

Evolution of Innovation Network Governance Mode from Analysis of University Spin-Off Companies' Growth: a Case Study of Neusoft Group

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Abstract: This paper optimized the transaction cost-embeddedness approach, and applied it to the growth of university spin-off companies. The growth process of Neusoft Group is discussed in details, and the corresponding network governance mode of every growth stage is analyzed as following: at the venture stage, the businesses have limited strength, and need to be embedded to the university's network for resources; at the growing stage where they are growing, and already have some resources, the businesses are still in need of investment and technical support from universities, and then a semi-embedded network governance mode is employed; at the grown stage, the businesses have become almost completely independent, and they own and control the strategic network resources which support their edge-leading services, so that the union governance mode is applied. The conclusions can be drawn from the growth process of university spin-off companies that the evolution of innovation network governance has obvious regularity.

Key words: University spin-off companies; Innovation network; Governance mode; Evolution

1 Introduction

University spin-off companies (USO) are companies setting up to transit knowledge, technology and other research fruits created by universities to commercialization. Commercialization can strengthen the relationship between knowledge innovation system and technology innovation system, accelerate the speed of regional knowledge communication, and finally promote the regional economic development. It is particularly proved by the accomplishments achieved by Silicon Valley, Route 128 and other new economic areas like Zhong Guan Cun.

What determines the success of a university spin-off company and its impact on economic development? It is believed to have close relationship with the atmosphere including administrative hierarchy, market as well as network. In 1980s, universities run spin-off companies in a hierarchy way, interfering the operation directly. The apparently difference notion between university and companies business, say, university has no knowledge of a specific market and no mature business experience, usually result in bankruptcy of university spin-off companies. In addition, university will bear higher risks if a university establishes companies directly. If a newly-established company access resource for growth in the market directly, it will be difficult for them to survive because of poor social reasonableness, uncertainty as well as huge transaction cost. In light of this, the proper habitat for a university spin-off company should be network rather than hierarchy system, including entrepreneurs' social network and the innovation network created by mother-university. As a network in the organizational level, the later one is supposed to have stronger influence and should get more attention. The innovation network evolves dynamically and this special characteristic leads to the growth of enterprise. Utilizing reasonable theory framework and an empirical case study of Neusoft Group, this paper uncovers the inner evolution mechanism of innovation network governance in a university spin-off company growth perspective.

Research interest relative to university spin-off companies are mainly focused on the growth process, resource support from the mother-university innovation and business network evolution. Ndonzuau divided the development of global university spin-off companies into four periods, including producing business notion from research fruits, determining new risk projects, establishing new university spin-off companies and finally producing economic benefits from university spin-off companies^[1]. Ajay divided the evolution into 5 separate parts, they are research period seeking for business opportunity, company- sprout period, enterprise growth period and stable development period, and he highlighted the "critical junctures" transition between different periods^[2].

Steffensen found what help the mother-university can offer is an important factor determining the success of the new company^[3]. Ajoy delivered that most of the capital of university Spin-off Company is supported by mother university or venture investment in the beginning. Usually, the new university

spin-off companies are short of accumulated credit and business experience. They are placed at a disadvantage position while conducting business with potential business partner and investment companies^[2]. Keasey and Waston’s research shows that mother-university, taking advantage of its social reputation and social identity, can help deliver this problem by providing certain credit guarantee^[4].

Butler and Hansen identified the three phases of business network evolution: in the establishment phase, business network is a kind of social network, aiming at providing more resource for entrepreneurs and identifying opportunities widely; in the start phase, business network focus on business development, aiming at business survival and creating value; in the growth phase, the objective shift to a long-term strategic planning level^[5]. Hire proposed three clues of business network evolution: transition from embedded relationship to contractual relationship, transition from strong ties utility to structural holes, shift to effective managerial mode from path dependency^[6].

In summary, scholars abroad paid attention to exploration in different branch and get independent perspective. Few researches can integrate these areas to elaborate the how to allocate resources in network governance mode, explain the relationship between network evolution and university spin-off companies’ growth.

2 Theoretical Framework

2.1 Network in Williamson’s eyes

Because of fraud and uncertainty, it is difficult to make agreement in advance. There is transaction cost in the market. Even in private property rights system, the allocation of resources can not entirely rely on market. Due to the high market transaction cost, the manufacturer replaces the market to guide the use of resources.

