8055.75	4

4.2 Discussion on the problem of link path

The link in social network is the connection mode between nodes in the network, which determines the diffusion mode of information and the function mode of the first user to the following user. It is a targeted selection of the recommended object. The selection of the optimal recommended object is studied from the perspective of the edge value measurement in the network (also can be understood as a measure of the importance of the network link). Based on the introduction of the implementation of policy-oriented agricultural insurance, which is the key node, the diffusion path of policy-oriented agricultural insurance in farmers is discussed.

The total net premium of 68 policies insured by individuals in Baiquan County is 514,601.3 yuan, with an average of 12,252.41 yuan, of which the minimum net premium is only 300 yuan, while the maximum net premium is 53,207.5 yuan, which shows that there is a big gap in the total net premium of individual insurance, and that there are great differences in farmers' attitudes towards policy-oriented agricultural insurance. Some farmers can fully realize the important role of policy-oriented agricultural insurance in the fight against agricultural risks, while others take a try attitude only with a small amount of premium to check the effect, which also reflects the current situation of farmers' insufficient understanding of policy-oriented agricultural insurance.

Table 9 Comparison of minimum and maximum individual insurance

Products	Applicant	Total net premium	Premium with central subsidiary	Premium with provincial subsidiary	Premium with county subsidiary	Premium paid by farmers
Rice seed	Individuals	300	142.5	75	22.5	60
Corn	Individuals	53207.5	25273.56	13301.88	3990.56	10641.5

In comparison, the average net premium of group insurance is only 732.6 yuan, which fully reflects the problems existing in the implementation of policy-oriented agricultural insurance in Baiquan County. First, the way of group insurance has not realized the effective link of policy-oriented agricultural insurance. Although group insurance increases the number of covered farmers, it is more convenient for farmers to buy the insurance in groups, which can not really show

the farmers' demand for insurance. The difference of total net premium between individual insurance and group insurance shows that when farmers choose to take out insurance alone, they often have greater demand for policy-oriented agricultural insurance. It is thus clear that the way of group insurance is at the expense of the real needs of farmers. Second, the effective link of individual insurance has not been opened. First of all, individual insurance accounts for 1/5 of the number of policies, but the coverage is obviously very small, which shows that farmers, especially individual farmers, do not realize the important role of taking out policy-oriented agricultural insurance. Secondly, some of the individual farmers are lower than the group farmers in the total net premium, which shows that the farmers are more conservative and not fully aware of the policy-oriented agricultural insurance. It is concluded that the link is of great significance for the effective implementation of policy-oriented agricultural insurance.

4.3 Discussion on the construction of social network

The formation of nodes and links constructs the whole social network structure. Social network is an important foundation of recommendation network. Generally speaking, people follow the relationship of friends on social network to recommend. Social network is a kind of social structure composed of nodes (usually individuals or organizations) and links (including various social relations). It not only constitutes the skeleton of social economic life, but also is regarded as an invisible capital of organizations and individuals.

The sample shows that the organizers of group insurance are generally Township People's Governments and villagers' Committees. However, it is observed from Table 8 that various organizations play different roles in the implementation of group insurance. There is a big gap in both the number of farmers covered and the total net sum insured. The implementation effect of Township People's Government on policy-oriented agricultural insurance is far better than that of Villagers' Committees, which shows that there is not a perfect policy-oriented agricultural insurance diffusion network in Baiquan County. The reasons are obvious: first, the differences are on key nodes; second, neither individual insurance nor group insurance has formed an effective diffusion link. Because the problems of "point" and "edge" eventually lead to the ineffectiveness of the establishment of social network, in the process of implementation of policy-oriented agricultural insurance, those key nodes with high quality, that is, lead farmers, should be selected and a more effective cognitive diffusion path should be sought to build a sound implementation network of policy-oriented agricultural insurance. Therefore, the agricultural, financial and insurance supervision departments at all levels should strengthen the publicity of the plant insurance, make full use of various media tools such as radio, television, newspapers, etc. to vigorously publicize the plant insurance policy and insurance knowledge, and further enhance the insurance awareness of the masses of farmers through business training, media lectures, science and technology collections, insurance to households, typical cases, and so on.

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