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Construction of Collaborative Innovation Mechanism of Knowledge Alliance between Chinese State-Owned Enterprises and Organizations

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Abstract: In order to improve learning ability and innovation ability in a competitive marketplace rapidly, more enterprises begin to explore a collaborative innovation model which takes knowledge alliance as its organizational form. Experts and practitioners particularly focus on collaborative innovation operation mechanism of knowledge alliance. This paper makes use of grounded theory to refine a collaborative innovation mechanism model of knowledge alliance by analyzing a concrete case from the collaborative innovation center of Dongda and Shougang Group and collecting related data by open questionnaires. It is found in the research that the collaborative innovation mechanism of knowledge alliance is composed of dynamic mechanism, operating mechanism, dispersal mechanism and safeguard mechanism. The research also elucidates the elements and concrete content of the four mechanisms of knowledge alliance's collaborative innovation. On this basis, empirical analysis conducted by SPSS validates and improves innovative mechanism model of knowledge alliance, which provides enterprises with theoretical foundation and practice guidance for knowledge alliance's collaborative innovation.

Keywords: State-owned enterprises, grounded theory, knowledge alliance, collaborative innovation mechanism

1. Introduction

It is difficult for state-owned enterprises to realize technology innovation breakthrough due to a limit of innovation resource, innovation ability and innovation system. Meanwhile, the innovative activities of state-owned enterprises are facing up to innovation risks caused by increasingly fierce competition from private enterprises and transnational enterprises. In marketing environment with high uncertainty, more state-owned enterprises begin to explore a collaborative innovation model which takes knowledge alliance as its organizational form so as to improve their learning ability and innovation ability in a competitive marketplace rapidly. More and more enterprises choose to innovate collaboratively by forming alliance. Collaborative innovation of foreign enterprises has showed rapid growth momentum since last century （Maggi，1996）.

Kahn（1996，2001）made an empirical analysis of the application of "collaboration" in enterprise innovation whose result showed that collaborative innovation of enterprises could improve the R&D performance and management performance of products and thus gained more innovative returns for enterprises. Shaaker（1999）believed that knowledge transfer and exchange of information would be the key to alliance's collaborative innovation whether enterprises maintain continuous competitive advantages. Research shows that many state-owned enterprises make rational decision based on profit

maximization and loss minimization; therefore, their non-cooperative attitudes lead to no vicious interaction and effective collaborative innovation mechanism. State-owned enterprises are not able to give their respective potentials to full play to join force and thus alliance collaborative innovation exists in name only. The conflict between knowledge transfer among knowledge agents and the demand of knowledge sharing and the proprietary and protection of intellectual property, knowledge agents' inadequate ability or willingness of collaboration and incomplete policy environment or collaborative innovation culture all affect collaborative innovation of knowledge alliance. Therefore, searching for operating mechanism of collaborative innovation inside the alliance, realizing collaborative innovation effect of alliance to improve state-owned enterprises' own core competence and creating powerful competitive advantages become an emphasis of studying collaborative innovation of knowledge alliance for scholars.

2. Research design

Grounded theory is a qualitative research method gained from systematic analysis of data and materials （Glaser，1978，1998）. Glaser（1967）defined grounded theory methodology as a universal method used for analyzing and collecting data. It drew an inductive conclusion on substantive area by in a series of ways systematically. The objective of grounded theory lies in generating a theory by constantly comparing data to raising the level of abstraction （Glaser，1992）. The most notable feature of grounded theory is its lack of specific research question or theoretical assumption at early stage of research. Researchers have to observe research participants and try to find research questions （Parry，1998；Allan，2003）. Research process of grounded theory consists of research design, data collection, data sorting, data analysis and inspection of theory saturation degree. Five-Phase Model invented by Pandit（1996）is the research process that is most widely quoted.

Bauer and Reiner（2000）believed that in-depth case study could provide a part data for grounded theory. This paper studies the collaborative innovation mechanism of knowledge alliance by choosing the cooperation between Shougang Company and Northeastern University who is a part of "collaborative innovation center of steel generic technology" as its case and collecting data on the spot. Data is mainly from the Scientific Research Office of Northeastern University. Meanwhile, the author also learns about some views and comments about collaborative innovation center of Dongda-Shougang through Internet and search engine and obtains relevant qualitative material.

Preliminary analysis of data collected is conducted in this research. Open questionnaires about collaborative innovation of knowledge alliance are also distributed on Questionnaire Star Website (www.sojump.com) for the sake of making research results more complete. Questionnaires include five questions. In order to guarantee the validity of questionnaires, all participants must be the staffs who participate or used to participate in collaborative innovation of university-enterprise knowledge alliance and each answer must contain more than 100 words.

100 questionnaires are distributed on Questionnaire Star Website and all of them are taken back. 80 of them are collated and integrated together with collaborative innovation case of Northeastern University and Shougang Company. The rest 20 are used for the inspection of theory saturability to ensure that

materials reflect traits, advantages and development trends of knowledge alliance's collaborative innovation mechanism accurately and truthfully.

3. Refining category and building model

In order to find out underlying cause of collaborative innovation of knowledge alliance, data sample for model construction is collated as follows: Delete data whose content is simple; eliminate data whose content is too obscure; exclude data whose content is not very related to research. All data is labeled by open code. There are 79 labels by collating data and questionnaires. Axial coding refers to associating different categories of materials fragmented in open code by clustering analysis. Whether there is potential correlation among the concepts of all categories needs to be analyzed so as to look for clues. Therefore, different categories appearing in open coding will be analyzed one by one for trying to analyze potential context or casual relationship.

Table 1. Categories forming in open coding

No.	Categories	Concept
1	Collaborative innovation strategy	Cooperative strategy, creative plan
2	Market requirement	production need, need of running a school, running a school for market requirement
3	Personnel investment	School experts reserve, personnel training, talent team construction, personnel allocation, talent introduction, cultivating talents and participation of research personnel
4	Technical innovation	Technical innovations and innovations in respect of technology
5	Outcome of technical innovation	Technology upgrading, products, accumulation of technological knowledge, technical ability enhancement and technological improvement
6	Market innovation	Market-oriented, technological innovation combined with market and market survey
7	Accumulation of technological knowledge	Accumulation of technological knowledge, reserve of talents and technical knowledge learning
8	Capital investment	Capital investment from enterprises, subsidies provided by enterprises, capital investment from enterprises and equipment investment
9	Diffusion environment	ratify an accord, declare the project together, share the fruits of cooperation, patent and scientific payoffs and enjoy intellectual property right protection
10	Information communication	Enterprise proposes technological demand and Northeastern University provides Shougang Company with technical information to solve the problem information asymmetry
11	Technical support	Enterprise provides Scientific research and technological platform, personnel support and technology support

12	Dispersal mode or channel	Transfer of technology, joint venture cooperation, intellectual property right appraised as capital stock, academic communication activities, forums and technical guidance
13	Establishment of management organization	Establish Cooperation Council, innovation center and cooperation R&D center
14	Self-organization management	organization structure, cooperative organization management and organization adjustment
15	Technology input	technical condition of enterprise and technical support from university
16	Market innovation achievement	expansion of market and opening up new market
17	Management innovation achievement	Change of system and new management style
18	Management innovation	Change of management and innovation on management level
19	Culture inside alliance	Enterprise encourages innovation, innovative culture and knowledge sharing and encourages to innovate culture.
20	Incentive of enterprise	Provide salary incentive, stock right incentive and job promotion opportunity for staffs.
21	Market competition	Enhancement of competitiveness, pressure of competition and competitors
22	Scientific and technological progress	Advanced market technology and foreign high-tech technology
23	System of information	information management system and information communication software
24	Risk sharing	Reduce the cost of innovation and minimize risk
25	Profit-driven	Increase profit, the capacity for scientific research, core competitiveness and economic benefit
26	Policy support	Government subsidies and government policy
27	Culture outside alliance	Innovative industry culture and nation's policy of encouraging innovation
28	Organization management among enterprises	Manage staffs of cooperative enterprises, distribution of rights and unclear responsibility
29	Incentive from alliance	Motivation of cooperation , teamwork atmosphere and benefit distribution

Data source: Collated by the authors.

