An Empirical Study of Relationship Networks of Listed Forestry Enterprises

Xu Wang [1] , Lei Gao [2] , Jielong Huang [3] , Liqun Wang [1,*]

[1] School of Economics and Management, Beijing Forestry University, Beijing 100083, China
[2] School of Economics and Management, Yanshan University, Qinhuangdao 066004, China
[3] School of Internet Economics and Business, Fujian University of Technology, Fuzhou 350000, China

* Corresponding author: wlq@bjfu.edu.cn

Abstract. Based on the data of the a-share national listed forestry enterprises in 2023, this paper uses the social network-analysis method to study the network structure characteristics of the national listed forestry enterprises and the role positioning and functional differences of the internal member enterprises from the perspective of network relations. The results show that Chinese listed forestry enterprises have formed a relatively close cross-regional inter-enterprise relationship network, and two cohesive regions have been formed at the same time, and there are some differences in the tightness of the ties among forestry enterprises with different main businesses in the relationship network. The results of this paper are intended to provide a reference basis for the upgrading of forestry industry chain and the coordinated development of forestry industry among regions under the "double-loop" pattern.

Keywords: Listed Forestry Companies; enterprise relationship network; structural characteristics

1   Introduction

As the main body of the development of green economy, forestry industry organically combines ecological protection and economic construction to promote the sustainable development of green economy in China, and gradually realize the goal of high-quality economic development of forestry and coordinated development of high-level ecological protection. In the process of forestry industry development, leading forestry enterprises have played a key role in guidance, demonstration and driving[1], Has become the key link of forestry industrialization[2] It is of great significance to extend the forestry industry chain and improve the overall level of the forestry industry chain[3-4].Listed forestry enterprises are the key business entities among leading forestry enterprises, the main force of forestry construction [5] and an important link in the economic development of forestry industry [6], and play an important role in upgrading forestry industry [7]. Forestry industry: a focus for policy

China has made great progress in forestry reform in recent years. Specifically, it is mainly manifested in the following aspects:

Firstly, the forestry reform concept of "returning power to the people" has been put into practice. This is a remarkable progress compared with the original concept of only promoting "good governance" without reflecting on the faults. If the forestry authorities carry out the forest reform with such magnanimity and breadth of mind, the majority of farmers will surely be very comfortable, the relationship between the cadres and the public will surely be very harmonious, and the cultivation and management of forest resources will surely be more effective. The results of the forest reform have shown that the implementation of the concept of "returning power to the people" has improved the governance structure of forestry, mobilised farmers to cultivate their forests, increased the productivity of forest land, and increased the contribution of forests to farmers' income. The problems affecting the development of collective forestry due to the extremely low contribution of forests to farmers' income generation have basically been resolved.

Secondly, the situation in which the forestry department monopolised the timber acquisition market by entering the mountains to buy timber has been broken, and the foundation has been laid for the cultivation of a fully competitive timber acquisition market. In the past, it was believed that strict logging management was the key to the sustained, stable and rapid growth of forest resources, while the monopoly of the timber purchase market was the bull's eye of logging management. However, the problem is that the monopoly will inevitably suppress the price, suppress the price will inevitably frustrate the farmers to cultivate the enthusiasm of the forest; and in a fully competitive situation, the competition between the timber purchase enterprises to a considerable extent for the price and service competition; this competition is conducive to improving the cultivation of timber profitability, and timber cultivation of the more profitable, the greater the input of the forest, the forest resources may be able to achieve sustained, stable and rapid growth of the forest resources. The more profitable timber cultivation is, the greater the investment in forests, and the more likely that forest resources will achieve sustained, stable and rapid growth.

2   Data and Methods

2.1   Social network analysis method

Social network analysis is a norm and method to study the structure of social network and its attributes[8]. Based on the research of related scholars on social networks[9-10], this study first investigates the overall network structure characteristics of forestry listed enterprises by measuring five types of indicators: central potential, density, cohesion, average distance and cohesive subgroups, and then analyzes the role positioning of different forestry listed enterprises in the relational network by measuring centrality, and further investigates each forestry listed enterprise in the relational network structure The functional role of each listed forestry enterprise in the relationship network structure is further studied. The specific calculation formula please refer to the literature Liu Jun[10].

2.2   Data sources

This paper firstly collects the annual reports of A-share listed forestry enterprises in 2023 through Juchao Information Website, extracts the names, numbers, addresses and main businesses of listed forestry enterprises and their subsidiaries, and adds the provinces where the subsidiaries are located by using the website of "Sky Eye Search". Secondly, a 68×30 multi-valued relationship matrix F (i, j) was constructed based on the establishment of subsidiaries by 68 listed forestry enterprises in 30 provinces (autonomous regions, municipalities directly under the Central Government and special administrative regions), and the relationship network structure characteristics of listed forestry enterprises were analyzed using Ucinet 6.0 software.

