Characteristic Analysis and Strategy Research on Synergetic Development of Construction Enterprises of Different Scales

——Take Northwest China as an example

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Abstract. With the concept of "The Fourth Management Revolution" put forward, the platform ecosystem is regarded as one of the important trends in the future development of the construction industry. Large, medium and small construction enterprises in Northwest China have advantages and disadvantages in the platform ecosystem. According to the operating characteristics and situation of construction enterprises in this region, this paper uses SWTO analysis method and internal & external factor matrix method to put forward synergetic development strategies. Based on the platform ecosystem concept and NetLogo software, a dynamic simulation model is built by using Logo language programming to simulate and compare the strategies, then puts forward evaluation and suggestions. This paper can help large, medium and small construction enterprises in Northwest China to clarify their own positioning and development direction as soon as possible.

Keywords: Platform ecosystem; Construction enterprise management; Synergetic development; Value Co-Creation

1 Introduction

With the concept of "the Fourth Management Revolution" [1], the platform ecosystem [2] is regarded as one of the important trends in the development of the construction industry in the future. The platform ecosystem provides an open & shared space and win-win operation mode for the construction industry, forming an ecological industry circle. In the industry circle, middle and downstream enterprises are linked, and large, medium and small enterprises flexibly participate. It realizes the coordination and connection of the whole industrial chain of construction engineering from contracting, contracting to procurement, construction, operation and maintenance.

Large, medium and small construction enterprises in Northwest China have different advantages and disadvantages under the platform ecosystem. Combining with the local actual situation, this paper adopts the methods of theoretical analysis and model analysis, combined

MSIEID 2022, December 09-11, Chongqing, People's Republic of China

DOI 10.4108/eai.9-12-2022.2327588

with relevant data, to carry out qualitative and quantitative research on the coordinated development strategies of construction enterprises of various scales in Northwest China.

2 Qualitative analysis of synergetic development of construction enterprises

2.1 Qualitative analysis of large construction enterprises

Most of the construction parties or owners are state-owned holding construction and investment enterprises, and most of them contract out or undertake large-scale construction projects, municipal bridges, expressways and other urban construction projects necessary for urban development.

By investigating the development of the construction engineering industry in the past decade, it can be found that large-scale construction enterprises have obvious advantages in the industry, with good resource background, sound mechanism, abundant funds, and large social influence and high industry trust. The above advantages can ensure that large-scale construction enterprises have stable engineering sources and sustainable development projects, and the construction investors or owners are more comfortable to deliver the necessary engineering projects for urban construction to the enterprises.

However, the disadvantages of large-scale construction enterprises are also gradually emerging in the current development trend. The more obvious is that their debt ratio is generally high, and the average debt ratio has reached 85%. The reasons for this phenomenon are as follows: First, large-scale construction enterprises undertake a large number of engineering projects and relatively large amount of early-stage investment; Second, most of the large construction enterprises are EPC projects, so the construction period is long and the capital withdrawal is relatively slow; Third, there are relatively many grass-roots construction personnel in large-scale construction enterprises. As the project life cycle becomes longer, there may be a phenomenon about insufficient utilization of labor force, which will lead to an increase in internal consumption of the enterprise and affect the overall profitability of the project.

Therefore, although large-scale construction enterprises in Northwest China can undertake large-scale engineering construction projects and other municipal projects necessary for development, after the completion of the projects, the profits still cannot repay the principal and interest generated in the whole cycle of the project, resulting in the continuous increase of liabilities.

