

# Research on platform-based transformation of traditional engineering consulting enterprises based on the dynamic embedding of value chain - Taking Glodon as an example

Si Wu\*, and Wenjia Zhang

School of Economics and Management, Beijing Jiaotong University, Beijing, China 100044

**Abstract.** Nowadays, the information revolution with digital technology as the core is taking place in the engineering consulting industry. Traditional engineering consulting enterprises should follow the trend and change with the trend, give full play to their long-accumulated knowledge and skills, and realize platform-based and digital transformation. Combining the existing literature research, this paper proposes the platform-based transformation of Chinese traditional engineering consulting enterprises based on dynamic embedding of value chain, and verify it with the platform transformation practice of Glodon Company. Taking environmental perception ability as the basis, relationship and structure debugging as the guarantee, and innovative learning as the driving force, engineering consulting enterprises adopt contingency and active embedding behavior to integrate resources along the value chain, and build a digital intelligence platform at the same time to support the strategic reconstruction of enterprises, form a platform ecology with themselves as the core and multiple subjects participating, complete the value chain leap, and adopt a digital governance system of cooperative governance of multiple subjects in order to maintain the healthy development of the platform ecology.

## 1 Introduction

Chinese traditional engineering consulting enterprises have taken shape after more than 20 years of development, and many industry benchmark enterprises have emerged. However, nowadays, in the background of national future investment structure differentiation and more obvious homogeneous competition in engineering consulting industry, it is increasingly difficult for enterprises to undertake business, and the requirements for brand, scale, qualification and staffing of enterprises are getting higher and higher. At the same time, its pursuit of professional development has also brought about synergistic contradictions such as business fragmentation, stage fragmentation and process fragmentation, which makes it difficult to adapt to the owner's complex demand for

---

\* Corresponding author: [wusiii@126.com](mailto:wusiii@126.com)

comprehensive, cross-stage and integrated projects. The transformation of engineering consulting enterprises is imminent.

Some researchers have studied from the perspective of the internal capabilities of enterprises and the value chain in which they are located, and advocate that the capability upgrade of enterprises can be achieved through value chain embedding. However, the information technology represented by “cloud, big data, IoT, AI” are widely combined with the field of engineering and construction nowadays, which is reconstructing business infrastructure. The time and space limitations of the enterprise management are broken through, and the development of the enterprise management network without borders is achieved. The combination of information technology and traditional industries has created a new business model - the platform model.

To meet the challenges in the era of network economy, traditional engineering consulting industry must embrace digital transformation and deeply integrate with digital technology for development. On the basis of dynamic embedding theory of value chain, this paper will conduct research on the platform-based transformation path of traditional engineering consulting enterprises with a view to providing reference for their future development.

## **2 Literature review**

### **2.1 Theory of the dynamic embedding of value chain**

Professor Porter (1985) mentioned in his book “Competitive Strategy of Enterprises” that value chain is a variety of activities that are strategically composed by enterprises. If enterprises want to acquire their competitive advantages, they need to carry out the value chain strategic movements that are better than those of their rivals[1]. However, not only value chains exist within an enterprise, but also its value chains are interconnected with those of other economic entities, The value chains of all enterprises are linked together, to form a value system consisting of many value chains[2]. Subsequently, some scholars began to apply the embeddedness theory to the value chain theory, arguing that Chinese traditional enterprises can improve their comprehensive capabilities by embedding in GVC[3]. Further research shows that double embedding in GVC/NVC can promote traditional enterprises to grow faster and then complete the upgrade of the value chain[4].

The value chain embedding capability is a static capability, which refers to The ability of a enterprise to build relationships with value chain partners or to take up a position in the value chain and use that position to obtain resources in a static market environment[5]. When the market environment evolves from static competition to dynamic competition, it is not enough to depend only on the static value chain embedding capability, but only to enhance the GVC/NVC dual dynamic embedding capability<sup>[4]</sup>. Traditional enterprises can obtain information, knowledge and resources[6] from GVC/NVC dual dynamic embedding, and realize enterprise transformation and upgrading through environment perception, value chain relationship and structure debugging, innovative learning and strategic reconstruction<sup>[5]</sup>. And when it comes to strategic reconstruction, this paper believes that building a digital intelligence platform to empower the digital transformation of industry is the only way to seek long-term development in the complex and changing environment.

