Le mécanisme interne et la relation des politiques d'intégration industrielle chinoises :Théorie ancrée et analyse des réseaux sociaux

WU, Bicong ; NEGASSI, Syoum

Stratégie et Economie d'Entreprises Université Paris 1 Panthéon Sorbonne

bicong.wu@univ-paris1.fr; syoum.negassi@univ-paris1.fr

Résumé : Dans un siècle, le monde traverse des changements considérables sans précédent. L'intégration industrielle est une tendance de développement économique qui favorise les interactions positives entre la circulation intérieure et la circulation internationale. De plus, le rôle des pays en développement dans l'intégration industrielle est devenu de plus en plus important. Par conséquent, cet article clarifie les similitudes et les lacunes des politiques d'intégration industrielle en se basant sur la Chine. Dans cette étude, nous analysons les politiques d'intégration industrielle entre 2007 et 2020 en utilisant la méthodologie de la théorie ancrée pour coder les politiques. Nous menons une analyse quantitative des politiques d'intégration du point de vue des côtés de l'offre, de l'environnement et de la demande. De plus, un gigantesque diagramme de réseau social complexe est construit pour visualiser la connexion interne des politiques en adoptant une approche d'analyse de réseau social. En outre, une recherche quantitative approfondie est menée en termes de densité de réseau et de centralité. Les résultats indiquent que la politique d'intégration industrielle est plus complète, mais la synergie entre les politiques est faible. De plus, les politiques du côté de l'offre et de l'environnement représentent une proportion relativement plus grande par rapport à celles du côté de la demande, et certains mots clés se trouvent à la marge du réseau social. En outre, les résultats montrent que le gouvernement chinois devrait accorder plus d'attention aux mots clés de politique négligés lors de la formulation de politiques industrielles connexes. Aussi, il devrait renforcer la coordination entre les différentes politiques. Dans le même temps, les réformes institutionnelles et l'investissement fiscal devraient être renforcés pour offrir un excellent environnement pour le développement intégré des industries chinoises.

Mots-clés : Intégration industrielle, Textes politiques, Grounded theory, Analyse des réseaux sociaux

The Internal Mechanism and Relationship of Chinese industrial integration policies : Grounded theory and social network analysis

WU, Bicong ; NEGASSI, Syoum

Stratégie et Economie d'Entreprises Université Paris 1 Panthéon Sorbonne

bicong.wu@univ-paris1.fr; syoum.negassi@univ-paris1.fr

Résumé : The world is undergoing momentous changes unseen in a century. Industrial integration is a trend of economic development and promotes positive interplay between domestic circulation and international circulation. Additionally, the role of developing countries in industrial integration has gradually become prominent. Therefore, commonalities and shortcomings of industrial integration policies are clarified in this paper based on China. In this paper, we analyze industrial integration policies between 2007-2020 using grounded theory methodology to code the policies. We conduct a quantitative analysis of integration policies from the perspective of supply, environment and demand sides. Furthermore, a gigantic complex social network diagram is constructed to visualize the intern connection of policies by adopting the social network analysis approach. Besides, extensive in-depth quantitative research is carried out in terms of network density and centrality. The findings indicate that the policy of industrial integration is more comprehensive, but the synergy between the policies is poor. In addition, policies in the supply and environment sides account for a comparatively large proportion compared with those in the demand side, and some keywords are located at the edge of the social network. Moreover, the findings show that the Chinese government should pay more attention to the neglected policy keywords when formulating related industrial policies. Furthermore, they should increase the coordination of different policies. In the meantime, institutional reforms and fiscal investment should be strengthened to provide an excellent environment for the integrated development of Chinese industries.

Mots-clés : Industrial integration, Policy texts, Grounded theory, Social network analysis

The Internal Mechanism and Relationship of Chinese industrial integration policies : Grounded theory and social network analysis

1. INTRODUCTION

In the past few decades, globalization, technological transformation and upgrading have fundamentally changed the structure of industrial development. As early as 1925, American scholar Frank (1925) pointed out that industrial integration is essential and industrial integration affects the economic status of an industry. With the continuous expansion of integration, the industry will be guaranteed in terms of resources. However, industrial integration affects the development of the industry and has a huge transformative impact on society. By the mid to late 20th century, developed countries completed industrialization one after another. RA and MA (1995) believed that an essential impact of this ever-changing competition pattern was the blurring of industry boundaries and the redefinition of industrial boundaries, which merged and developed into new industrial forms at the original industrial boundaries. This influence became the main growth point of value and the most dynamic driving force of economic growth. The revolutionary industrial innovation first started in the service industry and gradually penetrated. Then, it expanded to manufacturing and agriculture. For example, the United States used information as a medium, including the internet, new media, logistics, and transportation platforms to expand the marketing market for agricultural products. This measure saved human resources, material resources, and capital costs, which becomes a new driving force for traditional agrarian innovation. The United States has a well-developed agricultural industrialization system and large-scale export of farm products. By integrating agriculture and

e-commerce, agricultural core competitiveness has been formed, such as leading agricultural products e-commerce, advanced agricultural technology, and a high degree of informatization. With innovation as its essence, France broke through the boundaries of two different industries, 'agriculture' and 'tourism,' creating characteristic fusion products and positioning diverse consumer groups. Besides, as a solid agricultural country in Europe and a strong tourist country globally, France created a world-renowned rural tourism model by combining the industrial advantages of agriculture and tourism. Eventually, it triggered a new industrial revolution and promoted the development of the global economy as a service trend. Then, in the 21st century, with the rapid growth of the worldwide economy, the phenomenon of industrial integration created new challenges to the traditional industrial structure, organization, and policy. The rapid development of technological revolution and informatization promoted the emergence of new industrial forms. For instance, in June 2001, Lenovo and Siemens signed a strategic agreement to enter mobile phone technology, combining computer technology with wireless communication technology to form a new notebook computer. Moreover, the electric vehicles produced by Tesla also integrated the manufacturing industry and the electronic information industry. Besides, the lithium batteries used in the production of electric cars were also an effective integration of the manufacturing industry and the new energy industry.