SWOT analysis of synergetic development of large construction enterprises in Northwest China, please see table 1:

Table 1. Summary of SWOT analysis on synergetic development of large construction enterprises in Northwest China

Strengths / Weaknesses Opportunities / Threats	Strengths: 1) Sufficient funds 2) Strong risk resistance 3) Good management ability	Weaknesses: 1) Complex organizational structure 2) Low execution efficiency 3) Large internal consumption of enterprises
Opportunities: 1) Platform opportunities 2) Market opportunities 3) Management opportunities	SO-Strategy: Build a platform ecosystem, form an efficient management and decision-making mechanism, use its own capital reserves, and timely adapt to market demand.	WO-Strategy: Relying on the platform, strive to streamline the organizational structure, reduce internal consumption, adapt to the market and improve mobility.
Threats: 1) Reduce employee recruitment 2) Improve execution efficiency	ST-Strategy: Maintain good management and decision-making methods, properly control the number of employees and improve execution.	WT-Strategy: Streamline the organizational structure, control the number of employees, reduce internal consumption, and improve the execution efficiency by relying on the platform.

2.2 Qualitative analysis of medium-sized construction enterprises

The medium-sized construction enterprises in Northwest China are private enterprises with certain funds and anti-risk capabilities. There are many types of engineering projects undertaken by private enterprises.

The development of medium-sized construction enterprises is in a period of rapid social development. The advantage of medium-sized construction enterprises is that their organizational structure is relatively simple, and they have certain flexibility and funds. Medium-sized construction enterprises occupy a relatively large number in the entire construction industry.

However, compared with large-scale construction enterprises, medium-sized construction enterprises still lack economic strength, social influence and industry trust, which leads to their lack of core competitiveness, and some large-scale engineering projects cannot be undertaken independently. The medium-sized construction enterprises are limited by their economic strength and relatively low risk resistance ability, and the project period they undertake independently is relatively short, so they cannot undertake long-term construction projects. Such industry positioning makes medium-sized construction enterprises have to continue to accumulate funds, direct experience and industry reputation in small and medium-sized engineering projects to seek follow-up development. At present, there are several or even dozens of medium-sized construction enterprises under most large construction enterprises to share the construction pressure.

SWOT analysis of synergetic development of medium-sized construction enterprises in Northwest China, please see Table 2:

Table 2. Summary of SWOT analysis on synergetic development of medium-sized construction enterprises in Northwest China

Strengths / Weaknesses Opportunities / Threats	Strengths: 1) Relatively small scale 2) More efficient decision making	Weaknesses: 1) Insufficient funds 2) Weak risk resistance
Opportunities: 1) Platform opportunities 2) Market opportunities 3) Cost opportunity	SO-Strategy: Rely on efficient decision-making mechanism, timely adapt to market demand and make good use of cost opportunities.	WO-Strategy: Rely on the platform to improve the anti risk ability, strive for financial support and further develop the market.
Threats: 1) Managing risk 2) Expansion risk	ST-Strategy: Adhere to scientific and democratic management and decision-making, formulate reasonable development objectives and control development risks.	WT-Strategy: Relying on the financial support of the platform, we will improve our ability to resist risks, optimize the management system, and reduce the difficulties in expansion.

2.3 Qualitative analysis of small construction enterprises

Most of the small construction enterprises in Northwest China are privately-owned labor dispatch companies, which undertake projects based on physical labor or simple technical operations. In the construction industry in Northwest China, small construction enterprises are in the most basic position.

The members of small-scale construction enterprises are mainly migrant workers and skilled workers, and the organizational structure is relatively simple. Compared with medium-sized and large-sized enterprises, they have better mobility, more direct experience and more flexible and skilled performance in construction. In recent years, with the continuous innovation of construction technology, the construction equipment has become more advanced. In order to adapt to the development of the industry, the education level of the company members has been gradually improved, and the technology has also been gradually enhanced.

However, compared with medium and large construction enterprises, small construction enterprises lack funds and have no ability to resist risks, so they cannot undertake any engineering projects independently. Due to the simple and temporary organizational structure of small construction enterprises, the social trust is reduced, and they can only complete some basic construction projects under medium-sized enterprises.

SWOT analysis of synergetic development of small construction enterprises in Northwest China, please see Table 3.