## **2.2 Theory of the platform**

Previous researches have defined platforms from different viewpoints, and the current widely accepted definition considers that a platform brings together users in a bilateral or multilateral network by providing products and services through a set of access points or interfaces[7], bringing together producers and consumers, and providing infrastructure and rules as the basis for complementary products and services[8]. Platforms use system resources to coordinate and facilitate transactions between demand and supply sides, creating network effects among multilateral users of the platform and creating value through interactions between groups of platform participants[9]. The core enterprises that develop the platform are called platform companies, which are critical in the formation and development of the platform and its ecosystem[10]. The platform ecosystem includes not only platform enterprise, providers, demanders, public sector, other subjects and the relationships among them, but also a variety of connections and differences among platforms[11]. Faced with the challenges of subject plurality, environment dynamics and system complexity, it is also necessary to build an ecological governance model based on platform plurality and diversified competition and cooperation. Platform governance means to set up platform rules to regulate and manage the activities of platform participant groups, so as to realize the safe development of platform ecosystem and the expansion of participant groups<sup>[9]</sup>.

Although the research on the platform-based development of enterprises has made great progress, the scope of industries and enterprises involved in the existing research is still relatively limited, for example, the research on the platform-based transformation and development of engineering consulting enterprises is relatively lacking. Therefore, this paper will conduct an in-depth study on the platform-based transformation path of traditional engineering consulting industry based on the theory of dynamic embedding of value chain.

## **3 The transformation path of traditional consulting enterprise platform based on dynamic embedding of value chain**

### **3.1 Dynamic embedding of value chain**

Modern enterprises are no longer a highly structured closed system as considered by traditional industrial organization theory, and their survival and development cannot only rely on the adjustment of internal structure[12], but also should respond to complex dynamic environmental changes through transformation and upgrading[13]. However, it is far from enough to focus the starting point and acting point of transformation and upgrading on the cultivation of internal business capability, which will limit the long-term development of enterprises. Therefore, traditional engineering consulting enterprises must perceive environmental changes in time, continuously reconfigure and develop enterprise resources, and carry out transformation and upgrading at the right time in order to truly form sustainable competitive advantages.

In a complex and dynamic environment, the environment may have already changed before the transformation of the enterprise is fully implemented[14] and the strategic direction of the enterprise should change from pursuing the internal resource capability as the basis of enterprise development to the reconstruction of resource capacity for the purpose of adapting to environmental change. Therefore, the transformation and upgrading of enterprises is no longer a static cultivation of resources and capabilities, but a continuous dynamic adjustment process, which requires enterprises to have the dynamic embedding

ability of value chain, and “environmental perception - Debugging of relationships and structures along the value chain - innovative learning - strategic reconstruction” is the effective path for traditional engineering consulting enterprises to carry out transformation and upgrading based on the theory of dynamic embedding of value chain[15].

1) Environment perception. Traditional engineering consulting enterprises occupy a certain position in the value chain by virtue of their business capabilities and are influenced by the variable, interlocking and complex environment in the value chain. The dynamic embedding of value chain requires enterprises to have insight into external environmental changes, timely identify uncertainties in the value chain, strengthen their own risk resilience, and at the same time accumulate internal resources and capabilities, actively seek opportunities and change the value chain environment. 2) Debugging of relationships and structures along the value chain. Traditional engineering consulting enterprises can actively acquire information flow, policies, science and technology resources among partners in the value chain, such as suppliers, bidders, tender evaluators and contractors, through relationship embedding and structure embedding[16]. They need to enhance the strength of independent innovation and use the resources in the value chain to build their own core competitive advantages. 3) Innovative learning. In the process of embedding, enterprises will face the problem that the resources in the value chain are more and more difficult to obtain[17], so they need to conduct innovative learning, explore and integrate the obtained resources creatively to optimize the internal structure of enterprises and realize independent innovation[18]. 4) Strategic reconstruction. On the basis of “environmental perception - Debugging of relationships and structures along the value chain - innovative learning”, the structure and use of resources, internal strategies and organizational structure are adjusted so that the value chain resources obtained by the company can be better matched with the objectives.