Nevertheless, the development of industrial integration in developing countries started late. With the changes in global final demand, the importance of buyer-driven global value chains led by enterprises in developed countries is declining. Gradually, the role of developing countries is increasing. Through the development of industrial integration, it can enhance the status of developing countries in the global industrial division of labor value chain and the competitiveness. For instance, to promote local intangible cultural heritage, Brazil organizes carnivals to promote the deep integration of culture and tourism through experience-based integration. Besides, in 2018, Rio Carnival in Brazil attracted 6 million people, including 1.5

million tourists, and established its cultural tourism brand. As a relatively strong developing country, China has put forward the concept of 'constructing a new development pattern of international and domestic dual cycles' in the complex international environment. China accelerates the construction of a new development pattern in which domestic and international 'Dual cycles' are mutually promoted. Therefore, the construction of the 'Dual cycle' pattern has opened up the 'Main artery' of circulation, coordinated the sizeable domestic market, and optimized the large-scale allocation of resources. This pattern also promotes the logical flow and efficient agglomeration of various elements in different areas. Closer strategic links expose the latest 'Chinese Plan' for the development of industrial integration, and China will promote the development of countries along the route under the background of 'the Belt and Road'. For example, China and Africa jointly created the 'Maritime Silk Road' tourism project to promote Africa's economic growth by integrating culture and tourism. It can be seen from the above that the industrial integration is not only a trend of economic development but also a booster of the internal and external cycles. Therefore, to promote the development of industrial integration, China has issued a series of related policies.

To date, the effects of industrial integration policies in different countries are not the same. Besides, the continuous changes of industrial integration policies have caused that policy tools are introduced and made up in various countries. Especially in developing countries, the supplement of industrial integration policies is conducive to the overall development of the political economy. Industrial integration is an important way for the traditional industry to transform and upgrade and achieve innovation. The integration could reduce the barriers between industries and force enterprises to continuously enhance their technologies. Fuzzy industrial boundaries make interdisciplinary research possible. The optimization of industrial policy is an important driving force for social progress. It is also an important method for the government to optimize the industrial structure and promote the sustainable development of the

national economy. So far, however, the existing research on industrial integration still has certain deficiencies in terms of policies. On the one hand, the industries involved in existing research have certain limitations.

Most studies focus on the integration of specific two or three industries. There is a lack of research on "multi-industry" integration policies from a macro perspective. On the other hand, there are few researches on industrial integration policies, and the quantitative analysis of policy texts is seldom studied. Existing research is mainly qualitative research and focuses on logical speculation.

In light of this gap, we designed the quantitative research to analysis digital-driven firm innovation for the smart car company. This paper addresses the following two research questions:

RQ1: What are the general characteristics and logic of industrial integration policy formulation?

RQ2: What are the internal connections between different industrial integration policies?

The contributions are summarized as follows. First, we take industrial integration policy as the research object. China's industrial integration policies are the research object. We attempt to find the rules for formulating industrial integration policies, explore the common points, analyze existing, and make suggestions. Second, this study conducts quantitative research on policy texts. As an important research paradigm, quantitative research on policy texts has played a good role in policy interpretation, formulation and understanding the logic between policies.

On the one hand, we dig deep into the policy text of industrial integration through grounded theory, determine the logic of formulating China's industrial integration policy through three-time coding and draw a framework diagram. On the other hand, according to the results of grounded theory, we use social network analysis to explore the relationship between keywords and deeply explore the internal structure of the industrial integration policy network.

The remainder of this paper is organized as follows: In Section 2, background information on industrial integration and why we chose the policy aspect are described. The aim of the Section 3 is to introduce the research methods and data sources. Section 4 presents the Policy quantitative analysis. The final section gives a brief summary and critique of the findings.

2. THEORETICAL CONSIDERATIONS

2.1. Definition of industrial integration

Industrial integration is a new economic phenomenon that accompanies technological change and proliferation. Numerous studies have attempted to define industrial integration from different perspectives, but they did not reach a consensus. Data from several of industrial integration mainly focuses on two perspectives of technology and industry.

(1) Technical perspective

Industrial integration was first studied from technology integration. American researcher Rosenberg (1963) discovered the diffusion of the same technology to different industries in his research on the American machine tool industry's evolution and defined this phenomenon as 'technology fusion.' In 1978, Negreouponte, the Massachusetts Institute of Technology (MIT) Media Lab founder, observed the latest technology development and used three overlapping circles to vividly describe the technological integration between the computer, printing, and broadcasting industries. Point out that the intersection of these three industries will be the fastest growing and most innovative field (Brand, 1987). The so-called technology integration refers to sharing the same knowledge and technology between different industries. This knowledge and technology will significantly affect the competition and value of other sectors (Fai & Tunzelmann, 2001; Lind, 2004). On this basis, some scholars defined industrial integration from a technical perspective, that was, the process of continuously replacing old technologies with new technologies (Gains, 1998). For example, CNC machine tools have replaced ordinary machine tools due to technological progress, and digital TV has replaced standard TV.