Table 3. Summary of SWOT analysis on synergetic development of small construction enterprises in Northwest China

Strengths / Weaknesses Opportunities / Threats	Strengths: 1) Small scale 2) Strong mobility 3) Well-experienced	Weaknesses: 1) Shortage of funds 2) Poor risk resistance 3) Low industry trust
Opportunities: 1) Platform opportunities 2) Market opportunities 3) Cost opportunity	SO-Strategy: Relying on the overall management mechanism of the platform ecosystem, it can timely adapt to the market demand and give play to its advantages such as strong mobility and rich experience.	WO-Strategy: Strive for platform support, improve anti risk ability and industry trust, seize market opportunities and improve professional level.
Threats: 1) Industry fluctuation risk 2) Professional construction transformation	ST-Strategy: Rely on the platform to give play to the advantages of strong mobility, respond to industry fluctuations, formulate reasonable transformation objectives, and control transformation risks.	WT-Strategy: Set reasonable goals, steadily promote transformation, constantly replenish professionals, and improve the trust of the industry.

3 Quantitative analysis of synergetic development of construction enterprises

The method of quantitative processing is used to evaluate the coordinated development of enterprises of various scales in the northwest region, and the NetLogo software is used to carry out dynamic simulation and data comparison of the coordinated development to verify the rationality of the theory.

3.1 Theoretical analysis

Ten experts in the northwest construction industry used the Delphi method to obtain the weights of each dimension factor of SWOT. Strengths and Opportunities are scored on a scale of 1 to 5, and Weaknesses and Threats are scored on a scale of -5 to -1. See Table 4.

Table 4. Evaluation matrix results of internal and external factors of synergetic development of enterprises of all scales under the platform ecosystem

Matrix type	SWOT dimension	Specific factors	Weighting parametes	initial score	Composite Score
Internal factor	Strengths dimension	Enterprise scale	0.347	3.8	1.319
		Management ability	0.383	4.1	1.570

matrix		Strength score	-	-	2.889
	Weaknesses dimension	Capital cost	0.143	-3.6	-0.515
		Risk resistance	0.127	-4.2	-0.533
		Weaknesses score	-	-	-1.048
	Total score of internal factors		-	-	1.841
External factor matrix	Opportunities dimension	Platform opportunities	0.261	4.3	1.122
		Market opportunities	0.241	4.1	0.988
		Cost opportunity	0.265	4.4	1.166
		Opportunity score	-	-	3.276
	Threats dimension	Development risk	0.100	-3.5	-0.350
		Transformation risk	0.132	-3.1	-0.409
		Threats score	-	-	-0.759
	Total score of external factors		-	-	2.517

The results show that construction enterprises of various scales in Northwest China should give full play to their own advantages to promote large-scale development. Small and medium-sized enterprises should avoid their own disadvantages and cooperate with each other to create value. Ultimately achieve the fundamental goal of healthy development of the construction industry structure in the northwest region.

3.2 Computer data model analysis

Netlogo is a programmable modeling environment used to simulate natural and social phenomena. In netlogo software, Logo language is mainly used as the programming language, with "turtles" as the object to represent construction enterprises of various scales. With reference to the above summary of the characteristics of various construction enterprises, we define "turtles" and endow them with relevant unique attributes to simulate the scale and operating characteristics of various enterprises. Through the "ask" command statement, different defined "turtles" can be operated. Through the "ask" command and referring to the market situation of the construction industry, the movement law is defined to simulate the profit and development of the enterprise, as well as the quantities and bidding rules in the market. At the same time, the unique operation of each "turtles" under the "ask" command statement reflects the competition and cooperation between enterprises.

Netlogo is used to establish the survival dynamic model of various scale enterprises under the environment of construction industry in Northwest China, As shown in Figure 1 and Figure 2.