In the process of dynamic embedding of the value chain, the digital intelligence platform can have powerful ability of resource integration by virtue of network effect, “Cloud, Big Data, IoT, AI, 5G” and other technologies, connect and coordinate multilateral groups by virtue of bilateral or multilateral effect, and break the information silos. Therefore, enterprises can build a digital intelligence platform to promote the upgrading and reconstruction of core business scenarios of engineering consulting industry, and use the digital intelligence platform to promote the platform-based transformation of enterprises[19], which is an effective approach for engineering consulting enterprises to actively respond to the opportunities and challenges of the complex and dynamic environment.

## **3.2 The path of platform-based transformation of engineering consulting enterprises**

### *3.2.1 Construction of Digital Intelligence Platform for Engineering Consulting*

The digital intelligence platform is going to generate a new driving force for the transformation and upgrading of engineering consulting enterprises. Traditional engineering consulting enterprises can firstly operate their enterprises through digital technology[20], and at the same time use the PAAS platform provided by platform service providers to carry out rapid secondary development, so as to build a digital intelligence platform in line with their own enterprise characteristics, precipitate advanced industrial capabilities and realize the digitalization of each business link. Secondly, enterprises can use the digital intelligence platform to run through the whole process of traditional engineering consulting projects, upgrade all elements of the industry, connect all

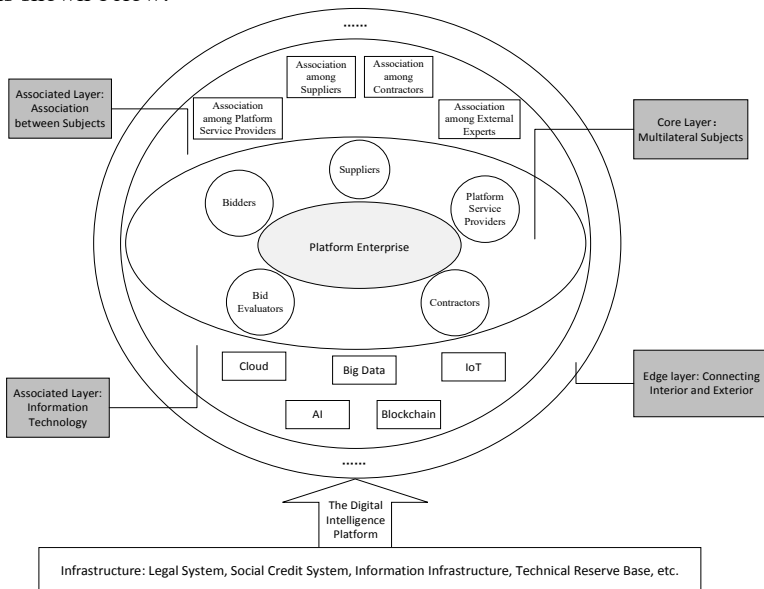
participants of engineering consulting projects, and provide virtual consulting services or twin consulting services that combine reality with virtuality, systematically realize the optimal allocation of resources in the whole industrial value chain, maximize efficiency, empower all parties in the industrial value chain with technology, and provide core competitive capabilities for engineering consulting enterprises.

The digital intelligence platform provides a digital base for the transformation of engineering consulting enterprises, and it is the digital infrastructure for building the enterprise platform ecology. Through platform building and dynamic embedding of value chain, more and more traditional consulting enterprises can realize digital upgrading and ecological integration of value chain, resulting in efficient linkage brought by the penetration of value chain and industry chain, finally developing a new model, new driving force and new ecology of traditional consulting industry.