(2) Industry perspective

The theory of industrial economics believes that industries have their boundaries. According to the change of industrial borders, industrial integration can be defined as the shrinking or disappearing of industrial limitations in response to industrial development (Shane & Tarun, 1997; Choi & Valikangas, 2001). From the perspective of inter-industry relations, industrial integration eliminates industry barriers through technological innovation and lower thresholds and increases the cooperative relationship between various industries (Zhu Cao Yi 2001). Marxt and Fahrni (2009) took the ICT industry as an example. They pointed out that industrial integration blurs the boundaries between two or more industries, promoting paradigm shifts and changing the competition rules between industries.

In general, industrial integration refers to the process of blurring the boundaries between two or more different industries by combining scientific knowledge, technology, and markets. In this process, the blurring of industry boundaries does not mean that industries have become similar. On the contrary, this integration enables the intersection of two or more previously independent areas. Industrial integration can occur in inter-industry integration as well as intra-industry integration. The emergence of industrial integration can make existing industries face a new market competition pattern and a new competitive environment in the value chain.

2.2. Types of Industrial Integration

Industrial integration is a new phenomenon of the economy, and there are a number of published studies that focus on the types, processes, and driving factors.

Firstly, several recent studies investigating the type of industrial integration have been carried out on technical and product perspectives. From a technical point of view, Shane & Tarun (1997) divide industrial integration into technology substitution integration and technology complementary integration. Technology substitution integration means that the innovation of new technology replaces the old technology, promoting the emergence of new industries.

Complementary technology integration refers to the combination of new technologies and existing technologies to create a new industry. For example, the PDA industry emerged from integrating the innovation of handwriting recognition technology with the computer hardware industry, software industry, and electronics industry. Some scholars divide industrial integration into application integration, horizontal integration, and potential integration according to the novelty of technology (Hacklin et al., 2005). Application integration refers to the breakthrough produced by the integration of two or more available technologies, that is, creativity with new added value based on the integration of existing solutions, such as the integration of the automobile and electronics industries in the manufacturing industry (Kim et al., 2015). Horizontal integration refers to the integration of more than one available technology and more than one new technology. The new technologies enable breakthroughs in existing solutions. Potential integration refers to integrating new technologies, and the resulting will bring breakthrough solutions. From a product perspective, industrial integration can be divided into alternative integration and complementary integration (Steiglitz, 2003). Substitutional integration refers to integrating products of one industry with products of another industry with similar characteristics so that these two products have more and more identical components. Complementary integration refers to the two unrelated products into complementary products. The second is the research on the process of industrial integration. Scholars research the perspectives of technological, industry, and value chain respectively. From the technological aspect, industrial integration is a process of continuous technological change. The process of technical substitution involves a technological learning curve. In addition to technology substitution, there is also a technology integration process (Stieglitz, 2003). Hooper (2003) pointed out that integration is not a single integration but integrates primary technologies, networks, equipment, enterprises, and regulations. From the industry perspective, Ono and Aoki (1998) proposed a core framework for three-dimensional coordinate representation,

explained the essence of integrating telecommunications, broadcasting, and other media information services, and proposed the switch from a dedicated platform to a non-dedicated platform. This also reflects the process of industrial integration. Shane & Tarun (1997) suggested that industrial integration can be divided into production integration, procurement integration, and distribution integration from the value chain perspective. The integration of one stage of the value chain will promote the occurrence of another step of integration. Some scholars also pointed out that the process of industrial integration includes the decomposition and reconstruction of the value chain (Wirtz, 2001; Hacklin and Marxt, 2003).

Finally, there is the research on the driving factors of industrial integration. As a new innovative method, industrial integration should be studied more deeply on the factors that affect industrial integration. The main factors affecting industrial integration in current research include government regulation, technological innovation, and business model innovation. In terms of government regulation, the relaxation of government regulation provides external opportunities. With the emergence of natural monopoly, monopolistic competition, perfect competition, and cooper-competition are primarily due to the relaxation of government control. In this context, more related industries have joined the competition and finally achieved industrial integration. Lei (2000) pointed out that it is precisely based on deregulation of the government that driving factors are both inside and outside the enterprise. In terms of technological innovation, this factor has become one of the main driving forces of industrial integration (Cho et al., 2015; Weenen et al., 2013). The spillover effect of technological innovation will speed up the industrial integration. On the one hand, technological innovation overflows, the transformation, and upgrading of related technologies will counteract the technology. Technical integration will inevitably occur. On the other hand, technological innovation will lead to the overflow of information such as market demand and market trends. Other industries will use the spillover to promote technology integration. In terms of business model innovation, as one of the crucial

factors affecting the development of industrial integration, it sometimes plays a decisive role in the integration process. The impact of business model innovation will surpass technological innovation (Chesbroug, 2007). Hacklin uses the ICT industry as an example. In the process of ICT industry integration, business model innovation is one of the vital driving factors. In this process, the business model mainly plays the role of value creation and acquisition.

3. METHODOLOGY AND DATA

3.1. Research methodology

This research mainly adopted the grounded theory and social network analysis for textual research of industrial integration policies. Grounded theory extracts keywords to understand the logic behind policy formulation through deep mining. The social network analysis could powerfully explore the interaction and influence between policies.

The grounded theory is a combination of qualitative and quantitative methods. It transforms policy texts into visible and quantitative forms of expression, which is useful to judge the characteristics of policies (Li, 2015). Based on reading the relevant industrial integration policies, this paper adopted the grounded theory to process the sentences of policy texts. Then, it carried out open coding and axal coding. Specifically, the open coding is the process of concept and category induction assigned to the original data. Axial coding is the process of coding the open coding. Finally, we analyze the logic of China's industrial integration policy based on the coding results and construct a framework. Grounded theory helps us understand the logic of policy text data. But there is no way to explore the internal relationship between keywords. The social network analysis can be used as supplementary research to explore the relationship between keywords.