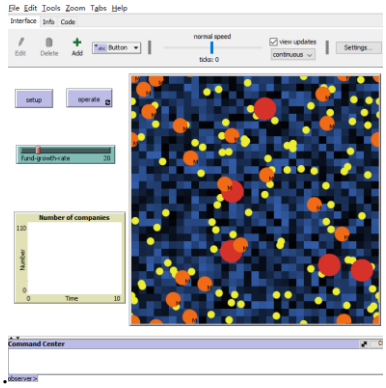

Fig. 1. Survival dynamic model interface of enterprises of various scales

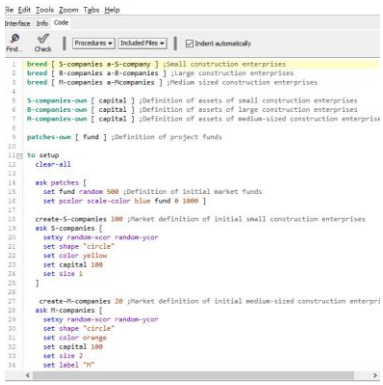

Fig. 2. Survival dynamic model code of enterprises of various scales

Through running the dynamic model of competition, it is found that according to the current development situation, the small construction enterprises in Northwest China will disappear the fastest. One part of them developed into medium-sized construction enterprises in the early stage, and the other part directly closed down due to competition failure. After the rapid increase of medium-sized construction enterprises in the early stage, they gradually disappear from large-scale competitive enterprises. From the trend chart, it can be seen that most of the medium-sized construction enterprises increased in the early stage were developed by small construction enterprises, and in the later stage, they failed because they could not compete with large construction enterprises. Although large-scale construction enterprises have developed to the end, their large-scale operations have led to a sharp increase in their asset liability ratio. As shown in Figure 3 to Figure 6.

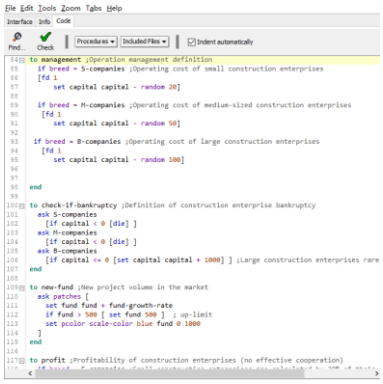

Fig. 3. Competitive dynamic model operation code

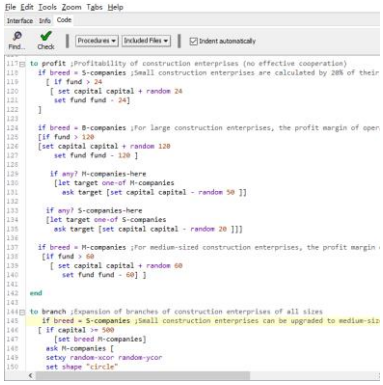

Fig. 4. Competitive dynamic model profit code

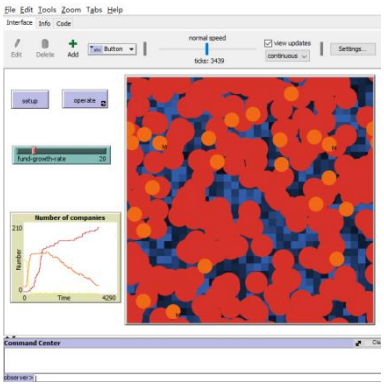

Fig. 5. Competition dynamic model interface

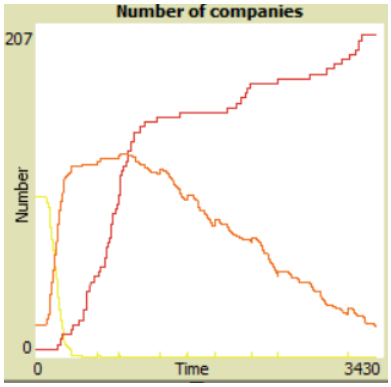

Fig. 6. Data trend of competitive dynamic model

Through the operation cooperation dynamic model, it is found that the large, medium and small construction enterprises in Northwest China form a linkage. The large construction enterprises provide energy for the platform by contracting projects, the medium-sized construction enterprises provide professional subcontracting management, and the small construction enterprises provide labor services for professional construction. Finally, an effective cooperative relationship is reached, and the market of the construction industry in Northwest China enters a stable development stage. It can be seen from the trend chart that the retention time of construction enterprises of all sizes has exceeded the competitive model, and their retention is also gradually increasing, forming a stable situation of synergetic cooperation cooperation. As shown in Figure 7 to Figure 10.