### 3.2.2 Platform ecology of engineering consulting enterprises

Based on the digital intelligence platform, engineering consulting enterprises can attract and connect huge multilateral user groups through network effect[21] and multilateral effect, and each group can develop synergistically and mutually benefit from each other, thus forming a solid platform ecosystem, and the enterprise becomes a platform enterprise and is in a leading position in the formation and development of the platform ecosystem [22].

Based on the Internet framework, the platform ecology of engineering consulting enterprises, driven by digital technology, is jointly constituted by multiple subjects in its value chain and their stakeholders. The participating subjects are multiple in nature, including suppliers, bidders, bid evaluators, contractors, platform service providers, etc. Each participating subject has relevance to other subjects due to interconnection, and the intensity of relevance is different, so multiple subjects will form a multi-layer multilateral and compound network relationship in the actual operation of the participating platform. A schematic diagram of the platform ecology with the digital intelligence platform as the endpoint is shown below:



**Fig. 1.** Schematic diagram of the platform ecology of engineering consulting enterprises.

1) The development of platform ecology is built on certain infrastructure, including institution, society, technology etc., which constitute the infrastructure layer of platform ecology development together, and the platform enterprise builds engineering consulting digital intelligence platform by fully integrating the infrastructure. The infrastructure layer includes the regulatory system, social credit system, information infrastructure, technical reserve foundation, etc.

2) The inner composition of the platform. The digital intelligence platform is managed and operated by engineering consulting enterprises, providing a connection channel for both supply and demand sides and promoting their transactions, creating revenue with services, maintaining existence and stimulating development with revenue. Platform enterprises set their development goals, fully utilize the sharing advantages of “vertical to the end and horizontal to the edge” to build a platform development model, establish a new organizational structure, and design based on digital technology to better serve the platform value goals and execution, collecting data in the front office, storing and processing data in the back office.

3) The platform ecology contains the participation of multiple subjects. Engineering consulting enterprises connect multiple subjects through the platform, forming bilateral or multilateral relationships, and also generating platform spillover effect in the process of operation, the layered pushing away of spillover effect forms a differential order network relationship. With its bilateral or multilateral market attributes and association advantages, the engineering consulting digital intelligence platform attracts suppliers, platform service providers, bid evaluators, bidders, contractors and others actors to take part in the platform. At the same time, the connection service provided by the engineering consulting digital intelligence platform for both supply and demand sides runs in the Internet framework, which has network relevance and reaches transactions based on the relevance and sociality of supply and demand among various groups, thus deriving association layer subjects, such as association among suppliers, association among contractors, association among platform service providers and association among external experts. It's also associated with information and communication technologies represented by cloud, big data, IoT, AI, blockchain, etc., so as to achieve the data sharing and information interoperability, comprehensively promote the construction of platform ecology of engineering consulting enterprises. Finally, the associated layer subjects further expand the new associated secondary layer with the innovation of the whole process engineering consulting service mode, forming a sustainable platform ecology.

To sum up, the platform ecology of engineering consulting enterprises not only includes the platform operator (engineering consulting enterprises), bilateral or multilateral customer groups and their transaction relationships, but also includes the mutual influence and interaction among various elements. The platform operator needs to manage the internal and external associations of groups with different attributes and forms in a hierarchical and graded manner to ensure the effective operation of the digital intelligence platform.

### ***3.2.3 Platform ecological governance for engineering consulting enterprises***

The ecology of engineering consulting enterprise platform is characterized by openness, multiple participating subjects, dynamic change of environment, complex evolution of system, etc. The applicability of traditional unidimensional governance mode is reduced, and the collaborative governance of multiple subjects led by platform enterprise is needed[23]. In the context of the information age, the modern information technique represented by “Cloud, Big Data, AI, 5G, IoT, Blockchain” can be applied to the governance process, forming a new model with shared goals, participation of multiple actors, clear rights and responsibilities, and building a platform-based ecological

governance system of diversified competition and cooperation. At the same time, to make the platform multiple subjects play their proper role in the common governance, the systematic configuration of rights, responsibilities and benefits is needed. The structure of rights and responsibilities of each subject is the driving force and guarantee of the common governance. A reasonable structure of rights, responsibilities and benefits means that this structure can balance various incentive and constraint relationships in the common governance.