Williamson applied the concept of transaction costs in the organization study. He emphasized that the size of transaction costs determines the organization’s transaction selection-----whether transaction within the organization or in the market. The transaction cost is determined its nature. Different nature also leads to different contract specifications. The nature of transaction can be analyzed from three dimensions -----asset specificity, transaction frequency, environment and behavioral risk.

On this basis, Williamson summarized the different forms of contractual specifications corresponding to different types of transaction costs: low specificity, corresponding to classical contract; exclusive high specificity, corresponding to relational contracts; medium specificity and low frequency, corresponding to the new classical contract; medium specificity and high frequency, corresponding to relational contract.

Further he pointed out that there is appropriate governance structure to different contract form. The so-called governance structure, in fact, is the system configuration to ensure the completion of the transaction, and curb speculation. Transaction cost theory thinks that the classical contract with low specificity and the relational contract with high specificity are respectively applied to market governance and hierarchical governance; the relational contract with medium specificity needs to take both sides of governance, i.e. a mixture of market and hierarchical governance, or the intermediate structure of the two governances, which is the so-called "network" in the transaction cost theory. Thereafter he received an explanation model. The explanatory variables are the three dimensions of the nature of the transaction. They produce the uncertainty of the transaction. The explained variable is a spectral distribution of a governance structure, the market and hierarchy are both ends, and the middle form is the network (shown in Figure 1).

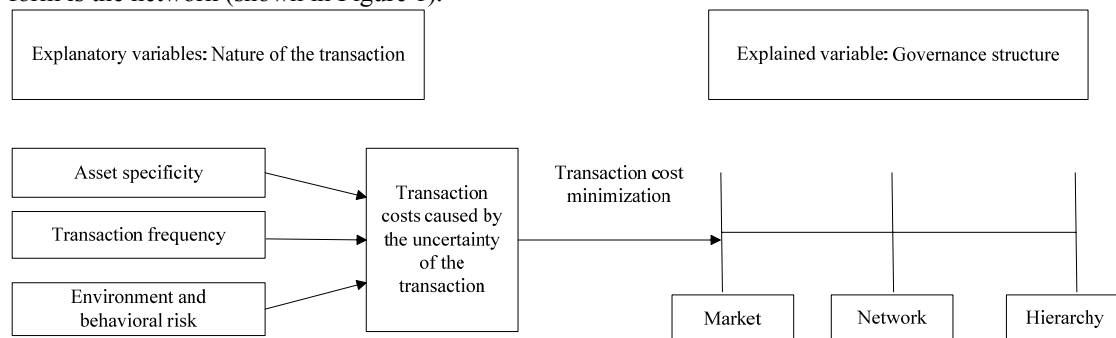


Figure 1 The Transaction Cost Theory to Explain Network

2.2 Embeddedness theory' modification to transaction cost theory

Granovetter thought that Williamson’s model miss an important explanatory variable that is trust. In "Economic action and social structure: The problem of embeddedness", he proposed two argument: first, trust is one of the factors that determine transaction costs; In some cases, trust can replace institution, resulting in transaction cost reduction; so trust is an important variable governance structure choice. Second, trust is necessary to transaction, without minimum trust, there is no business transaction^[7]. This "embeddedness theory" indicates that business behaviors are embedded in social network, due to that social link comprising trust can help cut transaction cost. In this case, network is a governance structure supported by trust ties rather than a link between market and hierarchy. Williamson’s theory has obvious defect, putting too much emphasis on the effect of market law and hierarchy right and viewing transaction entity as low social actors.

2.3 The transaction cost-embeddedness approach

Synthesizing transaction cost theory and the viewpoint of embeddedness theory, combining them with the high-tech outsourcing trading network, Luo Jiade proposed transaction costs-embeddedness approach^[8]. This approach considers the relationship between two transaction sides, such as trust ties and other relationship, then explores transaction uncertainty in the existed relationship, and finally set up a common governance structure including relationship and proper institution. Compared with Williamson’s model, trust relationship is added as an independent variable; among all the dependent variables, network is a governance structure mainly based on trust rather than combination of market and hierarchy (see Figure 2).