3   Empirical Analysis

3.1   Network construction

This study uses the data software Ucinet 6.0 to calculate the relationship matrix of the relationship network of listed forestry enterprises, and draws the network structure of listed forestry enterprises nationwide through the drawing software Net Draw.

3.2   Network analysis

(1). Network structure analysis.

The application software Ucinet6.0 calculates that the index of central potential of forestry listed enterprises' network is 17.25%, the network density is 10.59, the average distance of network is 1.35, and the index of network cohesion is 0.83. The results of these data show that the density of relationship networks among listed forestry enterprises nationwide is high and the overall relationship network structure is relatively stable.

(2). Cohesive Subgroup analysis.

As show in fig 1.Calculated by Ucinet 6.0 software, there are two clusters of listed forestry enterprises in China. The first cluster has the largest number of listed forestry enterprises, covering all types of listed forestry enterprises. The second cluster has nine forestry listed enterprises, covering all types of forestry enterprises such as forest cultivation and R&D, artificial board, paper making, home design and R&D, landscape design and engineering construction. In addition, there are nine listed forestry enterprises, such as Hexing Packaging, Shanying International, Fujian Jinsen that are not in any of the clustering areas, indicating that they maintain a neutral relationship with other enterprises in their network relationships.
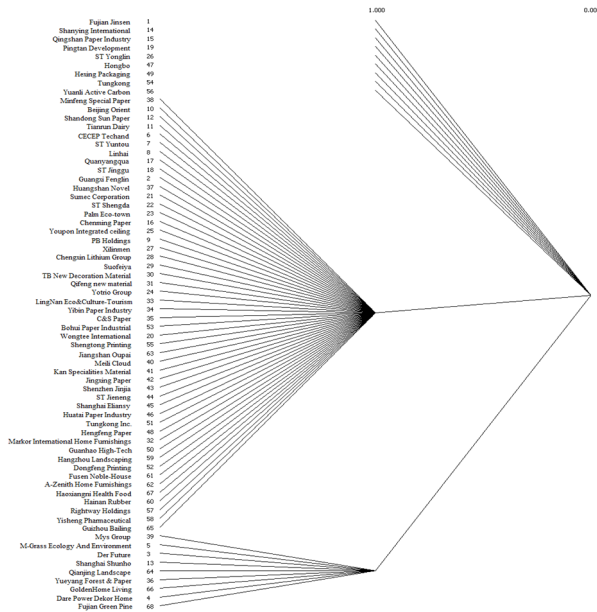
Fig. 1. Cluster diagram of the relationship network of national forestry listed enterprises

(3). Centrality analysis

This paper measures the values of three centrality degrees of listed forestry enterprises and ranks them according to the values of each centrality degree, and analyzes the characteristics of the roles of different listed forestry enterprises in the network and the functions and roles they play in the relationship network, as shown in Table 1.①
Through the empirical results, it is found that: first, there are 39 and 37 forestry listed enterprises with point degree centrality and near-centrality above the mean level respectively, accounting for more than half of the total; there are 27 forestry listed enterprises with intermediate centrality above the mean level, accounting for nearly half of the total; these data indicate that the forestry listed enterprises in China have established a relatively close relationship network at present, which again confirms the These data show that the listed forestry enterprises in China have established a relatively close relationship network, which again confirms the analysis of the network structure characteristics in the previous article. Second, there is a high degree of consistency in the ranking of point centrality and near-centrality of listed forestry enterprises. Among them, paper companies and landscape design and engineering construction companies ranked top and dominated; Chinese medicine and food companies ranked last. Third, in the ranking of the intermediate centrality of forestry listed enterprises, other types of enterprises occupy a seat, which indicates that these types of enterprises in the relationship network of forestry listed enterprises have a strong degree of control over resources and have certain competitive strength; at the same time, the intermediate centrality of

---

① Because of the large space, the top 5 and the bottom 5 enterprises with the point centrality, intermediate centrality and close centrality will be listed respectively.

the enterprises ranked after is 0, which indicates that they do not have the ability to control resources in the relationship on the network. Fourth, the three centrality rankings of the paper company Heixing Packaging Enterprise are all first, indicating that the enterprise is ahead of other enterprises in terms of its own value or external links or the ability to control resources, and is at the core of the relationship network.