Platform enterprises lead the governance. In the common governance system of engineering consulting enterprise platform ecology, platform enterprises are the core players and play a leading role, leads bilateral or multilateral participating subjects and various participants of the subsystem to act in accordance with the law, takes the lead in implementing the concept of co-creation value[24], expresses the self-restraint mechanism of co-creation value clearly, plays a leading and demonstration role, improves the platform governance mechanism continuously, stimulates and restrains the governance activities of multilateral subjects. Platform enterprises can govern the ecological chaos of the platform through private supervision, such as deducting deposits, adjusting the price structure, strengthening the reputation mechanism and improving the payment mechanism[25]. Meanwhile, platform enterprises can comprehensively apply big data technology in the governance process, establish the cooperation architecture system of governance subjects through effective design, build a digital governance platform in line with the characteristics of their own enterprises, realize the digitalization of all links and the ubiquitous connection of all elements, so that the isolation between the participating subjects in the traditional governance mode is broken. And it accelerates the construction of governance system and completes the digital transformation of vertical governance subjects. Based on the digitalization of the vertical governance chain, the digital upgrade of other subjects such as business centers and branches is conducive to multi-level and multi-body collaborative governance, this results in a new pattern, new power and new ecology of the governance system.

Multilateral subjects collaborate to govern. Multilateral subjects mainly include suppliers, bidders, bid evaluators, contractors, platform service providers and other stakeholders, which can enhance their own governance roles within the rules of the platform. Multilateral subjects pursue profit maximization, so they have the right and responsibility to monitor the factors affecting the ecology of the platform and maintain the healthy development of the platform. Its governance can also be combined with information technology, so as to digitally upgrade itself to enter the digital governance process of the platform enterprise, jointly promote the construction of the ecosystem of the governance platform, expand the governance network through virtual operation, realize the development of the network “power” without boundaries[26], and generate efficient linkage effects.

In a diversified and digital platform ecological governance system led by platform enterprises, multilateral groups within the platform ecology can not only conduct transactions or other activities on common rules, but also contribute their respective strengths to create a common platform ecosystem; not only make transaction activities orderly, but also jointly create a platform ecosystem of continuous co-learning, co-creation of value and common governance.

#### **4 Practical examples: the practical experience of Glodon**

Founded in 1998, Glodon started with the DOS version of “Software Series in Project Cost”, established a foothold in the construction industry, and built an efficient research, operating, marketing and service system around the whole life cycle of engineering projects.

Its digital costing business has gradually matured to the forefront of the domestic digital costing field, including engineering costing, engineering calculation, engineering information, and e-government business lines.

In 2015, the construction industry is facing many problems, such as difficult management coordination, high procurement costs, shortage of funds, serious arrears, financing difficulties, high factor costs, etc. This has led to the increasingly prominent conflicts in the informationization of construction enterprises. In terms of software integration, most domestic enterprises have established scattered, single-point consideration of information systems based on the business itself, such as financial management systems, human resources systems, etc. It is difficult to provide a complete system to achieve interoperability between various businesses and levels. At the same time, with the increasing degree of digitization, not only software integration capabilities, but also the problem of hardware integration capabilities is becoming more serious.

Recognizing the problems faced by construction enterprises in informatization, Glodon was actively seeking opportunities with the massive customer and data resources it accumulated over the years. In 2015, it officially announced its comprehensive transformation into the “Internet Platform Service Provider of Construction Industry”, which takes professional applications in the field of construction engineering as the core foundation support and consider industrial big data, industrial credit and industrial finance as value-added services, so as to create a platform ecology and promote the modernisation of the construction industry.