The social network analysis is one of the more practical ways of analyzing the closeness and connection structure within the network. In the form of network diagrams and matrices, the social relationships of the subjects or behaviors in the network are visualized (Liu, 2004). After

determining the initial and axal categories, this paper used social network analysis to investigate the network relationship. Furthermore, it explored the structure and attribute characteristics of the network, which involves both individual and overall attributes. Moreover, we employed Ucinet software to quantitatively study the industrial integration policy texts. By summarizing the commonalities and shortcomings of the current industrial integration policies, this paper hoped to provide suggestions for the formulation of future industrial integration policies.

3.2. Data Source

To ensure the policy's authenticity and completeness, policies of our paper originated from relevant government portals such as the National Development and Reform Commission, the Ministry of Industry and Information Technology, and the Central People's Government. Then, the search was conducted with 'integration' and 'industrial integration' as the primary keywords and finally the 2007-2020 industrial integration-related policy texts were selected as the research sample, including 37 direct and indirect policies totally.

According to statistics, from 2007 to 2019, the number of reports about industrial integration fluctuated and increased, as shown in Figure 1. Among them, the number of reports published from 2007 to 2012 was relatively small, proving that industrial integration was at an early stage. Afterwards, the number of reports increased from 2013 to 2016. 2013 was a critical year for the integration of informatization and industrialization. Promoting deep integration is a critical way to accelerate development. Noting a significant move to promote the simultaneous development of four modernizations is an inevitable choice to realize industrial transformation and upgrading. Therefore, since 2013, the government has issued more documents to improve the development of industrial integration in the policy aspect with full support. Subsequently, the number of issued reports has increased significantly from 2017-2019, which is at the peak of publishing. In 2017, as the stage of fully implementing 'Made in China 2025' to achieve innovation and integration, industries such as education, culture and tourism were continually introducing

policies to promote integration. In March 2018, the first meeting of the 13th National People's Congress passed the State Council's institutional reform plan and approved establishment of the Ministry of Culture and Tourism. The institutional obstacles of culture and tourism were broken entirely, opening a new chapter in the deep integration. In 2019, China officially entered the age of 5G communication. The integration with the technology industry has become the focus, especially the culture industry. The country has issued relevant policies in April, May, June, and August of 2019, which realized the deep integration of culture and technology. In the post-epidemic era in 2020, the country combined its experience in fighting the Covid-19. In the 14th Five-Year Plan, the proposed report emphasized the deep integration of industries and technologies including the internet, artificial intelligence, and big data. It will further enhance domestic industrial upgrading and accelerate the development of the industry integration which is becoming a new model of national economic growth.

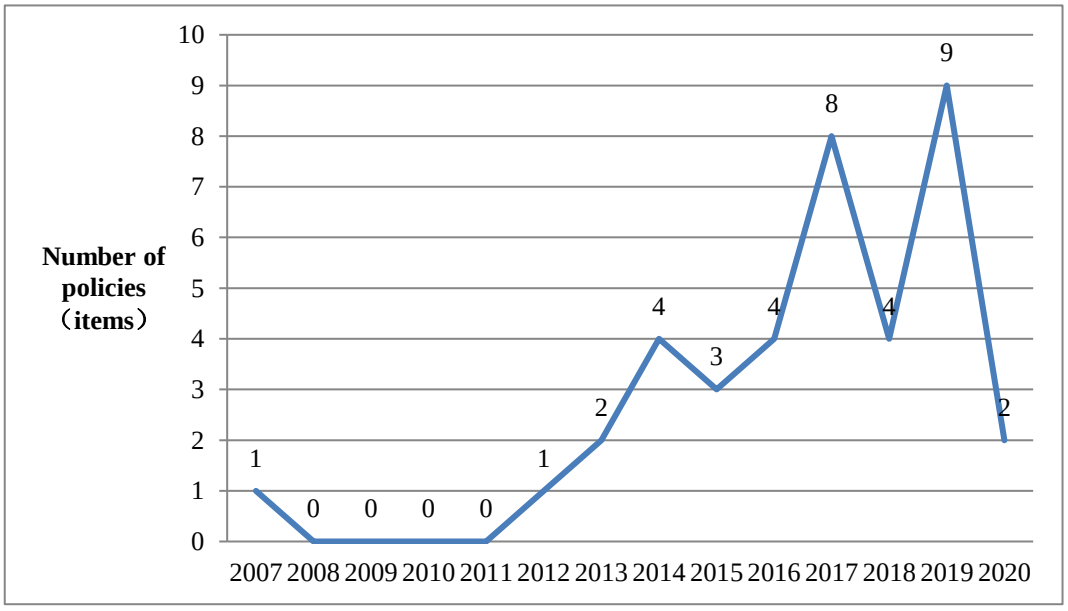

Figure 1 Distribution of Industry Convergence Policy Publication Time

4. POLICY QUANTITATIVE ANALYSIS

4.1. Keyword extraction

After reading the industrial integration policy, the grounded theory was adopted to extract keywords from the policy texts. Through open, axal, and selective coding, we provided a basis for the subsequent quantitative analysis using social network analysis:

1. The core of each policy was extracted and coded by tagging the policy texts sentence by sentence, and totally 133 initial keywords are obtained. Due to the huge number of keywords and duplication, the policy should be read intensively. Finally, 49 keywords were selected, whose frequency is higher than or equal to 3.

2. Based on open coding, 49 keywords were coded on the axal, and 17 main categories were obtained.

3. Seventeen main categories were selectively coded, combined with the types of policy tools to form three core categories with 'supply, demand, and environment sides' as the mainline, which is shown in Table 1 and Figure 2.