We find that there is inner link and inter-promoting relation between these samples and categories. There are thirteen kinds of relationship after classifying them. See Sheet 2. On the basis of Sheet 2, the author teases out four main categories by combining the research objectives of this paper: collaborative innovation dynamic mechanism of knowledge alliance, including "external power" and "internal power" that affect the collaborative innovation of knowledge alliance; collaborative innovation operating mechanism of knowledge alliance, including "organizational management", "information communication",

"technology platform" and "elements of innovation" during collaborative innovation of knowledge alliance; collaborative innovation diffusion mechanism of knowledge alliance, including "innovative products", "diffusion environment" and "diffusion mode or channel"; collaborative innovation safeguard mechanism of knowledge alliance, including "cultural guarantee", "organizational guarantee", "input guarantee" and "incentive guarantee".

From what is discussed above, four main categories are reached, including "collaborative innovation dynamic mechanism of knowledge alliance", "collaborative innovation operating mechanism of knowledge alliance", "collaborative innovation diffusion mechanism of knowledge alliance" and "collaborative innovation safeguard mechanism of knowledge alliance".

According to research purpose, this paper takes "collaborative innovation mechanism of knowledge alliance" as core category to lead the other four main categories by studying and comparing repeatedly the relationship between material, 92 concepts and 29 deputy categories, category and deputy category. Story-line of core category is: core category, also known as "collaborative innovation mechanism of knowledge alliance", contains four aspects: collaborative innovation dynamic mechanism of knowledge alliance, collaborative innovation operating mechanism of knowledge alliance, collaborative innovation diffusion mechanism of knowledge alliance and collaborative innovation safeguard mechanism of knowledge alliance. The author presents a story-line that connects all main categories, deputy categories and their relationship by combing collaborative innovation case of Northeastern University and Shougang Company.

Driven by external power (scientific and technological progress, market competition, market requirement and policy support) and internal power (benefit driving, risk sharing, collaborative innovation strategy and accumulation of technical knowledge), Shougang Company and North-eastern University make a knowledge alliance to innovate collaboratively, which is known as collaborative innovation dynamic mechanism of knowledge alliance. After making a knowledge alliance, both parties involved establish cooperation committee for organizational management, including organizational management between enterprises and inside enterprises. For the university and enterprise are not very familiar with each other, they exchange information. Effective exchange of information needs support form technical platform to guarantee an unimpeded access to information. Therefore, both parties innovate on technology, market and management during the process of collaborative innovation.

Collaborative work among those innovative elements brings innovative products, which is known as collaborative innovation operating mechanism of knowledge alliance. Now that there are innovative products, how to introduce innovative products from R&D center to university and enterprise needs to be considered. Innovative products mentioned above refer to technological innovation as well as management innovation and market innovation. Before introduction, Enterprise and university need corresponding intellectual property rights and relevant agreements on account of their own interest. In such a dispersal environment, innovation is spread to both sides through dispersal mode or channel, such as forums, meeting of exchange, transfer of technology and so on, which is known as collaborative innovation dispersal mechanism of knowledge alliance.

During the whole operating process of collaborative innovation between Northeastern University and Shougang Parent Company, the enterprise and university will invest personnel, capital and technology to

guarantee the process of innovation. They also set up corresponding organization to manage the collaborative innovation process of alliance. Both enterprise and university have their own innovative culture. They encourage innovation and knowledge sharing. In order to promote collaborative innovation, the enterprise and university will adopt material incentives, such as stock right incentive and salary incentive to encourage relevant R&D panel to innovate. The enterprise and university are also encouraged to innovate collaboratively with product sharing. In this process, culture safeguard, organization safeguard, investment safeguard and incentive safeguard play an important role from the beginning of collaborative innovation to the end, which is known as collaborative innovation safeguard mechanism of knowledge alliance. We could learn from this process that "collaborative innovation mechanism of knowledge alliance" contains four mechanisms: dynamic mechanism, safeguard mechanism, operating mechanism and dispersal mechanism. See Sheet One.

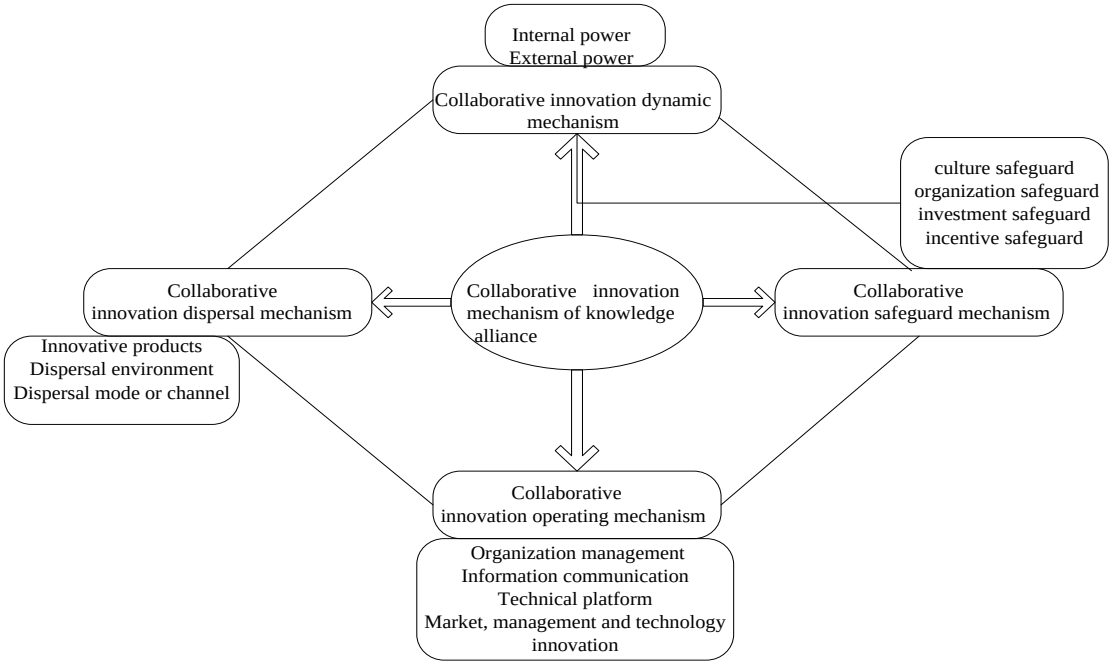
Table 2. Relationship based on axial coding

No.	Classification of relationship	Categories affecting relationship
1	Internal power	Benefit driving, risk sharing, collaborative innovation strategy and accumulation of technological knowledge
2	External power	scientific and technological progress, market competition, market requirement and policy support
3	Organizational management	Organizational management between enterprises and inside enterprises
4	Exchange of information	Exchange of information
5	Technology platform	System of information, technology support
6	Elements of innovation	Market innovation, management innovation and technology innovation
7	Innovation products	Technology innovation achievements, market innovation achievements and management innovation achievements
8	Dispersal environment	Dispersal environment
9	Dispersal mode or channel	Dispersal mode or channel
10	Cultural safeguard	Culture inside alliance and culture outside alliance
11	Organizational safeguard	Establishment of managing organization
12	Input safeguard	Capital investment, technology investment and personnel investment
13	Incentive safeguard	Incentive of enterprise and alliance

Data source: Collated by the authors.