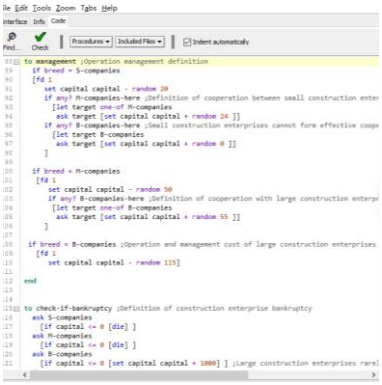

Fig. 7. Cooperation dynamic model operation code

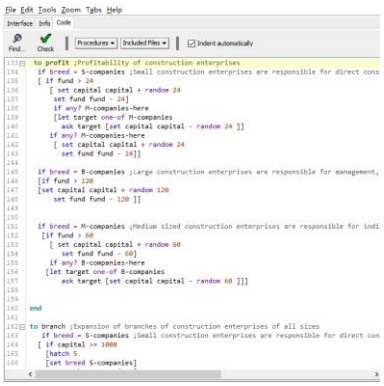

Fig. 8. Cooperation dynamic model profit code

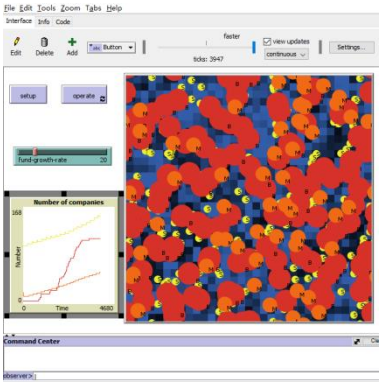

Fig. 9. Cooperation dynamic model interface

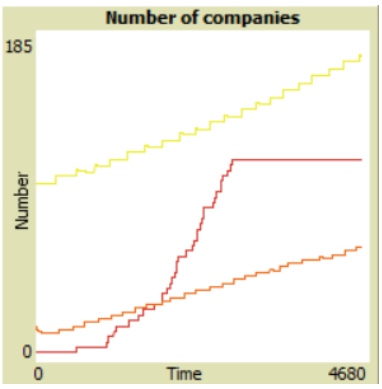

Fig. 10. Data trend of cooperative dynamic model

4 Strategy and evaluation of coordinated development of construction enterprises in Northwest China

4.1 Enterprise benefits

Collaborative development among enterprises is one of the fundamental purposes for the establishment of the platform ecosystem. The development of enterprises in the industry is not single, but the common development of different types of enterprises. Only when the enterprise is improved and developed as a whole can the industry develop steadily.

In the platform ecology, small and medium-sized construction enterprises need to complete the transformation of the specialized construction model and the comprehensive service-oriented construction model. It needs to rely on the platform built by large construction enterprises in the platform ecosystem to achieve development. Large construction enterprises are reducing the organizational structure of their grass-roots construction and retaining the management mechanism to reduce internal consumption and management difficulty. The general contracting of engineering projects has become the most important task of large-scale construction enterprises, and is also an important way to provide nutrients for the platform ecosystem. Large construction enterprises can take advantage of their abundant funds, sound mechanisms, good social influence and industry trust to complete the general contracting of engineering projects and contract out the engineering projects according to types. The professional construction mode and good construction service after contracting will greatly enhance the value of small and medium-sized construction enterprises in the platform ecosystem, and also improve the core competitiveness of enterprises in the industry, so as to obtain the survival status and development of enterprises.

4.2 Economic performance

Today, the zero-sum game has been gradually replaced by the concept of mutual benefit and win-win. The platform ecosystem is to help each enterprise develop stably in the market by establishing an ecological chain, improve economic benefits, and avoid malicious market competition and disrupt the market order.