Table 1 Axis coding classification

Types of policy tools	Axis coding	Open coding (keywords)	Proportion (%)
Supply side	Infrastructure services	Platform construction, Infrastructure construction, Service center, Forecast and evaluation	49%
	Financial Services	Risk compensation, Capital financing	
	Configure resources	Efficiency, Optimizing resource allocation, Integrating element resources	
	Technological innovation	Innovation, Achievement transformation, Big data, Transformation and upgrading, Key technology research, Extension and expansion	
	Talent development	Talent development	
	Industrial Cluster	Industrial alliances, Complementary cooperation, Industrial clusters	

	Network system construction	System network construction, Standard system, Ecosystem, Service system, Evaluation system	
Demand side	Demonstration Project	Pilot demonstration	12%
	Government subsidies	Government investment, Financial support	
	Strategic Planning	Government guidance, Policy support, Decentralization and service	
Environmental side	Regulatory control	Intellectual property protection, Monitoring and supervision, System reform, Emergency protection, Standardized operation	39%
	Development Environment	Overall coordination, Co-construction and sharing, Integration, intelligence, Online and offline integration	
	Globalization	International development	
	Market guidance	Market leadership, Matching supply and demand, Differentiated development, Promotion of inclusiveness, Publicity and training	
	Leading enterprises	Leading enterprises	
	Adapt to local conditions	Adapt to local conditions	
	Competitive mechanism	Competitive mechanism	

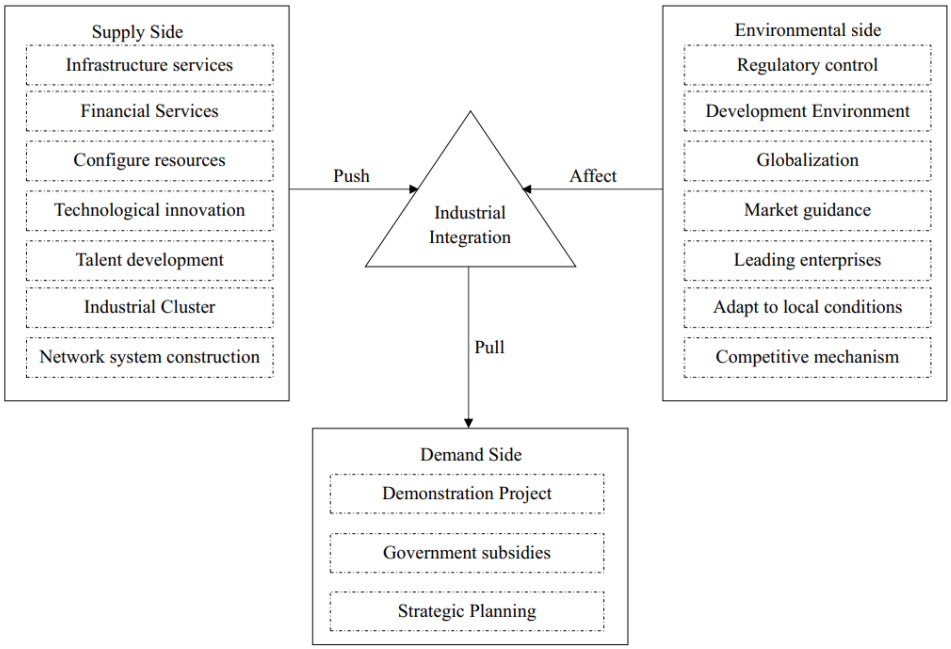

Figure 2. The Logical Framework of industrial integration policies

The essential policy tools are mainly divided into three sides: the supply, demand, and environment side. The policy from the supply side refers to using policy tools to support enterprise R&D and the effective allocation of scarce resources. The policy from the demand side mainly acts on the market dimension. To reduce the uncertainty faced by enterprises through government subsidies and policy support. The policy from the environment side refers to creating a suitable environment for the development of enterprises and ensuring healthy competition. In this paper, these three policy tools are taken as the core category. It can be easily seen that the industrial integration mainly involves the policy from supply side. The second is environment-side policies. Demand-side policies are not fully reflected, and they appear less frequently compared with other two policy tools.

According to the keywords extracted from the integration, the frequency of each keyword was determined by word frequency analysis software, as shown in Table 2. Noting that only keywords with a frequency greater than five are listed in Table 2. Results showed that the frequency of 'Platform construction' and 'Innovation' were relatively high, 29 and 25 respectively. Therefore, they may be covering most policy texts.

Table 2 Keyword frequency statistics table of the industrial integration policy texts (partial)

Serial number	Key words	Frequency (times)	Serial number	Key words	Frequency (times)
1	Platform construction	29	17	Industry Alliance	9
2	Innovation	25	18	Adapt to local conditions	8
3	Co-construction and sharing	19	19	Complementary cooperation	8
4	Pilot demonstration	18	20	Standard system	8
5	Overall coordination	16	21	Docking supply and demand	8
6	Infrastructure	15	22	Policy Support	8
7	Monitoring and supervision	14	23	Tackling key technologies	7
8	Upgrade	13	24	System network construction	7
9	Extension	12	25	Service system	7

10	Efficiency	10	26	Competitive mechanism	7
11	Integration	10	27	Ecosystem	7
12	Market dominance	10	28	Government investment	6
13	Intelligent	10	29	Predictive evaluation	6
14	Talent development	10	30	Leading enterprises	6
15	Globalization	9	31	Big Data	6
16	Government guidance	9	32	Optimize resource allocation	6

4.2. Quantitative Analysis

The extracted keywords whose frequency is at least three were filtered and selected. Using Bicomb software, the standard word matrix was formed by counting the frequency of simultaneous occurrence of pairwise keywords in one policy. Based on the obtained common word matrix, the social network analysis tool (Ucinet) is used to analyze. On the one hand, with the help of Netdraw function, the social network relationship diagram of the co-word matrix was drawn, as visualized in Figure 3. On the other hand, we used the density and centrality to visually explore the internal connections.