Table 1. Centrality of the relationship network of national forestry listed enterprises

	Sort	Listed Enterprises	Degree Centrality	Listed Enterprises	Closeness Centrality	Listed Enterprises	Between Centrality
Top five	1	Hexing packaging	98.507	Hexing packaging	98.529	Hexing packaging	2.364
	2	Dare Power Dekor Home	95.522	Dare Power Dekor Home	95.714	CECEP Techand	1.828
	3	Beijing Orient	95.522	Beijing Orient	95.714	Shanying International	1.697
	4	Shanying International	95.522	Shanying International	95.714	Dare Power Dekor Home	1.679
	5	CECEP Techand	94.030	CECEP Techand	94.366	Beijing Orient	1.538
Bottom five	64	Fusen Noble-House	31.343	Fusen Noble-House	59.292	ST Yonglin	0.000
	65	Fujian Jin-sen	25.373	Fujian Jin-sen	57.265	Yibin paper industry	0.000
	66	ST Yonglin	25.373	ST Yonglin	57.265	Hengfeng Paper	0.000
	67	Hengfeng Paper	17.910	Hengfeng Paper	54.918	Hangzhou Landscaping	0.000
	68	Tianrun Dairy	10.448	Tianrun Dairy	52.756	Fusen Noble-House	0.000

4   Conclusions

This paper analyzes the roles and functions of listed forestry enterprises from a new perspective of "relationships" among enterprises. An empirical analysis of the relationship characteristics among listed forestry enterprises is conducted through social network analysis. The study finds that Chinese listed forestry enterprises have formed a relatively close cross-regional inter-enterprise relationship network with a high network cohesion index, which helps regional industries form agglomeration effects. At the same time, forestry listed enterprises formed two cohesive regions and emerged as co-ordinators and champions in the relationship network, which helped strengthen inter-enterprise cooperation. The study also found that in the relationship networks of

forestry listed enterprises, paper companies and landscape design and engineering construction companies dominate and have strong control and influence, while Chinese medicine and food companies are weaker. This study expands on previous research on forestry listed companies. In order to better modernize the forestry industry chain under the "double cycle" pattern and promote the coordinated development of the forestry industry among regions, we should pay attention to the leading forestry enterprises in the future.

Acknowledgment

References

1. Lv Y, Shi F. (2018) Production efficiency analysis on the national leading forestry enterprises based on the DEA model. Forestry Economics., 40(01): 82-86. 10.13843/j.cnki.lyjj.2018.01.017
2. Cheng Y, Wang Z. (1999) On the leading enterprise construction in forestry industrialization. Issues of Forestry Economics. (03): 11-15. 10.16832/j.cnki.1005-9709.1999.03.003
3. Lan Z, Wang L. (2011) Integration of forestry industry chain in China. Journal of Beijing Forestry University (Social Sciences)., 10(1): 70-75. 10.13931/j.cnki.bjfuss.2011.01.009
4. Zhang Y. (2013) Research on expansion of characteristic nonwood forests industry chain in Yunnan Province. Guangdong Agricultural Sciences., 40(17): 196-199. 10.16768/j.issn.1004-874x.2013.17.016
5. Liu M, Li Y, Wu Y, Zhang C. (2015) Research on the Disclosure of Environmental Accounting Information of Listed Forestry Companies in China. Issues in Agricultural Economy., 36(01): 66-72. 10.13246/j.cnki.iae.2015.01.011
6. Fan Y, Liu R, Gong T. (2019) Investment efficiency calculation of listed companies in China's forestry industry-based on panel data and SFA model. Friends of Accounting. (14): 86-90.
7. Ding S, Li S, Liang Y, Zhao Q, Cao F, Lv L. (2021) Analysis of the factors influencing the financing of the listed companies in the economic forest industry. Journal of Nanjing Forestry University (Natural Sciences Edition)., 45(3):9. 10.12302/J.ISSN.1000-2006.202008006
8. Mohanmod Peter. (2020) An Empirical Study on the Relationship Network of Chinese Agricultural Listed Enterprises-Based on A Share Agricultural Listed Enterprises. Forestry Economics., 42(08): 86-96. 10.13843/j.cnki.lyjj.2020.08.002
9. Faizen Khan. (1979) Centrality in social networks: Conceptual clarification. Social Network., 1(3): 215-239. https://doi.org/10.1016/0378-8733(78)90021-7
10. Mohanmod David. (2004) Introduction to Social Network Analysis [M]. Beijing: Social Sciences Press, Beijing. http://www.ssdph.com.cn