As the standard of perfection of when to stop sampling, inspection of theory saturation refers to the moment that no extra data could be obtained for analyst to further develop the traits of some category. 20 questionnaires used for inspection of theory saturation are coed and analyzed in this paper and the result still conforms to the context and relationship of "collaborative innovation mechanism of knowledge alliance". There is no new category after inspection. Therefore, theoretical model mentioned above is saturated.

Figure 1. Graph of collaborative innovation mechanism of knowledge alliance



4. Research result and empirical analysis

4.1. Interpretation of component factors

4.1.1. Dynamic mechanism

Owing to limited condition, it is difficult for knowledge agents with innovative willingness to innovate independently. Therefore, they form knowledge alliance with other knowledge agents to innovate collaboratively. The internal and external power that affects the collaborative innovation of knowledge agents is the power of knowledge alliance's collaborative innovation. It can be seen that collaborative innovation dynamic mechanism of knowledge alliance refers to the sum of mutual relations and interactions of dynamic factors that promote the innovation activities of knowledge agents. Based on the analysis of grounded theory, it is believed in this paper that collaborative innovation dynamic mechanism of knowledge alliance mainly includes the following components:

External power refers to the driving factors that are outside the alliance or knowledge agents and exert outside force on the collaborative innovation activities of knowledge alliance, mainly including market requirement, market competition, scientific and technological progress and policy support. Market requirement is the most essential power promoting knowledge agents to innovate collaboratively（Bryan and Ferrel, 2000）. Knowledge agents innovate collaboratively by taking market requirement as the guidance, which means to some extent benefits of innovation is safeguarded and thus improves the motivation of innovation. Market competition is the external pressure promoting knowledge agents to innovate collaboratively （Franklyn and Ven, 1996）. However, restricted by knowledge agents' own technology and resources, self-dependent innovation cannot meet the requirement of fierce competition.

That is why knowledge agents have to form knowledge alliance with other knowledge agents for collaborative innovation so as to enhance their products' and even the enterprises' competitiveness. Scientific and technological progress promotes knowledge agents to improve their innovative technology continuously, which needs broad exchange of knowledge and information with outside world. Consequently, scientific and technological progress provides knowledge alliance's collaborative innovation of knowledge agents with outpouring external power. Policy support offer powerful support from policy to the collaborative innovation among knowledge agents.

Internal power refers to the driving factors that are inside the alliance or knowledge agents and exert inside force on the collaborative innovation activities of knowledge alliance, mainly including profit motivation, collaborative innovation strategy, accumulation of technical knowledge and risk sharing. Profit motivation is the most essential power that promotes knowledge agents to innovate collaboratively and the commercialization of innovation products （Henry，2003）. Collaborative innovation strategy provides a direction of development for the collaborative innovation among knowledge agents (Yaowu Yang, Renkai Zhang, 2009) and it is the internal power of the survival and development of knowledge alliance. Accumulation of technical knowledge provides capability basis for the knowledge agents to absorb knowledge from outside world, provides new knowledge that motivates innovation and thus exerts influence on the innovative performance of enterprises （Cohen and Levinthal，1990）.

Accumulation of technical knowledge can be interpreted as the progressive of technology or innovative ability forming in producing and technical activities. Knowledge agents absorb new technology and innovative knowledge continuously from outside world, accumulate technical knowledge by applying them to production practice and promote knowledge agents to develop unceasingly. Knowledge agents aim at pursuing profit maximization and innovation is a highly risky activity. However, in face of fierce competition, enterprises have to adapt them to the development of external market, or they may be eliminated. Under such circumstances, making collaborative innovation by cooperating with other knowledge agents effectively shares the risks during innovation process.

Internal power plays a dominant role in system operation. The reason why external power makes difference is also internal power (Bing Sun, 2007). Therefore, the external power of knowledge alliance plays an important role on promoting the collaborative innovation of enterprise, as external power, can its energy efficiency be realized only when it is turned into internal power by being abducted, aroused and driven.

4.1.2. Operating mechanism

Collaborative innovation operating mechanism of knowledge alliance is the internal function and operation mode of the collaborative innovation of knowledge alliance, which runs throughout the whole process of collaborative innovation activity and plays a key role in the success of collaborative innovation. It is believed in this research that collaborative innovation operating mechanism of knowledge alliance mainly includes the following components:

Information communication among knowledge agents will exert an influence on the organization and management of knowledge alliance's collaborative innovation. Organizational characteristics of alliance

include other-organization of alliance and self-organization of members. Other-organization of alliance means that the organization is compulsory and self-organization of members means members manage the alliance autonomously. Therefore, the organization of knowledge alliance's collaborative innovation is characterized by self-organization and other-organization, according to which, the organization and management of knowledge alliance's collaborative innovation is divided into two categories: Self-organizational management of enterprises and organizational management among enterprises. Knowledge alliance will guide, lead and control the members of alliance to reach the management objective of collaborative innovation, during which there is flow of information. If you want to organize and manage the collaborative innovation of knowledge alliance well, information communication among knowledge agents which to some degree affects these two kinds of organization and management is very important.

Information communication among knowledge agents is to a great extent affected by collaborative innovation technical platform of knowledge alliance. If knowledge alliance was equipped with an information system that have the function of information integration, assistant information, knowledge sharing and optimal configuration of resources and ability, knowledge agents could exchange information through this system and solve the problem of information asymmetry. Such an information system needs the service from the technical platform of knowledge alliance's collaborative innovation; that is to say, collaborative innovation technical platform of knowledge alliance will have an effect on the information communication among knowledge agents.

Collaboration of innovative elements. In order to realize high efficiency of innovation project or achieve benefit expected, you should not only focus on the collaboration of innovative elements but also the total synergy between enterprises' non-technology innovative elements and technology innovative elements (Gang Zheng, Xinru Liang, 2006). The collaboration of innovative elements aims at maximizing the effect of collaborative innovation, giving full play to all innovative elements and realizing "1+1>2", namely, the relevant value-added activities and system's overall functional effect of knowledge alliance's collaborative innovation. Based on the analysis of grounded theory, innovative elements in this research mainly include technological innovation, market innovation and management innovation. The relationship among these three innovative elements needs to be understood so as to improve innovative performance of knowledge alliance's collaborative innovation.

4.1.3. Dispersal mechanism

Liming Duan and Yueping Du (2005) pointed out that the diffusion of technological innovation meant innovative products' dispersal process among enterprises. Therefore, it is believed in this paper that the diffusion of knowledge alliance's collaborative innovation refers to innovative products' dispersal process among the knowledge agents of alliance. Collaborative innovation dispersal process of knowledge alliance means that innovative products disperse themselves to the knowledge agents of alliance in some way or channel. Collaborative innovation dispersal mechanism of knowledge alliance is composed of elements, such as innovative products, innovation dispersal way or channel, dispersal environment and so on. These elements interact with each other and affect innovation diffusion speed and scope, which is known as collaborative innovation dispersal mechanism of knowledge alliance. It is believed in this paper that Collaborative innovation dispersal mechanism of knowledge alliance mainly includes the following components:

Innovative products of knowledge alliance's collaborative innovation not only contains innovative products like the improvement of technological innovation and innovation ability, but also the management of innovative products, such as the improvement of alliance system innovation, the management mode of alliance, the management and organization of knowledge alliance and so on, as well as market innovation products, such as new market created by innovative products brought by the collaboration of alliance.