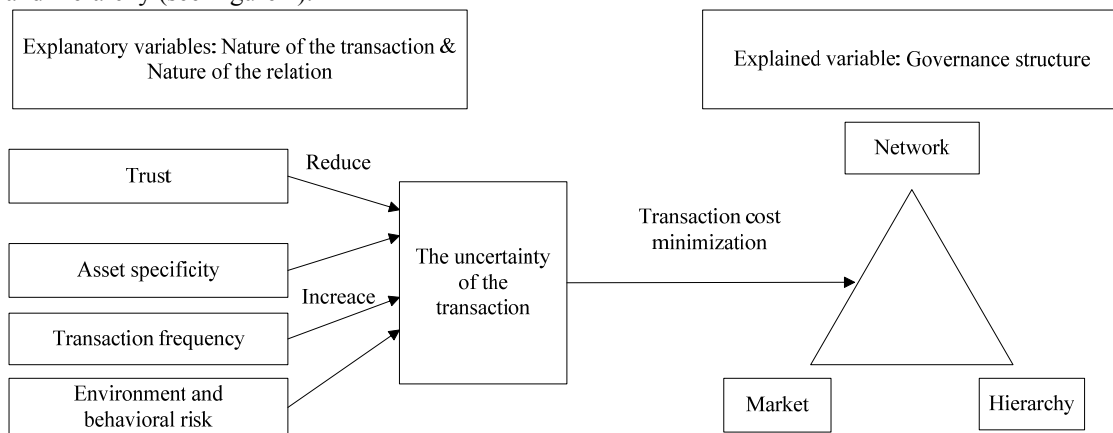


Figure 2 The Transaction Cost-Embeddedness Approach to Explain Network

2.4 Optimization of the transaction cost-embeddedness approach

The transaction costs-embeddedness approach provides a scientific theory to research relative to university spin-off company. Some modification to this approach has to be conducted before it is applied to this research. That’s because the object Luo Jiade studied is high-tech outsourcing network, that is a "whole network", but the growth network of university spin-off companies is a network based on individuals, that is "individual centre network". The former network relies on bilateral and multiple governance, trust is the only explanatory variable to relationship; while the later network strengthen individual’s control and management to network, explanatory variables include trust as well as other variables.

The network position of individuals has important influence on the capability of accessing to network resources, the closer to the centre, the more structural holes are controlled, the more proper the strong-weak ties are, the more transaction cost can be cut down. Additionally, the common cognition reached through long-term collaboration and strategic goal between individuals and other network nodes help to reduce transaction cost. Therefore, variables belonging to the relationship set extend to structure, trust and cognition. Social capital belonging to individuals can reduce the uncertainty caused by transaction nature. Social capital and this uncertainty determine the network governance mode finally.

With the growth of university spin-off companies, the expansion of the three dimensions of social capital leads to sustainable growth of social capital. Meanwhile, the core of the transaction between university spin-off company and other network nodes is conducted based on technology developed. Tacit knowledge and information are transformed explicit gradually in the evolution of technology and product. In this regard, uncertainty caused by transaction nature will gradually decrease. The interaction between these two reasons brings consecutively change to innovation network governance (Figure 3).

