

# Research on the Characteristics of Multi-Subject Collaborative Relationship Based on the Background of Computer Algorithm

Xu Wang<sup>1,\*</sup>, Lei Gao<sup>2</sup>

\* Correspondence: wx712807@bjfu.edu.cn

School of Economics and Management ,Beijing Forestry University, Beijing 100083, Beijing, China<sup>1</sup>  
School of Economics and Management ,Yanshan University, Qinhuangdao 066004, Heibei, China<sup>2</sup>

**Abstract.** On the basis of combing the diversified characteristics of participants in the process of regional industrial branding, the participants in regional industrial branding are divided into five categories: government departments, industry organizations, enterprises in the industry, resource subjects and consumer subjects. At the same time, based on the interview and research data of 10 regional industrial brands, with the help of social network analysis method, the network relationship of the participants in different stages of regional industrial branding is measured. The purpose of this paper is to build a theoretical model of multi-subject collaborative relationship development of regional industrial branding and explore the multi-subject collaborative organization relationship. The results show that: in different stages of regional industrial brand building, there are obvious differences in the number of participants and the collaborative relationship between them; in the regional industrial brand multi-subject collaborative relationship network, it shows the characteristics of multi-core subjects; the government departments represented by the economic operation regulation and regulation departments play a significant role in the early stage of regional industrial brand building. In the later stage, the end product manufacturers are in the absolute core position in the process of regional industrial branding, followed by the economic operation regulation and standardization and industrial cooperation organizations; logistics enterprises / organizations and tourism and trade enterprises / organizations play an important role in information transmission in the application stage of regional industrial brands.

**Keywords:** regional industry branding; multi-subject; collaborative relationship; Social Network Analysis

## 1 Introduction

Under the conditions of modern market economy with innovation and competition as the core, brand has become an economic factor of equal importance with new factors such as technology, innovation and management, after traditional factors such as land, labor and capital[1]. Regional industry brand as an advanced form of industrial cluster development life cycle, it is market dynamics, improve the adaptability and flexibility of the supply side, in order to form a regional industry development of important strategic initiatives and ability of competitive advantage, it is also to adapt to the new normal economy, to realize the economic transformation and upgrading, and participate in the inevitable choice of economic globalization[2]. Although the

brand of China's state council general office on play leading role to promote the opinions of the supply and demand structure upgrade, have put forward "to play a role of leading brand as the breakthrough point, give full play to the decisive role, enterprise market main body, and the roles of the government role and social participation" the basic train of thought, on the "subject" in the process of construction of the regional industry brand relationship were described in principle. However, due to the complexity of the subject relationship, such practical problems as unclear property rights, difficulty in interest distribution, disguised government support and the emphasis on form over operation have not been effectively controlled [3]. How to solve the problem of multi-subject cooperation in the process of regional industrial branding, effectively play the role of different subjects in regional industrial branding, and avoid the problem of regional industrial branding in form and governance deviation has become the focus of regional industrial branding [4].

## **2 Research Basis and Review**

### **2.1 The Complexity of Regional Branding**

The complexity of regional industrial branding construction is mainly reflected in two aspects: process complexity and participant complexity.

Regional industry brand is a breeding and application of the regional industry brand as the main task of the development process[5], in the process, regional industry brand, stakeholders and regional environmental factors constitute the brand ecosystem[6,7,8], the system is possessed of a tremendously complex structure[9] and mechanism of the characteristics of long cycle, nonlinear characteristics, adaptability and sustainability[10]. According to the theory of brand life cycle, regional industrial branding can be divided into brand planning stage, brand differentiation stage and brand application stage. Regional industry brand planning stage, it is the beginning of the regional industry brand, the stage to complete the whole of the regional industry brand positioning, concept and value of planning, and on this basis, the brand builders through the competitive brand analysis of the similarities and differences in regional industry brand elements, to formulate regional industry brand implementation, so can use the stage task of strategic planning and tactical planning two categories. The product differentiation stage is the specific implementation stage of the regional industry branding implementation plan.

### **2.2 Multi-subject Relationship from the Perspective of Synergetics**

"Relationship" is a typical sociological concept transplanted into management science. Relationships can be thought of as networks, connections, exchanges, resources, and processes. In recent years, management experts have incorporated relationships into the study of management issues such as organizational performance, market expansion, knowledge transfer, and innovation and entrepreneurship. The above research results show that the establishment of relationships can help participants obtain "structural support", thus reducing transaction costs caused by the uncertainty of the environment. The theory of coordination perfectly explains the necessity and rationality of this "structural support".

### 3 Methods and Data

#### 3.1 Social Network Analysis

By using the description, visualization and statistical functions of the social network graph in the social network analysis, this paper discusses the collaborative relationship network structure of the regional industrial branding multi-subject, and identifies the key actors (network nodes) and their roles and functions in the collaborative branding process. The following indicators will be used to analyze the cooperative relationship of multiple players in regional industry branding.

##### (1) Network Density

The value range of network density is 0-1, and the closer the value is to 1, the closer the connection between subjects is. The calculation formula is:

$$D = \frac{\sum_{i=1}^k \sum_{j=1}^k d(i,j)}{k(k-1)} \quad (1)$$

In formula (1),  $D$  is the network density of multi-subject collaborative relationship of regional industry branding,  $k$  is the number of agents (nodes),  $d(i, j)$  is the contact quantity between agent  $i$  and agent  $j$ .