Dispersal process of knowledge alliance's collaborative innovation. Innovative products are created by synergistic effect of knowledge alliance and dispersed to knowledge agents or cooperative knowledge agents through dispersal mode or channel. After knowledge agents and cooperative knowledge agents receive innovative products, they will give feedback of corresponding information to the collaborative innovation of knowledge alliance and then improve innovative products, which is the "output-input-output" process of innovative products. Dispersal process of knowledge alliance's collaborative innovation is the core of collaborative innovation dispersal mechanism of knowledge alliance.

Dispersal process of knowledge alliance's collaborative innovation interacts with dispersal environment. On one hand, dispersal environment of knowledge alliance's collaborative innovation can promote dispersal process; for example, good protection of intellectual property makes innovative products disperse better among knowledge agents. On the other hand, dispersal environment also restricts dispersal process; for example, innovative products without intellectual property protection may not be dispersed to all the knowledge agents in alliance effectively. Meanwhile, dispersal process will in turn affect dispersal environment and improve it. Dispersal process of knowledge alliance's collaborative innovation interacts with dispersal environment and proceeds within it.

4.1.4. Synergetic innovation safeguard mechanism

Knowledge alliance synergetic innovation safeguard mechanism consists of cultural security, organizational security, investment guarantee and incentive guarantee four elements. Cultural security is to form an ideology from the subjects of knowledge to protect the formation and conduct of synergetic innovation. Organizational security is to set up an organization to support innovation from the knowledge alliance to conduct the daily management of synergetic innovation. Investment guarantee is as the resources needed for knowledge alliance in synergetic innovation, such as capital, technology, talent, etc. Incentive guarantee refers to some corresponding incentives for knowledge in knowledge alliance synergetic innovation, in order to promote the effective operation of synergetic innovation between knowledge of subjects and the effective diffusion of innovations. This study suggests that knowledge alliance synergetic innovation safeguard mechanism mainly includes the following sections:

The influence of cultural security to the motivational mechanism, operation mechanism and the diffusion mechanism of knowledge alliance synergetic innovation. Cultural security includes not only the culture within the alliance, but also the social culture. The social culture outside the knowledge alliance system promotes that the innovation will promote the knowledge to choose the knowledge alliance synergetic innovation to enhance their own technology or innovation, in order to reduce the risk to obtain maximum benefits. The cultural security within knowledge alliance can will affect the operation mechanisms and

diffusion mechanism of synergetic innovation, because a kind of knowledge-sharing culture formed in the subject of knowledge will promote the operation of synergetic innovation, make communication between the subjects of knowledge more smoothly, to allow the effective conduct of each innovative elements together and more effective diffusion of innovations.

The influence of organizational security to the operation mechanism and diffusion mechanism of knowledge alliance synergetic innovation. Reasonable and effective alliance management organization is an important organizational guarantee of knowledge alliance synergetic innovation. Knowledge alliance synergetic innovation will generate some organization and management problems in the process of running, such as the organization and management problems between knowledge or the knowledge subject itself. These problems will affect the running of knowledge alliance synergetic innovation. It is necessary to form a union management organization to solve the problems. At the time of innovation diffusion, it will involve the benefit assignment problem. Also, the alliance management organization can protect the benefits of all knowledge subjects to a certain extent.

The influence of investment guarantee to the operation mechanism of knowledge alliance synergetic innovation. The knowledge alliance synergetic innovation cannot proceed without capital, technology and talents investments. Innovative elements of knowledge alliance synergetic innovation will be formed to have further synergetic, and output the innovations finally only with the capital, technology and talents investments.

The influence of incentive guarantee to the operation mechanism and diffusion mechanism of knowledge alliance synergetic innovation. Incentive guarantee not only includes the knowledge itself to employee's motivation, but also contains to encourage knowledge alliance to promote the output and diffusion of the innovations. The incentives of knowledge alliance include explicit and implicit incentives, active incentive and emergent incentive (Sun Xinbo, Liu Bo, 2012). The four kinds of incentive methods can promote the efficient operation of synergetic innovation, and the efficient diffusion of innovations.

4.2. Empirical study

4.2.1. Research design

Based on the four mechanism of knowledge alliance synergetic innovation mechanism established on the basis of grounded theory in the above context, to design targeted questionnaire which consists of four subscales, and define the variables in each mechanism.

According to discussion of motivational mechanism components of the knowledge alliance synergetic innovation, this paper extracts 10 variables as follows: A1: the influences of external motivations (market demand, market competition, scientific and technological progress and policy support) on knowledge alliance synergetic innovation A2: the influences of internal motivations (interest-driven, collaborative innovation strategy, technical knowledge accumulation, risk-sharing) on knowledge alliance synergetic innovation. A3: the factors that have an impact on interest-driven. A4: the factors that have an impact on collaborative innovation strategy. A5: the factors that have an impact on technical knowledge accumulation. A6: the factors that have an impact on risk-sharing. A7: the factors that have an impact on science and technology progress. A8: the factors that have an impact on market competition. A9: the

factors that have an impact on market demand. A10: the factors that have an impact on policy support.

According to discussion of operation mechanism components of the knowledge alliance synergetic innovation, this paper extracts 12 variables as follows: B1: the influences of organization and management on the operation of knowledge alliance synergetic innovation; B2: the influences of information communication on the operation of knowledge alliance synergetic innovation; B3: the role of technology platform in the process of knowledge alliance synergetic innovation operation; B4: the influences of information communication on the independent organization and management for enterprise; B5: the influences of information communication on organization and management among enterprises; B6: the role of technology platform on information communication; B7: the role of market innovation on technology innovation; B8: the role of market innovation on management innovation; B9: the role of technology innovation on management innovation; B10: the role of technology innovation on market innovation; B11: the role of management innovation on market innovation; B12: the role of management innovation on technology innovation.

According to discussion of diffusion mechanism components of the knowledge alliance synergetic innovation, this paper extracts 5 variables as follows: C1: the role of innovations in the process of diffusion of the knowledge alliance synergetic innovation; C2: the influences of diffusion modes or channel on the knowledge alliance synergetic innovation; C3: the influences of diffusion environment on the diffusion of the knowledge alliance synergetic innovation; C4: the influences of diffusion environment of the knowledge alliance synergetic innovation on the process of diffusion; C5: the influences of diffusion process of the knowledge alliance synergetic innovation on diffusion environment.

According to discussion of components of the knowledge alliance synergetic innovation safeguard mechanism, and this paper extracts 8 variables as follows: D1: the role of organizational security on guaranteeing the knowledge alliance synergetic innovation; D2: the role of incentive guarantee on guaranteeing the knowledge alliance synergetic innovation; D3: the role of investment guarantee on guaranteeing the knowledge alliance synergetic innovation; D4: the role of cultural security on guaranteeing the knowledge alliance synergetic innovation; D5: which mechanism does the organizational security have influence on guaranteeing the knowledge alliance synergetic innovation; D6: which mechanism does the cultural security have influence on guaranteeing the knowledge alliance synergetic innovation; D7: which mechanism does the investment guarantee have influence on guaranteeing the knowledge alliance synergetic innovation; D8: which mechanism does the incentive guarantee have influence on guaranteeing the knowledge alliance synergetic innovation.

The study on the basis of theoretical analysis makes the questionnaire design based on the design of variables of motivational mechanism, operation mechanism, diffusion mechanism and guarantee mechanism of knowledge alliance synergetic innovation. The first part of questionnaire is the basic situation of the survey, and the second to the fifth part are the four mechanisms of the knowledge alliance synergetic innovation mechanism. The questions are mainly composed of questions which express the degree and attitude and multiple choice questions. It adopts the prevailing level 5 Likert scale and uses “not important very much”, “not important”, “general”, “important”, and “very important” to express for questions which express the degree and attitude.