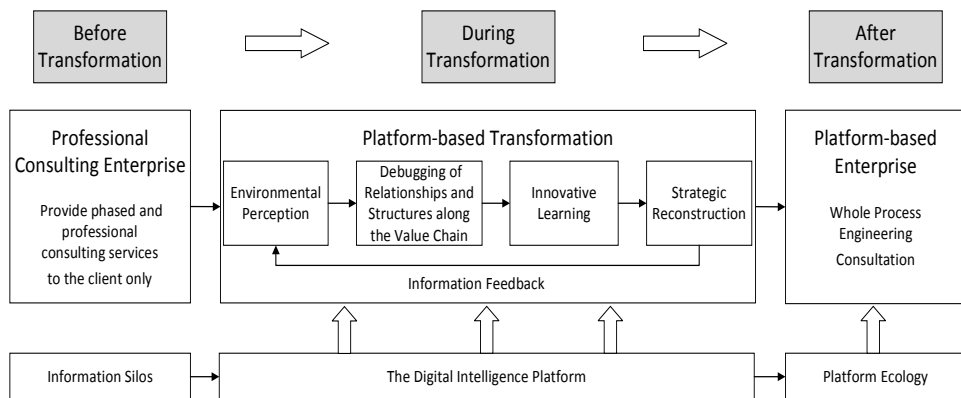
The transformation strategy of Glodon is expressed by “two aggregations, two enclosures and one construction”, which points to the market with great potential. The “two aggregations” is to gather the quantity and people. The aggregation of quantity means to aggregate the bulk purchase between buyers and suppliers so as to reduce the cost. “The aggregation of quantity” is the gathering of all participants involved in the construction site. “Two enclosures” is short for “the enclosure of lands” and “the enclosure of buildings”, meaning that Glodon will try to occupy the operation and maintenance market of construction sites and buildings. The “one construction” means building a BIM-based component library. Through the relationship embedding and structure embedding of the value chain, Glodon debugs the relationship and structure of the value chain, takes the initiative to acquire, accumulate and integrate the resources of the partners in the value chain, so as to realize the transformation strategy.

The simple absorption and internalization of the acquired resources is no longer sustainable, enterprises should create and utilize them further. Glodon serves the industry actively and integrates into the industry continuously. It uses BIM, Cloud, Big Data, AI, 5G, IoT, Blockchain, etc. to carry out innovative learning in the whole life cycle management of project production activities, such as design, production, procurement, construction, operation and maintenance. It also expands information technologies to all links upstream and downstream of the whole industrial value chain, which can cross the limits of space and time, improve the ability of resource acquisition and allocation, and create incremental value for customers and enterprises themselves.

For better connection with external resources, Glodon has built a digital intelligence platform to support its strategic reconstruction, achieving the transformation from a traditional engineering consulting enterprise to a platform-based enterprise. The “one construction” in the transformation strategy of Glodon refers to building a BIM-based component library to establish core advantages, obtain big data, and then carry out related credit services with engineering projects as the core. Glodon firmly grasps the key points of “design, schedule, measurement and collaboration” in engineering projects to build the enterprise platform ecology, and plays the role of platform in consulting services, solutions and ecological cooperation to integrate ecological resources. After years of practice and

accumulation, it has formed sustainable enterprise core competitiveness, including digital design capability represented by BIM deepening design, schedule control capability represented by network planning, engineering calculation capability represented by bidding calculation and construction calculation, and collaborative management capability represented by Project Intelligence and intelligent scheduling, becoming the leader of digital transformation in the industry.

In the process of enterprise transformation, Chinese local engineering consulting enterprises, represented by Glodon, can follow the path of “environment perception - relationship and structure debugging among the value chain - innovative learning - strategic reconstruction” based on the theory of dynamic embedding in the value chain. They can combine information technology with enterprise transformation. Through the integration of “construction gene” and “digital gene”, the integration of “construction ecology” and “digital ecology”, a new paradigm of “ecological win-win and integrated development” and a new industrial ecology of resource sharing, symbiotic development, multi-win can be established. They also need to accomplish the platformization of horizontal business, break through the whole process of value chain and support partners to ensure that they can carry out the whole process engineering consulting business on the platform. As a result, an ecosystem of mutual empowerment and integration in the construction industry is formed.