(1) Social network relationship

The policy keywords shown in Figure 3 are related to each other. Keywords such as 'Platform construction', 'Innovation', 'Pilot demonstration', 'Co-construction and sharing', and 'Infrastructure construction' are at the core of the network. Keywords such as 'Online and offline integration', 'Security system', and 'System reform' are in the more fringe areas of the network. It means that these keywords are rarely mentioned in the current policies. Specific role of these keywords needs to be determined by analyzing the network density and centrality.

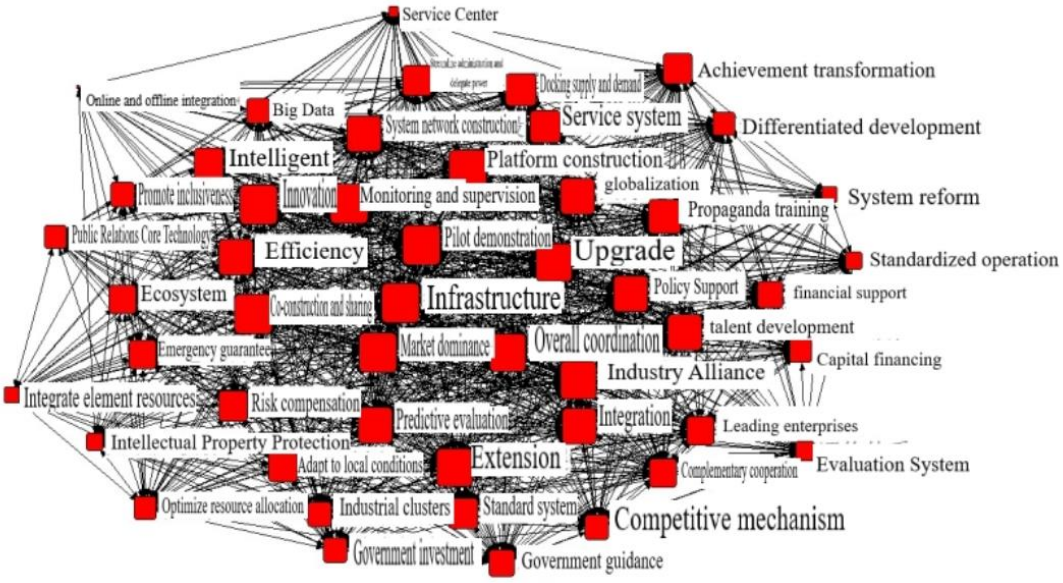

Figure 3 Social Network of Industrial Integration

(2) Network density

In the social network analysis, the overall network is analyzed mainly through the density and relevance degree. The density refers to the ratio of actual connections to all possible connections (Liu, 2004). According to Ucinet software, the density of the network is calculated to be 0.8622. It shows that about 86% of the possible connections appear, and the correlation between the various keywords is relatively high. The degree of internal relevance of the overall network is mainly judged by the relevance degree, that is, the reachability of the network. The network's correlation degree is 0.979 by using Ucinet, demonstrating that the network has high relevance and brilliant accessibility.

(3) Network centrality

After analyzing the overall density and relevance of the network, it is necessary to analyze the role of each keyword specifically in the industrial integration network, that is, to analyze the centrality. The social network analysis mainly adopts point centrality, betweenness centrality, and closeness centrality as indicators. The results of the centrality analysis are displayed in Table 3.

1) *Point centrality.* Point centrality is used to measure the criticality of keywords in the network. The average of the network point degree centrality is about 118. Besides, there are 19 keywords whose centrality exceeds the average. Among them, 'Platform construction', 'Innovation', 'Co-construction and sharing', 'Pilot demonstration,' and 'Over coordination' are ranked in the top five and are at the core of the network. It is important to mention that the top 10 keywords are almost the same as the keywords with the higher word frequency. The result indicates that the fit degree between the point centrality and the keyword frequency is high.

2) *Betweenness centrality.* The betweenness centrality reflects the closeness between different nodes in the network, which is, mediation. Experiment results show that the betweenness centrality average is 3.306. Moreover, 23 keywords have a median centrality that exceeds the average, which is similar to point centrality. Among them, the centralities of 'Platform construction', 'Innovation', 'Co-construction and sharing', 'Pilot demonstration', 'Infrastructure construction', 'Monitoring and supervision,' and 'Market-led' are the highest at 5.904. It shows that these seven keywords are the more critical media in the model. The centrality of keywords such as 'Transformation and upgrading', 'Industrial alliance', 'Predictive evaluation,' and 'System network construction' follow closely and play a particular intermediary role in the network. Nevertheless, keywords including 'Standardized operation', 'Service center', 'System reform', and 'Online and offline integration' have low centrality. The medium of those keywords is not complete and the interaction within the network is poor. Therefore, they are in the fringe area of the network.

3) *Closeness centrality.* Closeness centrality is a measure of how far a node is not controlled by other nodes. It can be seen from Table 3 that the keywords with low rankings of closeness centrality are roughly the same as keywords with high rankings of point and betweenness centrality. Besides, it shows that keywords are in the core position, which can be combined with others and have higher relevance to others. Furthermore, keywords with a higher degree of

closeness centrality are at the edge of the entire network, such as 'Online and offline integration', 'Service center', 'Integrated element resources', 'System reform', and 'Intellectual property protection'. Noting, they are less affected by other keywords.