To test the reliability of the questionnaire, a preliminary investigation with a total of 20 questionnaires was conducted before the formal questionnaire, and retook 20 copies. In accordance with the recommendations of the relevant researchers, and through SPSS20.0 for reliability analysis of the results, the questionnaire was modified and optimized to obtain the final formal questionnaire. This research mainly takes the enterprises and units which participate in knowledge alliance synergy innovation as the research sample. The main research object is mainly involved in knowledge alliance enterprises or schools. The enterprises include foreign capital enterprises, private companies and state-owned enterprises, and the schools are mainly aimed at the research institute and university and other colleges and universities.

The study mainly uses two methods for data collection to protect the diversity of data sources. Firstly, in this study, the questionnaire is uploaded to the internet through the Questionnaire Star website, and the site-related personnel will contact relevant staff of knowledge alliance to fill out the questionnaire. Compared to traditional mail or fax survey, questionnaire survey has the advantages of wide range of distribution, faster recovery and lower costs（Simsek and Veiga, 2001). Then, distribute the questionnaire to the respondents through the field investigation. The objects are MBA and EMBA students at school in the Northeastern University.

4.2.2. Sample data analysis

The survey questionnaires were totally distributed 200 copies, of which 100 copies were distributed through the network, and 100 copies were distributed through on-site. 100 copies which were distributed through the network were all retook, and the site investigation questionnaires retook 76 copies. Tested on the questionnaires, which the incomplete ones as well as ones' choice answers present certain disciplines will be excluded. There are 100 copies of valid questionnaires distributed by the network and 43 valid copies on site investigation. The total effective questionnaire recovery rate is 71.5%.

Descriptive statistics is done by the nature of enterprises involved in the investigation, and the work nature of investigators and so on, we can see that the companies involved in the knowledge alliance are mostly private enterprises, and the state-owned enterprise is in the second, while the proportions of joint venture, foreign-funded enterprises and universities are less. It can be seen in the knowledge alliance, the staff has higher education. Respondents have longer working life in the present enterprise, and have more understanding of the situation of participating knowledge alliance by enterprises and help to the investigation of this study. Respondents involved in the investigation have both management work and technical work, of which the nature of management work is more than the other two.

Reliability is the degree of consistency or reliability of test results. Usually, researchers will use inner reliability to analyze the internal consistency of the questionnaire, and investigate whether the questions in the questionnaire measure the same content. Ni Xuemei (2010) gives the commonly used metric of Cronbach's α coefficient value, points out that the reliability is very high when the Cronbach's α value is greater than 0.9; the reliability is higher when Cronbach's α value is between 0.8 and 0.9; the reliability is acceptable when Cronbach's α value is between 0.7 and 0.8; and the reliability is not acceptable when Cronbach's α value is less than 0.7. This study uses the Karen Bach α coefficient for reliability analysis. It obtains the scale reliability analysis results by using SPSS20.0 for analysis. It can be seen that the Cronbach's value of the whole of the scale is 0.916, and Cronbach's values of four subscales are all

greater than 0.8. So that, the data obtained from the survey of this research have high reliability and the scale has good internal consistency.

Validity can be defined as the ratio between the variance of actual scores of measurement contents and the total scores variance. Validity is generally divided into content validity, construct validity and criterion-related validity. Combined with the research purpose, it mainly analyzes the validity of the present study from content validity. The topics for questions item in this research are mainly set based on knowledge alliance synergy innovation mechanism obtained by grounded theory, and the appropriate options are set separately to verify and improve its theory framework according to the four sub-mechanism of knowledge alliance synergetic innovation. Questionnaire aims to examine and improve the knowledge alliance synergetic innovation mechanism, so each question item in the questionnaire is close to this topic content of knowledge alliance synergetic innovation mechanism, that is to say, the question items in the questionnaire have a strong representativeness for the assessment scope of the content of the research, so, the questionnaire of this study has good content validity.

4.2.3. Data analysis

Knowledge alliance synergetic innovation motivational mechanism. This study uses a questionnaire to conduct variable analysis for verification for knowledge alliance synergy innovation motivational mechanism, and designs knowledge alliance synergy innovation motivational mechanism question item (hereinafter referred to as “motivational mechanism”).

Table 3. Descriptive statistical analysis of motivational mechanism variables

	N	Minimum value	Maximum value	Mean	Standard deviation
A1	143	3	5	4.50	.522
A2	143	2	5	4.50	.640
Effective N (listing status)	143				

The variable A3 to A10 are the multiple-choice questions, to do the descriptive statistical analysis to the variables in addition to A3 to A10, mainly on the mean and standard deviation for analysis, as shown in 他 table 3. It can be seen from table 3, the score of variable A1 and A2 is 4.5, the importance of variables has been verified. Therefore, it can be seen that the external motivations (scientific and technological progress, market competition, market demand, policy support) are very important to promote knowledge alliance synergy innovation, and the internal motivations (technical knowledge accumulation, risk-sharing, interest-driven, collaborative innovation strategy) are also very important to promote knowledge alliance synergy innovation. Namely, the external motivations and internal motivations are the two important factors of motivational mechanism in knowledge alliance synergy innovation. Whether there will be some relationships between the internal motivations and external motivations, it will proceed through the analysis of variables of A3 to A14.

This study selected the factor which the percentage is greater than or equal to 15.0% as the influential standard of other factors, the following conclusion can be drawn by table 4 to table 11. The factors that have impacts on interest-driven are: risk sharing, market competition, market demand; The factors that have impacts on collaborative innovation strategy are: scientific and technological progress, market

demand, market competition, and policy support; The factors that have impacts on technical knowledge accumulation are: collaborative innovation strategy, scientific and technological progress, market demand; The factors that have impacts on risk-sharing are: interest-driven, market competition and market demand; The factors that have impacts on scientific and technological progress are: collaborative innovation strategy, technical knowledge accumulation, market demand;

Table 4. Statistical analysis of the factors impacted on motivational mechanism

		Response		Percentage of cases
		N	Percentage	
A3[a]	Collaborative innovation strategy	66	14.5%	46.2%
	Technical knowledge accumulation	54	11.9%	50.3%
	Risk-sharing	72	15.9%	37.8%
	Scientific and technological progress	62	13.7%	43.3%
	Market competition	74	16.3%	51.7%
	Market demand	76	16.7%	53.1%
	Policy support	50	11.0%	35.0%
Total		**454**	**100.0%**	**317.4%**

The factors that have impacts on market competition are: interest-driven, market demand; The factors that have impacts on market demand are: interest-driven, technical knowledge accumulation, market competition;

Table 5. Statistical analysis of the factors impacted on collaborative innovation

		Response		Percentage of cases
		N	Percentage	
A4[a]	Interest-driven	37	9.0%	46.2%
	Technical knowledge accumulation	56	13.7%	48.3%
	Risk-sharing	51	12.4%	35.7%
	Scientific and technological progress	63	15.4%	44.1%
	Market competition	69	16.8%	39.2%
	Market demand	68	16.6%	47.6%
	Policy support	66	16.1%	25.9%
Total		**410**	**100.0%**	**286.7%**

The factors that have impacts on policy support are: scientific and technological progress.