**Fig. 2.** The path diagram of platform-based transformation.

## 5 Conclusion

As a form of service that can adapt to the cross-stage, integrated and comprehensive needs of the client, whole-process engineering consulting has become an important development trend for high-quality development in the engineering consulting industry. To adapt to the development of whole-process engineering consulting, cope with complex environmental changes and explore new opportunities, this paper proposes a platform-based transformation path based on the dynamic embedding of the value chain. And the theoretical path of this paper is verified by Glodon's successful platform transformation. The transformation of enterprises in complex and dynamic environments is no longer a simple “static” mode of re-embedding in the value chain, but a continuous dynamic evolution process. To cope with the highly uncertain market environment and ensure the timeliness and long-term of enterprise transformation, traditional engineering consulting enterprises should firstly perceive the changes in the environment quickly and coordinate relationships with partners along the value chain actively. Secondly, they can take the initiative to integrate and utilize external resources through repositioning in the value chain. Next, they use information technology to learn innovatively from external and their own

resources. Finally the engineering consulting enterprises should reshape enterprise strategy and organizational structure by building a digital intelligence platform, which can form a symbiotic and mutualistic platform ecology of multilateral groups. This will break the limit of time and space, improve the ability of resource allocation, increase the management span and shorten the management radius. Meanwhile, the platform ecology should be jointly governed by multilateral groups, so as to implement the value co-creation of multiple subjects, the platform-based transformation of traditional engineering consulting enterprises and high-quality development of industry. It is hoped that this study can enrich the theoretical research on the platform-based transformation of traditional engineering consulting enterprises and maintain the sustainable development of engineering consulting industry.

## References

1. M. Porter, *Competitive advantage* (New York: Free Press, 1985).
2. X. Zhang. International Economics and Trade Research, **03**, 34-37(1997).
3. J. Wang, Journal of Zhejiang University (2006).
4. X. Wang, F. Hu, Science and Technology Management Research, **08**, 228-233(2013).
5. J. Yu, B. Sun, F. Hu, Fujian Tribune(The Humanities&Social Sciences Monthly), **09**, 97-107(2020).
6. W. Li, Modern Management Science, **04**, 54-56(2015) .
7. K. Rong, Y. Lin, Y. Shi, et al, International Journal of Technology Management, **01**, 62(2013).
8. T. R. Eisenmann, , G. Parker, and M. van Alstyne. Social Science Electronic Publishing, **10**, 84(2006).
9. E.G. Anderson, G.G. Parker, B. Tan, Social Science Electronic Publishing, **01**, 25(2014).
10. A. Gawer, M.A. Cusumano. Mit Sloan Management Review, **02**, 49(2008).
11. G. Jiang, Frontiers, **Z1**, 32-39(2021).
12. G. Ray, J.B. Barney, W.A. Muhanna, Strategic Management Journal, **01**, 25(2004).
13. C.K. Prahalad, G. Hamel, Strategic Management Journal, 15(1994).
14. R. Cao, Y. Cang, Academic Exchange, **04**, 115-126+192(2019).
15. D.J. Teece, Strategic Management Journal, **13**, 1319-1350(2007):.
16. M. Granovetter, American Journal of Sociology, **03**, 481-510(1985).
17. H. Zhong, X. Liu, Science & Technology Progress and Policy, **07**, 74-81(2018).
18. Y. Wang, H. Cai, Construction Economy, **07**, 31-34(2021).
19. R. Fan, Social Sciences in China, **12**, 131-152+202(2021).
20. Z. Wu, L. Yu, Informatization of China Construction, **06**, 32-35(2022).
21. A. Afuah, Strategic Management Journal, **03**, 257-273(2013).
22. P. Li, H. Hu. Science & Technology Progress and Policy, **10**, 1-5(2016).
23. Y. Zheng, Journal of Public Governance Research, **05**, 92-98(2021).
24. Q. Zhong, X. Yang, Z. Wu, System Engineering - Theory&Practice, **02**, 421-430(2021).
25. Y. Wang, H. Feng. The Economist, **11**, 73-80(2017).

26. H. Yang, P. Ning, *Social Science Journal*, **05**, 135-144(2021).