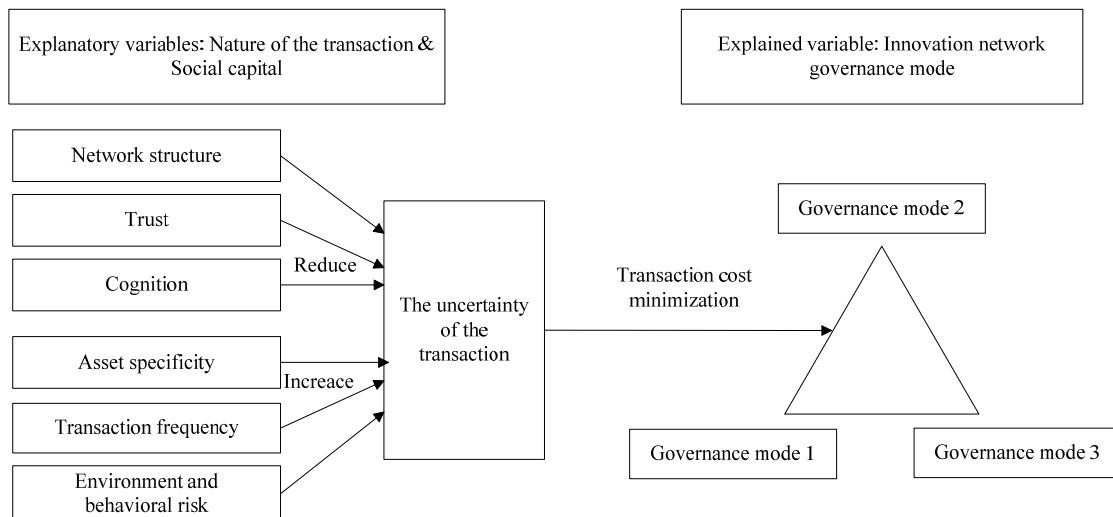


Figure 3 The Transaction Cost-Embeddedness Approach to Explain USO Network Governance Mode

3 Data and Methodology

3.1 Methodology

Case study has been an important research method since management theory was established. This paper choose Northeast university and its spin-off company Neusoft as cases, and analyze the variety of social capital, transaction nature and network governance mode through deep exploration of Neusoft development.

Neusoft was established at Northeast University in China in 1991. Currently, Neusoft has developed into a large technology group with various subsidiaries and more than 18,000 employees around the world. Neusoft set software as its core business, offering business like industry solutions, product engineering solutions, medical equipment and soft ware development, IT education and consultation service. Neusoft known as the " Top 10 IT service provider". The chairman and CEO of Neusoft, Mr. Liu Jiren was elected as "Chinese economic person of the year 2009" and "China's 25 most influential business leaders". Northeast University and Neusoft are chosen due to the following reasons: (1) Neusoft has been established for more than 20 years, the development track is relatively clear, which is favorable for experience summarization and theory generalizations; (2) Neusoft is a most typical Chinese high-tech enterprise, both the business size and output value takes leading position among science and technology enterprise attached to Chinese universities; (3) Neusoft has kept close relationship to Northeast University from generation till today, sustainable cooperation, exchange or even alliance makes Northeast University and Neusoft a sound progress model for "university-industry".

Research data are collected from two channels: First, collecting data relative to Northeast University and Neusoft from internet, journals, newspapers and other media, knowing the policy and relative documents of Northeast University and the history, annual report and strategic plan of Neusoft; Second, interviewing staff from Northeast University and Neusoft face to face. Staffs from different division and administrative level are interviewed, including the runner of Neusoft, member of the business set-up, research development staff, managers from the university, staff from the group, retired professors. A specific plan was drawn before the interview is conducted, the interviews are recorded and were analyzed after the interview. Various data resource, direct and real-time interview guarantees the objectivity of the research.

3.2 Analysis and findings

3.2.1 Venture stage

(1) explanatory variables

When Neusoft was set up, the newly-born baby had little social capital and lied on the edge of the network; because of low status in social reasonableness, trust to Neusoft mainly came from personally trust to its boss; uncertainty of the enterprise development resulted in disagreement between partners in cognition dimension.

As technology was still under transition, product positioning and the relationship between upstream and downstream industry chain was not clear, the traction nature caused significant uncertainty and

would increase the transaction cost. Little social capital in Neusoft could not cut down transaction cost effectively. Under these circumstances, Neusoft had to embed Northeast University's network, relying on her mother node and getting resources from the network.

(2) explained variables

Firstly, Northeast University offered regulatory and material support. At the venture stage when it needed to improve its working environment, the leaders of the university granted half a floor of school building to Neusoft. Later, when the software center was established and when a joint venture with the Japanese Alpine was set up, the university also provided tremendous supports. 1992 Neusoft was about to set up a modern apartment with duplex structure to keep talents. When Neusoft applied to the school leaders for this project, it was approved and the standards of the apartment could be decided by Neusoft. At that time, many had negative attitude to the businesses run by universities, thinking that businesses run by professors are shameful things, and they do not attend to their proper duties. However, a vice-president wrote an essay titled "Construct the special zone of Neusoft, and develop the industries of Northeast University", which explained the goals of businesses operated by the school, and the meanings of Neusoft, and the relationship between Neusoft and the university. This answered many doubts of the faculties, and supported Neusoft politically.