Table 3 Centrality Analysis of Industrial Convergence Path Network

Serial number	Key words	Point centrality			Betweenness centrality		Closeness centrality	
		Degree	Nrm Degree	Share	Degree	Rank	Degree	Rank
1	Platform construction	327	35.855	0.057	5.904	1	48	43
2	Innovation	300	32.895	0.052	5.904	1	48	43
3	Co-construction and sharing	241	26.425	0.042	5.904	1	48	43
4	Pilot demonstration	239	26.206	0.041	5.904	1	48	43
5	Overall coordination	225	24.671	0.039	4.728	15	49	39
6	Infrastructure	221	24.232	0.038	5.904	1	48	43
7	Extension	195	21.382	0.034	5.116	13	49	39
8	Monitoring and supervision	194	21.272	0.034	5.904	1	48	43
9	Upgrade	163	17.873	0.028	5.516	8	49	39
10	Market dominance	153	16.776	0.026	5.904	1	48	43
11	Industry Alliance	139	15.241	0.024	5.516	8	49	39
12	Talent development	139	15.241	0.024	3.779	18	51	32
13	Policy Support	139	15.241	0.024	4.169	16	50	34
14	Intelligent	138	15.132	0.024	3.401	23	54	23
15	Efficiency	136	14.912	0.024	5.141	12	50	34
16	Globalization	133	14.583	0.023	4.902	14	50	34
17	Integration	131	14.364	0.023	3.983	17	51	32
18	Government guidance	122	13.377	0.021	2.207	36	56	17
19	Service system	120	13.158	0.021	2.904	24	53	29
20	Adapt to local conditions	116	12.719	0.020	2.587	28	54	23
21	Standard system	112	12.281	0.019	2.618	25	54	23

22	Predictive evaluation	112	12.281	0.019	5.258	10	50	34
23	Docking supply and demand	111	12.171	0.019	3.664	19	53	29
24	Complementary cooperation	108	11.842	0.019	2.400	32	55	18
25	System network construction	107	11.732	0.019	5.222	11	50	34
26	Ecosystem	96	10.526	0.017	2.591	27	55	18
27	Emergency guarantee	93	10.197	0.016	2.597	26	55	18
28	Promote inclusiveness	90	9.868	0.016	2.432	30	57	15
29	Leading enterprises	86	9.430	0.015	2.244	35	55	18
30	Tackling key technologies	85	9.320	0.015	1.792	40	59	8
31	Propaganda training	84	9.211	0.015	3.498	22	52	31
32	Government investment	83	9.101	0.014	2.141	38	58	12
33	Big Data	82	8.991	0.014	2.553	29	58	12
34	Risk compensation	81	8.882	0.014	2.204	37	54	23
35	Competitive mechanism	81	8.882	0.014	2.321	34	58	10
36	Optimize resource allocation	75	8.224	0.013	2.364	33	59	8
37	Differentiated development	74	8.114	0.013	1.683	41	59	8
38	Decentralized service	69	7.566	0.012	3.649	20	54	23
39	Integrate element resources	67	7.346	0.012	0.830	45	64	3
40	Capital financing	66	7.237	0.011	1.515	42	59	8
41	Financial support	62	6.798	0.011	2.423	31	56	17
42	Achievement transformation	59	6.469	0.010	3.632	21	54	23
43	Evaluation System	55	6.031	0.010	1.073	44	61	7
44	Industrial clusters	54	5.921	0.009	1.973	39	57	15

45	Intellectual property protection	47	5.154	0.008	1.365	43	63	5
46	Standardized operation	46	5.044	0.008	0.769	46	63	5
47	Service Center	45	4.934	0.008	0.768	47	67	2
48	System reform	39	4.276	0.007	0.714	48	64	3
49	Online and offline integration	36	3.947	0.006	0.430	49	72	1
	Average	117.878	12.925	0.020	3.306	-	54.612	

In summary of the above analysis, the following conclusions can be drawn through the quantitative analysis of the industrial integration policies:

(1) Supply-side policy. Firstly, the supply-side policy accounts for the highest proportion. Specifically, policies in this area mainly promote industrial integration through infrastructure services, financial services, resource allocation, technological innovation, talent development, industrial agglomeration, and network system construction. Among them, keywords such as 'Platform construction', 'Innovation', 'Infrastructure construction', and 'Transformation and upgrading' appear frequently, and they are at the core of the network. It shows that these keywords are effective paths and methods in most industrial integration policy texts, and they have a certain universality. Then, for instance, 29 policy texts such as the 'Guiding Opinions of the State Council on Actively Promoting the Internet + Action' mentioned promote industrial integration by constructing platforms for public services, testing and verification, and data sharing and exchange. Moreover, twenty-five policy texts such as the 'Guiding Opinions on Further Promoting the Integrated Management System of Informatization and Industrialization' mentioned the need for innovation in technology, management mode, experience mode, and service. Besides, policy maker should promote industrial integration by developing new products, industries, and formats. Nevertheless, fifteen policy texts, such as the 'Implementation Plan for Building a National Demonstration Zone for Industry-City Integration' mentioned that infrastructure construction should be coordinated and targeted

support measures. Value-added services should be introduced. Thirteen policy texts, including 'Several Opinions on Promoting the Integrated Development of Transportation and Tourism' mentioned that management should be reformed. Finally, the development of industrial integration should be promoted by creating new models of industrial transformation and upgrading.