Table 6. Statistical analysis of the factors impacted on technical knowledge

		Response		Percentage of cases
		N	Percentage	
	Interest-driven	36	10.1%	25.2%
	Collaborative innovation strategy	63	17.6%	44.1%
	Risk-sharing	34	9.5%	23.8%

A5[a]	Scientific and technological progress	83	23.2%	58.0%
	Market competition	47	13.2%	32.9%
	Market demand	60	16.8%	42.0%
	Policy support	34	9.5%	23.8%
Total		**357**	**100.0%**	**249.7%**

Table 7. Statistical analysis of the factors that have impacts on risk-sharing

		Response		Percentage of cases
		N	Percentage	
A6[a]	Interest-driven	58	15.9%	40.6%
	Collaborative innovation strategy	51	14.0%	35.7%
	Technical knowledge accumulation	43	11.8%	30.1%
	Scientific and technological progress	36	9.9%	25.2%
	Market competition	78	21.4%	54.5%
	Market demand	60	16.4%	42.0%
	Policy support	39	10.7%	27.3%
Total		**365**	**100.0%**	**255.2%**

Table 8. Statistical analysis of the factors impacted on scientific and technological progress

		Response		Percentage of cases
		N	Percentage	
A7[a]	Interest-driven	47	12.9%	32.9%
	Collaborative innovation strategy	62	17.0%	43.4%
	Technical knowledge accumulation	79	21.6%	55.2%
	Risk-sharing	37	10.1%	25.9%
	Market competition	48	13.2%	33.6%
	Market demand	57	15.6%	39.9%
	Policy support	35	9.6%	24.5%
Total		**365**	**100.0%**	**255.2%**

Table 9. Statistical analysis of the factors impacted on market competition

		Response		Percentage of cases
		N	Percentage	
A8[a]	Interest-driven	59	16.6%	41.3%
	Collaborative innovation strategy	50	14.0%	35.0%
	Technical knowledge accumulation	47	13.2%	32.9%
	Risk-sharing	47	13.2%	32.9%
	Scientific and technological progress	44	12.4%	30.8%
	Market demand	74	20.8%	51.7%
	Policy support	35	9.8%	24.5%

Total	**356**	**100.0%**	**249.0%**

Table 10. Statistical analysis of the factors impacted on market demand

		Response		Percentage of cases
		N	Percentage	
A9[a]	Interest-driven	51	15.0%	35.7%
	Collaborative innovation strategy	43	12.6%	30.1%
	Technical knowledge accumulation	51	15.0%	35.7%
	Risk-sharing	42	12.3%	29.4%
	Scientific and technological progress	50	14.7%	35.0%
	Market competition	68	19.9%	47.6%
	Policy support	36	10.6%	25.2%
Total		**341**	**100.0%**	**238.5%**

Table 11. Statistical analysis of the factors impacted on policy support

		Response		Percentage of cases
		N	Percentage	
A10[a]	Interest-driven	50	13.2%	35.0%
	Collaborative innovation strategy	55	14.5%	42.7%
	Technical knowledge accumulation	45		31.5%
	Risk-sharing	56	14.7%	39.2%
	Scientific and technological progress	67	17.6%	42.7%
	Market competition	54	14.2%	37.8%
	Market demand	53	13.9%	37.1%
Total		**380**	**100.0%**	**265.7%**

Knowledge alliance synergetic innovation operation mechanism. This study uses a questionnaire to conduct variable analysis for verification for knowledge alliance synergy innovation operation mechanism, and designs knowledge alliance synergy innovation operation mechanism question item (hereinafter referred to as "operation mechanism"). Do the descriptive analysis to the variables of B1 to B12, mainly on the mean and variance for analysis, as shown in table12. It can be seen from the table 12, the mean value of each variable is greater than 4.3. So it has verified the importance of organization and management, information communication and technology platform in the process of operation of knowledge alliance synergy innovation, at the same time, the information communication is also important for the organization and management for the enterprise itself and between the enterprises, and the technology platform also has important influence on information communication. It can be learned from the mean scores of variables of B7 to B12 that there are relationships among technological innovation, management innovation and market innovation. They interact with each other. The synergy of three innovative elements together constitutes the core of knowledge alliance synergy innovation.

Table 12. Statistical analysis of operation mechanism variables

	N	Minimum value	Maximum value	Mean	Standard deviation
B1	143	3	5	4.45	.537
B2	143	3	5	4.60	.548
B3	143	3	5	4.49	.608
B4	143	3	5	4.41	.601
B5	143	2	5	4.32	.660
B6	143	3	5	4.39	.598
B7	143	3	5	4.40	.583
B8	143	3	5	4.34	.650
B9	143	3	5	4.47	.591
B10	143	3	5	4.44	.572
B11	143	3	5	4.36	.624
B12	143	3	5	4.41	.617
Effective N (listing status)	143				

This study uses a questionnaire to conduct variable analysis for verification for knowledge alliance synergy innovation diffusion mechanism, and designs knowledge alliance synergy innovation diffusion mechanism question item (hereinafter referred to as “diffusion mechanism”). Do the descriptive analysis to the variables of C1 to C5, mainly on the mean and variance for analysis, as shown in table 13.

Table 13. Statistical analysis of diffusion mechanism variables

	N	Minimum value	Maximum value	Mean	Standard deviation
C1	143	3	5	4.51	.521
C2	143	3	5	4.36	.639
C3	143	3	5	4.49	.592
C4	143	3	5	4.37	.626
C5	143	3	5	4.36	.592
Effective N (listing status)	143				

Knowledge alliance synergetic innovation diffusion mechanism. It can be seen from the table 13, the mean value of each variable is greater than 4.3. So it can be learned the importance of innovations in the process of diffusion of knowledge alliance synergy innovation. Diffusion modes or channels play a considerable role as a medium for the transmission of innovations. Diffusion environment also can have certain effect on the transmission of innovation among the subjects of knowledge, and the transmission of innovation in the process of communication among knowledge subjects will be affected by the diffusion environment. At the same time, diffusion process will be applied to diffusion environment, and there are interactive relations between them.

Knowledge alliance synergetic innovation safeguards mechanism. This study uses a questionnaire to

conduct variable analysis for verification for knowledge alliance synergy innovation diffusion mechanism, and designs knowledge alliance synergy innovation diffusion mechanism question item (hereinafter referred to as "diffusion mechanism"). The variable D5 to D8 are the multiple-choice questions, to do the descriptive statistical analysis to the variables in addition to D5 to D8 and descriptive analysis to the variables D1 to D4, mainly on the mean and standard deviation for analysis, as shown in table 14.

Table 14. Statistical analysis of safeguard mechanism variables

	N	Minimum value	Maximum value	Mean	Standard deviation
D1	143	3	5	4.47	.591
D2	143	3	5	4.50	.608
D3	143	3	5	4.62	.544
D4	143	3	5	4.46	.574
Effective N (listing status)	143				

It can be seen from the table 14, the mean values of the variables of D1 to D4 are greater than 4.4, and the importance of each variable has been verified. So it can be learned the importance of organizational security, cultural security, investment guarantee and incentive guarantee in the knowledge alliance synergetic innovation safeguard mechanism.

Safeguard mechanism plays an important role for the entire operation of knowledge alliance synergetic innovation mechanism. It can be learned that organizational security, cultural security, investment guarantee and incentive guarantee play an important role for which mechanism in the knowledge alliance synergetic innovation mechanism through the analysis of the variables of D5 to D8. The standard, selected in this paper that organizational security, cultural security, investment guarantee and incentive guarantee have an impact on motivational mechanism, operation mechanism and diffusion mechanism of knowledge alliance synergetic innovation respectively, is the mechanism with the percentage is greater than or equal to 30%. The following conclusions can be drawn from table 15 to table 18: the influence of organizational security on operation mechanism is the most important, the second is the motivational mechanism; cultural security plays the most important role on the operation mechanism, followed by diffusion mechanism; investment guarantee has the most important influence on operation mechanism, the second is the motivational mechanism; incentive security plays the most important role on the motivational mechanism, followed by operation mechanism.