Secondly, Northeast University supported the development of enterprises by their influence. During Start-up period in Neusoft, the shortage of talent to become a major impediment to development issues, and then Shenyang as a heavy industry base, it was difficult to attract the software elite, So Liu Jiren proposed to select the talent at school, created "Software to enhance classes", and cultivated talent by themselves. This practice was not in line with the relevant provisions, so the school negotiated with the Ministry of Metallurgy and got permission. "Software to enhance classes" held two stages in all, the graduates now have become the backbone of Neusoft. The practice of "Software to enhance class" was flexibility in the school management. It not only resolved bottleneck of Neusoft talent, but also reinforced the potential for further development, also known as the earliest talent customized training mode in China's industry. At Northeast University in that time except Liu Jiren was doing software development, there were some other organizations also doing, such as the management control center at Northeast University, led by the Lu Zhaoxia, it focused on the systems integration projects such as CIMS project, office automation, information management systems and so on. School leaders quite emphasized Lu Zhaoxia's courage and ability, persuaded her and ultimately led to Lu Zhaoxia team to join Neusoft. Lu Zhaoxia joining the enterprise, not only expanded the Neusoft R&D team and Mrs. Lu's marketing talent had played a significant role on the market development of Neusoft. In addition, the institutions about computer engineering and digital medical imaging equipment research recorded by Zheng Quanlu was also becoming a member of Neusoft, as a result of driving by the school and have become a key strength entering the medical field.

3.2.2 Growing stage

(1) explanatory variables

During business growing stage, the explanatory variables in social capital has changed: Structure transfers from the edge of the network into a control structure holes and move close to the centre of the network; Neusoft stepped into the chain and controlling the high-end part, resulting in trust derived from power relationships (such as collateral, position of the industrial structure, mutually grasping long-term interests), then the trust dimension expanded; after a long-term cooperation with other network nodes, tacit understanding was induced, and then common cognition and awareness was reached.

As technology and products were becoming mature gradually, the uncertainty generated by transaction decreased gradually, transaction cost was cut down consequently. Expansion of social capital in this period enabled them to reduce transaction costs further. Combining these two points, company started with certain autonomy and had the ability to build their own networks.

Comparing to the venture stage, the impact of university was reduced in this stage. However, the role that university plays was still irreplaceable due to its help to attract strategic investment to support business expansion and its continuous support to technological innovation.

(2) Explained variables

At the growth stage, business has to accomplish the dual mandate known as "Volume expansion" and "quality breakthrough". Volume expansion means business scope expansion; quality breakthrough aims at winning a huge market space through technological innovation and controlling of industrial technology chain.

During 1995-2002, Neusoft had grown rapidly. The most important expansion event was "Digital Enclosure". Through this campaign, Neusoft's turnover and market share had gained rapid growth.

However, due to excessive expansion trend and the rapid expansion of institutions and personnel, a serious shortage of enterprise funds resulted in a substantial increase in costs and expenses, then the strategic investment was needed. At that critical time, the leaders of Northeast University played an important role, they helped Neusoft made alliance with Baoshan Iron and Steel. Baoshan Iron and Steel invested 2.4 billion Yuan RMB, each part held 50% Share. The alliance with Baoshan Iron and steel , going public in 1996 and overall listing in 2008 are known as the "listed twice, once strategic restructuring", which is a milestone in the history of Neusoft and facilitated Neusoft development profoundly.

After establishing a joint venture with Alpine, Neusoft's main business was making software OEM for Japanese customers. Although they got a lot of money, but the company didn't develop as expected. Moreover, from a global perspective, Single software development can only take leading position for 8 months referring to its technology. So, it is necessary to combine software development and engineering design in order from low to high, and maintain business leadership by controlling the chain of industrial technology. After enter the growth stage, Neusoft have been looking for such opportunities from beginning. At this point, great leaders of Northeast University came forward again. They helped Neusoft not only took over the CT machine project and achieved the industrialization less than a year. CT is the product which helps Neusoft to achieve a combination of software development with design and engineering, to grasp the core technology firstly (The software part of the CT value constitutes its major part). So, Neusoft achieved a qualitative breakthrough by CT technology innovation project.

3.2.3 Grown stage

(1) Explanatory variables

After pioneering the venture stage and growing stage, corporate social capital variables has changed again: in the network structure, firm has been living in the center and played the role of network managers; organizer and manager of union enabled firm to further increase the visibility and credibility; Consistency of approach between the interests of members, made the allies to trust each other deeply; Consistent with the strategic objectives, played a role in cognition between members of the union, thus firms achieved strategic cognition. Increasing social capital, and technology leadership made transaction uncertainty lower and lower, the firm was no longer attached to the university, fully grown an organization which master a certain advantage resources and the ability of network management. Firm which took coalition governance mode for network, became the Strategic allies of university.