Large-scale construction enterprises are constantly transforming in the platform ecosystem and optimizing their internal structures. Therefore, the expenses of the construction personnel at the grass-roots level are reduced, and the slack work situation is avoided. In the platform ecosystem, small and medium-sized construction enterprises obtain the cooperation opportunities and industry recognition of large-scale construction enterprises through completing the transformation and establishing the later development mode, and through professional construction technology and comprehensive service mechanism. After the transformation, small and medium-sized construction enterprises can not only seek economic benefits for themselves, but also solve the problems of grassroots construction for large-scale construction enterprises, so as to achieve the goals of resource sharing, risk sharing, mutual benefit and win-win between large, medium and small-sized construction enterprises.

4.3 Social results

In the construction industry market, all participants have the ability to create value. Only when small and medium-sized enterprises and large enterprises cooperate with each other can they jointly create and share value.

It can be seen that the strategic cooperation of large, medium and small construction enterprises in Northwest China has good value co creation in the construction of the platform ecosystem. The transformation of specialized construction mode and comprehensive service mode is the value creation ability that small and medium-sized construction enterprises can hardly copy. In addition, small and medium-sized construction enterprises can still establish a stable cooperative relationship with large construction enterprises through the platform ecosystem. Such a cooperative relationship can make up for the shortcomings of small and medium-sized construction enterprises, improve the production efficiency of the entire construction industry platform ecosystem, and achieve the fundamental purpose of value creation and value sharing.

5 Conclusion

The contributions of this paper are mainly in the following three aspects: (1) through the analysis of the advantages and disadvantages of large, medium and small construction enterprises in the industry system in Northwest China, the development direction of large, medium and small construction enterprises towards platform construction, professional construction and comprehensive service construction mode is established. (2) Through the establishment of relevant models, the development of large, medium and small construction enterprises under the construction industry platform ecosystem in Northwest China is dynamically simulated and analyzed, and the relevant theories formed are corroborated. (3) It evaluates the collaborative development mode of large, medium and small construction enterprises in Northwest China and puts forward relevant development strategies, and further defines the impact of the platform ecosystem on the construction industry in Northwest China, as well as its contribution to the enterprise benefits, economic benefits and social benefits of large, medium and small construction enterprises.

References

[1] Cao Yangfeng. The strategy of the transformation of the fourth management revolution [J]. Enterprise Management, 2019(09):15-23.(Chinese)

[2] Liu Jiaming, Liu Fagen. Platform Innovation: Concept, Mechanism and Challenge Response [J]. China Circulation Economy,2019,33(10):51-58.(Chinese)

[3] Zhang Xiaoling, Pu Yunyu, Ge Hufei. Cooperation and Innovation: A Study on the Relationship between typical characteristics of SME business models and their performance[J]. Science and Technology Management Research,2017,37(17):233-238.(Chinese)

[4] Liu Renhui, Han Xishuang. Competitive Ecosystem of Construction Enterprises Based on Predation Model [J].Journal of Harbin Institute of Technology,2008,40(12):2016-2019. (Chinese)

[5] Qin Xia, He Jianmin. Research on the Organizational Model of Ecological Construction Enterprises Based on Organizational Learning [J]. Building Economics,2005(12):17-19. (Chinese)

[6] GAO Jianrong. Application analysis of business ecosystem in the formulation of competitive strategies of Chinese enterprises[J].Economic Issues,2007(11):58-59.(Chinese)

[7] WANG Wei. Research on the Dynamic and Coordinated Development of Technological Innovation and Management Innovation of Small and Medium-sized Enterprises[J]. Business Times, 2012(22): 85-86.(Chinese)

[8] Wang Maoxiang, Zhang Ruili, Abdulwase Rasheed, Yan Shuangsheng, Muhammad Mohsin. The Construction of Ecosystem and Collaboration Platform for Enterprise Open Innovation [J]. Frontiers in Psychology,2022,13.

[9] Uzunca Bilgehan, Sharapov Dmitry, Tee Richard. Governance rigidity, industry evolution, and value capture in platform ecosystems[J]. Research Policy,2022,51(7).