(2) Environment-side policy. Firstly, environment policies account for 39%, which is a high proportion. The policy in this side points out that laws and regulations should be adopted to provide an excellent competitive environment. Then, with the help of the market guidance and leading enterprises, the development is tailored to local conditions and the international market. For example, in 2017 the 'Opinions on Promoting the Deep Development of Military-civilian Integration in National Defense Technology Industry' pointed out that the civil-military integration maintenance support system should be promoted. Therefore, policy makers should strengthen the construction of emergency rescue forces and safety supervision and promote the in-depth development of the civil-military integration. Besides, in 2017, the 'Implementation Plan for Building a National Demonstration Zone for Industry-Urban Integration' pointed out that small towns with integrated industries should be developed according to local conditions. Policy makers should promote industrial transformation and upgrading and improve the quality of comprehensive services in urban areas. Furthermore, in 2017, the 'Guiding Opinions on Promoting the Integrated Development of Traditional Chinese Medicine Health Services and the Internet' pointed out support for the translation and publication of digital Chinese medicine ancient books and the development of a batch of traditional Chinese medicine cultural creative works suitable for overseas media dissemination. The information exchange is verified effectively through the international promotion of Chinese medicine culture to deepen Chinese medicine and the Internet's integration and development.

(3) Demand-side policy. First of all, the demand-side policies account for a relatively low proportion. Policies in this area require the government to provide subsidies and make strategic planning. Moreover, these policies actively play the guiding role in promoting the development of industrial integration. For example, the 2016 'Guiding Opinions on Promoting the Development of 'Internet +' Smart Energy' mentioned that the government should improve the scientific decision-making level of significant energy infrastructure planning. Besides, the full integration of streamlining administration and decentralization and the energy Internet should be promoted. In 2018, the 'Guiding Opinions on Promoting the Integrated Development of Culture and Tourism' pointed out that the Ministry of Culture and the National Tourism Administration should commend projects jointly that have achieved outstanding results in the integrated of culture and tourism. Moreover, policy makers should give necessary policy support to cultural tourism enterprises with capital as the link. In 2017, the 'Several Opinions of the General Office of the State Council on Deepening the Integration of Industry and Education' stated that in order to deepen the integration of industry and education and promoting the organic connection of the industrial chain, the talent chain, and the innovation chain, the policy system should be improved. It mainly includes implementing the project of production and education integrating, the fiscal and taxation land policy, and the construction of pilot projects to integrate production and education.

(4) In the industrial integration network, some keywords are located at the edge of it, such as 'Evaluation system' and 'Industrial clusters' at the supply-side, 'Intellectual property protection' at the environment-side, 'Online and offline integration,' 'System reform,' 'Financial support' and 'Delegation of control and service' at the demand-side. Therefore, the low frequency of these keywords is a shortcoming in policy making. Especially the policy keywords, which is at the demand side and locates at the edge of the overall network, have low synergy with others.

It is necessary to improve and strengthen the formulation of policies at the edge of the network. It can be summarized as the following four aspects: The first is to increase the coordination of supply-side, environment-side, demand-side policy tools and appropriately strengthen demand-side policies. The second is to strengthen system reform. In the upcoming industrial integration, the traditional development model should be broken by reforming the income distribution system, evaluation system, and property rights system. Besides, forming a development model that integrates online and offline promotes a digital environment for co-construction and sharing is essential. The third is to strengthen policy support. The Ministry of Finance should increase funds to support pilot demonstration projects for industrial integration and improvement. Moreover, an investment and financing system guided by government policies and extensive social participation should be established. Furthermore, lowering the entry threshold of social capital guarantees the capital needs of industrial integration and expansion. Finally, policies and measures for the protection of intellectual property rights should be increased to ensure that 'Infringement must be investigated and cases must be resolved.' The intellectual property service platform should be improved, and intellectual property reviews should be conducted. Moreover, financial subsidies to intellectual property pilot enterprises should be provided.

5. CONCLUSION

In this paper, the grounded theory and social network relationships were adopted to explore Chinese industrial integration policies. Firstly, political keywords were extracted through the grounded theory, and three main core categories including supply, environment and demand sides were selected by open coding and axis coding. On this basis, the social network relationship approach was employed to analyze the density and centrality of the network and the role of keywords was determined in the industrial integration policy network.

It is interesting to note that the policies of industrial integration were relatively complete. Meantime, the keywords in the policy network were highly correlated. However, the synergy of the policy was still insufficient. Compared with policies at the supply and environment sides, they promoted the industry integration through infrastructure construction, supporting resources, and financial services. Besides, policies from these two sides provided a superior competitive environment. Nevertheless, the number of demand-side policies were small, leading an incomprehensive coverage, and a low synergy between the supply and demand sides. In the overall industrial integration policy network, some keywords were at the edge of the network, such as 'Industrial clusters,' 'Intellectual property protection,' and 'Financial support.' Noting that the frequency of occurrence in the policy texts was relatively low.

Hence, with the next few years, China should strengthen the policy formulation. Based on strengthening organizational coordination and leadership, policies should be improved in supply-side, environment-side and demand-side. We hope to provide a good environment and guarantee the development of industrial integration.

Despite its contributions, however, this paper has limitations. On the one hand, the text analysis method of this research is primary. To be specific, the grounded theory is mainly used to extract keywords and form sample data through manual intensive reading and sorting. Therefore, more intelligent analysis approach such as machine learning should be introduced to intelligently organize text information so that more accurate sample data in future research can be obtained. On the other hand, the conclusions of this paper cannot be applied to countries all over the world. Because only China is selected as the case country, the conclusion is more applicable to developing country. Further work is required to select the industrial integration policies of developing and developed countries for comparative analysis.

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