(2) Explained variables

After start-up period and growth period, Neusoft has become the largest software companies in china, getting the same position as GE and Anke in the market of Chinese medicine equipment. How to maintain the technological advantage is an important strategic task of Neusoft.

The main point, how does firm maintain the technological advantage, is cooperate with universities from the source. Neusoft Institute of Information technology, which is founded by the cooperation of Neusoft and Northeast University, is a pioneering and model of industry-university technology strategy collaboration. Neusoft Institute has two main functions: first is the breakthrough of technology in the field of Digital medical equipment and network security, ability to solve key technical and continuous product development services; second is training.

We can see the advantages and rationality of this organization from following field: first, Neusoft Institute of Information technology is a hub link of university-industry cooperation. Neusoft Institute of Information technology is not only a department of Neusoft, and also are Affiliates of Northeast University. This advantage effectively reduces the obstacles to university-industry interaction. Second, Neusoft Institute of Information technology has a reasonable income distribution mechanism, Neusoft investment and University input the labor, Neusoft has the right to use patent, university get ownership of the research papers and books copyright. Third, healthy protect System and mechanism. It is different between and the general vertical structure and product line of Enterprise Institute, Neusoft Institute of Information technology not responsible for the vertical division, its management mechanism is relatively independent, as a cost unit. Despite Neusoft Institute of Information technology focus on solving the actual problem, but 60 percent of the work focused on forward-looking R&D and breakthrough. Fourth, strength sufficient funding. Neusoft Institute of Information technology has more than 30 doctoral tutors and master tutors and 50 million RMB annual research funding. So they can work with the world's leading research institutions and researchers for high-level cooperation.

4 Results

From the discussion above, social capital and transaction nature are chosen as explanatory indicators, network governance model is regarded as explained indicators, the evolution of these two indicators category are summarized as follows (see Table 1):

Table 1 Network Governance Model for USO Growth Process

Stage	Explanatory Variables				Explained Variable
	Social capital			Uncertainty of the transaction	Governance mode
	Structure	Trust	Cognition		
Venture Stage	Edge of network	Common trust	No common knowledge	High	Embeddings
Growing Stage	Control structure hole, Close to network centre	Power trust	Reach common knowledge	Middle	Semi-embeddings
Grown Stage	Network centre	Alliance trust	Alliance knowledge	Low	Union

5 Conclusion

Whether the resources required for the growth of spin-off companies can be configured reasonably depends on the innovation network governance mode. How to recognize the corresponding network governance mode of every growth stage needs related theory. Through consummating transaction cost-embeddings approach and discussing the growth process of Neusoft Group in details, the author summarized the corresponding network governance mode of every growth stage: at the venture stage, embedded mode is used; at the growing stage, a semi-embedded network governance mode is employed; at the grown stage, the businesses have become almost completely independent, and they own and control the strategic network resources which support their edge-leading services, so that the union governance mode is applied. The conclusions can be drawn from the comparison that the evolution of innovation network governance has obvious regularity.

Whether network governance mode can be effective depends on the two most important nodes in the network---spin-off companies and mother-university effectively coordination. The primary role of university is to help spin-off companies reducing the transaction costs of access to resources. To achieve this function, exploring a suitable derivative of the actual situation of own technology business mode and the courage to make the corresponding changes in the management system is necessary. Supporting spin-off companies closely integrated with the development of academic disciplines. Through industry-academia interaction, joint personnel training and cooperative research topics at the forefront, universities supply force for the subject development and make backing to the business continuity. University spin-off companies should complete the transformation actively at the primary phase of growing stage; gradually build their own networks through business development and technological breakthroughs at late phase of growing stage; adjust and re-define the relationship with partners, especially with the university to enable enterprises to maintain a strategic advantage for the service when the company independent at the grown stage.

Although a spin-off companies based on the growth of innovation network management framework for the analysis of mode selection was established, the analysis remains at the qualitative level in the absence of quantitative variables leading to the refinement of the theory to explain clearly insufficient in this paper. Thus future research will focus on converting theoretical model to a theoretical framework and carrying out the transaction costs-embeddedness approach of quantitative research.

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