##### (2) Network Centrality

The higher the point degree centrality is, the stronger the competitiveness of the subject, which can be divided into extroversion degree centrality and introversion degree centrality. The calculation formula is:

$$C_D(i) = \sum_{j=1}^n X_{ij} \quad (2)$$

In formula (2):  $C_D(i)$  is the centrality of point degree of subject  $i$ ,  $X_{ij}$  is the relation quantity between subject  $i$  and  $j$ .

The mediation centrality, which represents the ability of a subject to act as a medium between two non-adjacent subjects, is the measure of the resource control ability of the subject. The calculation formula is:

$$C_B(i) = \sum_j^n \sum_k^n \frac{g_{jk}(i)}{g_{jk}} \quad (3)$$

In formula (3):  $C_B(i)$  is the intermediary centrality of the subject,  $g_{jk}$  is the number of shortcuts between the subject  $j$  and the subject  $k$ ,  $g_{jk}(i)/g_{jk}$  represents the probability that the subject  $i$  is on the shortcut between the subject  $j$  and the subject  $k$ .

#### 3.2 Data Resources

Accordingly, from September 2018 to December 2019, the research group used the opportunity of project research and attending relevant meetings to interview and questionnaire the participants who participated in the construction of the above ten regional brands. Supported by the SME Development Promotion Center of the Ministry of Industry and Information Technology (China Centre for Promotion of SEM Development), the Brand Building Branch of

China Forestry Industry Federation, and Tieling Forestry and Grassland Bureau, the research group completed 15 interviews and issued 600 questionnaires, with a recovery rate of 87.83% and an effective sample size of 527. The demographic characteristics of the subjects are shown in Table 1.

**Table 1.** Demographic characteristics of subjects

Variables		Frequency (n=527)	Percentage (%)	Variables		Frequency (n=527)	Percentage (%)
Gender	Male	282	53.51	Position/ Title	Senior	197	37.38
	Female	245	46.49		Intermediate	214	40.61
Age	20~30 years old	127	24.10	Industry	Primary	116	22.01
	30~40 years old	132	25.05		Agricultural	187	35.48
	41~50 years old	157	29.79		Manufacturing	173	32.83
Maximum education level reached	50 years of age or older	111	20.06	Area	Services	167	31.69
	College degree	118	22.39		Tieling	53	10.07
	Bachelor degree	197	37.38		Beijing	104	19.73
	Master degree	142	26.94		Linyi	62	11.76
Departme nt	Doctoral candidate	87	16.51	Government departments	Tianjin	61	11.57
	Industry organizations	103	19.54		Linzhou	67	12.71
	Business organization	157	29.79		Yibin	50	9.49
	Universities and research institutions	91	17.27		Ganzhou	63	11.95
	Other	79	14.99		Linfen	47	8.92
					Jilin Mudanjiang	55 65	10.44 12.33

## 4. Analysis of Social Network

In order to show the multi-subject collaborative relationship of regional industry branding more intuitively, the collected data were imported into UCINET6.0 software respectively, and NetDraw tool was used to draw the network map structure of multi-subject collaborative relationship of regional industry branding. The node's location in the network determines its importance (as shown in Figure 1).

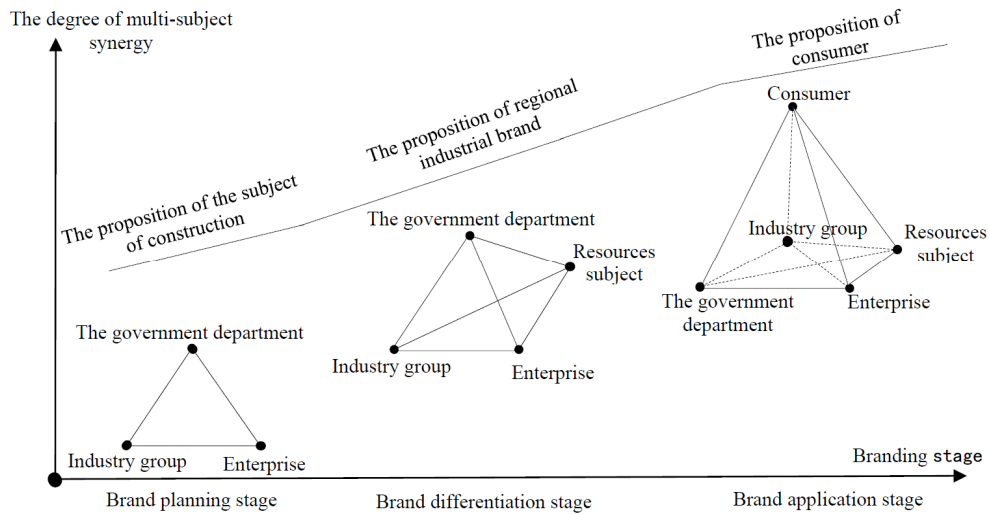


Fig. 1. Regional industry branding multi-subject collaborative relationship network

## 5. Conclusions

The main conclusions are as follows: The first, In different stages of regional industrial branding construction, the number of participants and the relationship between them show obvious differences. From the perspective of the number of participants, with the deepening of regional industry brand construction, the number of participants gradually increases. The second, In the cooperative relationship network of regional industry branding multi-subject, the characteristics of multi-core subject are shown. Comprehensive table 1, the economic operation regulation and standardize the department (G1), production cooperation organization (IG1), production and marketing cooperation organization (IG2) and sales cooperation organization (IG3), terminal products production enterprise (E2) and end products enterprise exclusively (E3) to participate in the whole process of the regional industry brand, and plays an important role in different stages, the multi-subject collaboration to carry out the regional industry brand plays an important role.

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