Table 15. Statistical analysis of safeguard mechanism variables

		Response		Percentage of cases
		N	Percentage	
D5[a]	Motivational mechanism	62	33.0%	43.4%
	Operation mechanism	85	45.2%	59.4%
	Diffusion mechanism	41	21.8%	28.7%
Total		**188**	**100.0%**	**131.5%**

Table 16. Statistical analysis that the cultural security has an impact on mechanism

		Response		Percentage of cases
		N	Percentage	
D6[a]	Motivational Mechanism	51	28.2%	35.7%
	Operation mechanism	68	37.6%	47.6%
	Diffusion mechanism	62	34.3%	43.4%
Total		**181**	**100.0%**	**126.6%**

Table 17. Statistical analysis that the investment guarantee has an impact on mechanism

		Response		Percentage of cases
		N	Percentage	
D7[a]	Motivational mechanism	60	30.3%	42.0%
	Operation mechanism	82	41.4%	57.3%
	Diffusion mechanism	56	28.3%	39.2%
Total		**198**	**100.0%**	**138.5%**

Table 18. Statistical analysis that the incentive guarantee has an impact on mechanism

		Response		Percentage of cases
		N	Percentage	
D8[a]	Motivational mechanism	85	41.1%	59.4%
	Operation mechanism	68	32.9%	47.6%
	Diffusion mechanism	54	26.1%	37.8%
Total		**207**	**100.0%**	**144.8%**

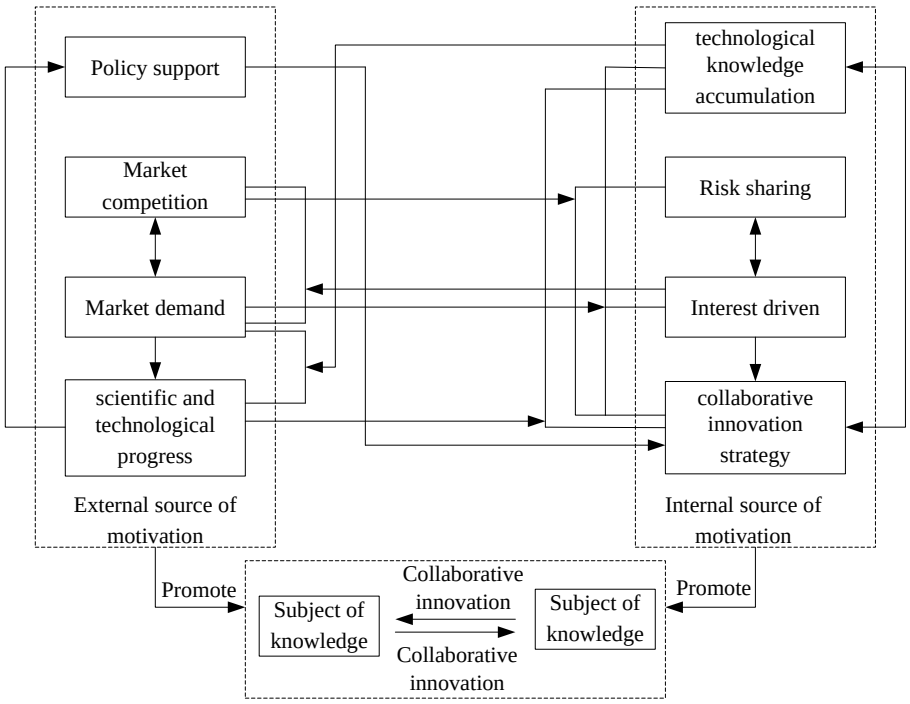
4.2.4. Model construction

Model construction of knowledge alliance synergetic innovation motivational mechanism. It can be learned through the analysis of the motivational mechanism of variables and considering the interaction between the internal motivations and external motivations. The market demand of external motivation has influences on the internal motivations collaborative innovation strategy, technology knowledge accumulation, risk-sharing and interest-driven. The external motivation market competition has an impact on interest-driven, collaborative innovation strategy and risk sharing of the internal motivation. The external motivation scientific and technological progress affects collaborative innovation strategy and technology knowledge accumulation of the internal motivation. The external motivation policy support affects the internal motivation collaborative innovation strategy. The internal motivation collaborative innovation strategy has influences on the external motivation scientific and technological progress. The internal motivation interest-driven has influences on the external motivation market competition and market demand. The internal motivation technology knowledge accumulation affects the external

motivations scientific and technological progress and market demand.

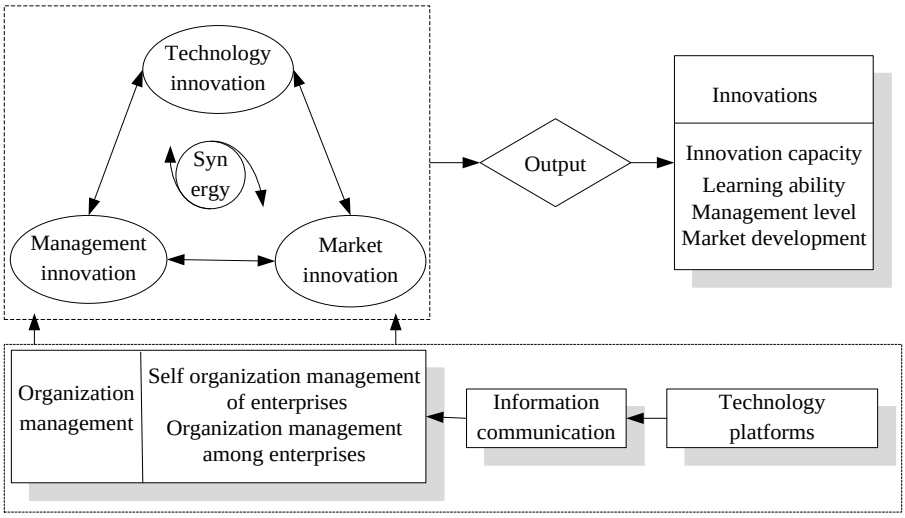
Among the external motivations, market competition and market demand affect each other; market demand will affect scientific and technological progress, and scientific and technological progress will affect policy support. Among the internal motivations, interest-driven has influence on the risk sharing and collaborative innovation strategy, technological knowledge accumulation will affect interest-driven and collaborative innovation strategy and technology knowledge accumulation will influence each other. The above are composed of relationship among factors. In this paper, the model of knowledge alliance synergetic innovation motivational mechanism is shown in figure 2. Motivational mechanism mainly refers to the sum of interaction and relationships between the external motivations and internal motivations as well as among the internal motivations and external motivations themselves.

Figure 2. Model of knowledge alliance synergetic innovation motivational mechanism



Model construction of knowledge alliance synergetic innovation operation mechanism. Organization management, information communication, technology platforms and innovative elements (technological innovation, management innovation, and market innovation) are the important component of operating mechanism of knowledge alliance synergetic innovation. Technology platform has an important influence on the information communication between the subjects of knowledge, information communication can affect the independent organization management of enterprise themselves and organization management among enterprises and innovation synergy is the core of operation mechanism. Therefore, this paper constructs the operation mechanism model of knowledge alliance synergetic innovation which takes the innovative elements as the core, as shown in figure 3.

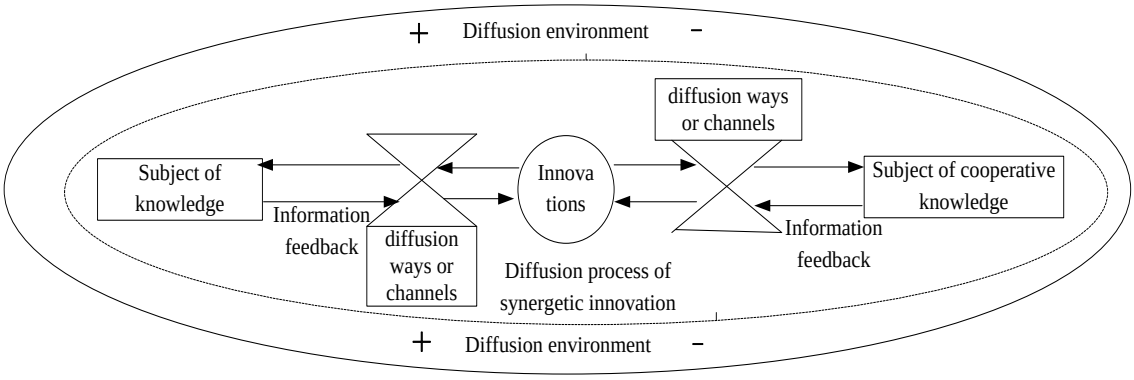
Figure 3. Model of knowledge alliance synergetic innovation operation mechanism



When the knowledge alliance of has a technology platform which has the function of knowledge sharing, information integration and other functions, both sides of the subject of knowledge can make better information communication through this technology platform.

Model construction of knowledge alliance synergetic innovation diffusion mechanism. Through analysis of the variables on the diffusion mechanism, it can be learned that innovations, diffusion ways or channel, and diffusion environment are the important components of diffusion mechanism of knowledge alliance synergetic innovation. At the same time, the diffusion environment and the diffusion process will also be interacted with each other. Therefore, this paper constructs the diffusion mechanism model of knowledge alliance synergetic innovation, as shown in figure 4.

Figure 4. Model of knowledge alliance synergetic innovation diffusion mechanism

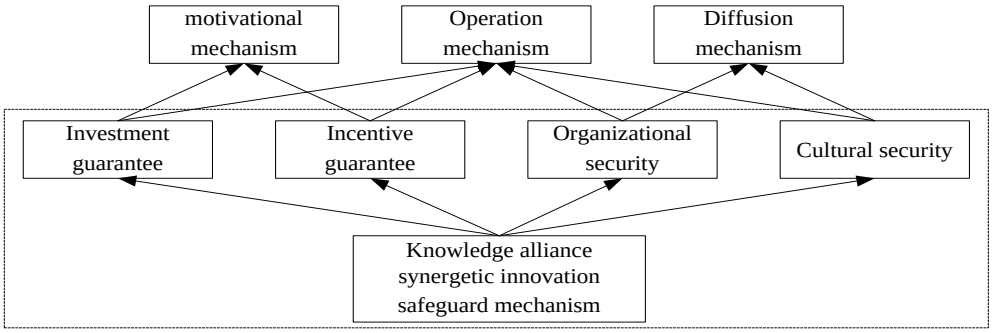


Innovations are obtained through working together by both sides of the subject of knowledge. The innovations will be diffused to the subject of knowledge through diffusion ways or channels, such as seminars, exchanges and other media. The subject of knowledge and cooperative subject of knowledge will feedback the use of the information to collaborating center through diffusion ways or channels after

the use of innovations, and then collaborating center can make corresponding modification. The diffusion process will not stop in such a cycle until the cessation of cooperation of both sides of knowledge subject. Diffusion environment can not only promote the diffusion process, but also can restrain the diffusion process. On the contrary, the diffusion process will have an impact on the diffusion environment, and the new diffusion environment will further affect the diffusion process. The diffusion process of knowledge alliance of synergetic innovation is conducted constantly with the interaction with the diffusion environment.

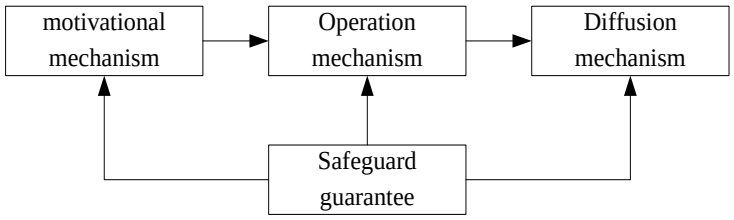
Model construction of knowledge alliance synergetic innovation safeguards mechanism. Through analysis of the variables on the safeguard mechanism, it can be seen that organizational security, cultural security, investment protection and incentive guarantee are the important components of safeguard mechanism. These four securities also have influences on motivational mechanism of knowledge alliance synergetic innovation, operation mechanism and diffusion mechanisms. Therefore, this paper constructs the safeguard mechanism model of knowledge alliance synergetic innovation, as shown in figure 5. The factors which have the most important influence on the motivational mechanism are investment guarantee and incentive guarantee. And the factors which have the most important influence on the diffusion mechanism are the organizational security and cultural security. The investment guarantee, incentive guarantee, organizational security and cultural security all have important roles on operation mechanism.

Figure 5. Model of knowledge alliance synergetic innovation safeguard mechanism



Model construction of knowledge alliance synergetic innovation mechanism. Through the above analysis, it is known that the relationships of the various mechanisms in the knowledge alliance synergetic innovation mechanism are the mutual interaction and connection, and all sub-mechanisms will play their roles together to promote the achievement of synergetic innovation effect. On the basis of this, “model of knowledge alliance synergetic innovation mechanism” is constructed, as shown in figure 6.

Figure 6 Model of knowledge alliance synergetic innovation mechanism



In the knowledge alliance synergetic innovation mechanism, the motivation is foundation to promote the development of the entire synergetic innovation, so the motivation mechanism of synergetic innovation is a prerequisite for the running of operation mechanism of synergetic innovation. And the operation mechanism of synergetic innovation will output the innovations on the premise of the motivation mechanism of synergetic innovation, through the support of technology platform, information flows between the subjects, and the innovation factors synergy. The diffusion mechanism of synergetic innovation will transmit the innovations output of the operation mechanism to the subject of knowledge on the premise of the operation mechanism. The synergetic innovation safeguard mechanism is as the important guarantee to realize the synergetic innovation effect, throughout the process of the entire knowledge alliance synergetic innovation, ensures that all activities in the process of synergetic innovation smoothly. The four mechanisms have formed the organic whole, and work together to realize the synergetic innovation effect.

5. Conclusion and implication

The model of knowledge alliance synergetic innovation mechanism with the core category of knowledge alliance synergetic innovation mechanism and the main categories of knowledge alliance synergetic innovation motivation mechanism, operation mechanism, diffusion mechanism and guarantee mechanism, is obtained on the basis of previous literature, based on the realistic case data and survey, and through grounded theory. Next, this paper makes the theoretical findings and empirical analysis to the results of research, and verification and improvement to knowledge alliance synergetic innovation mechanism. Basic conclusions of this study are as follows:

It should clear the strategic goals of knowledge alliance synergetic innovation and strengthen technical knowledge accumulation in connection with the motivational mechanism of knowledge alliance synergetic innovation. The subject of knowledge is the formation backbone of the subject of knowledge alliance synergetic innovation. In the beginning of the knowledge alliance synergetic innovation, each knowledge subject involved in knowledge alliance through correct understanding of their own technological knowledge accumulation should formulate the synergetic innovation strategy which is suitable for the development of knowledge alliance, and set corresponding target for the performance of knowledge alliance synergetic innovation. The knowledge subject of knowledge alliance can make a strategic adjustment in time facing to the market changes, so as to promote the generation of knowledge alliance synergetic innovation performance. The knowledge subject continuously absorbs new technology and innovation knowledge from the outside and applies them in the production practice to form the accumulation of knowledge and promote the continuous development of the subject of knowledge.

It should set up the modern technology information network platform to strengthen the trust between the subjects of knowledge in connection with operation mechanism of knowledge alliance synergetic innovation. Information communication is the connection between knowledge subjects. A network platform of technology information can be built among knowledge subjects for knowledge alliance synergetic innovation. Through this technology information platform, the subject of knowledge can deliver each other’s problems to their partners timely, promptly resolve problems and promote the conduct of knowledge alliance synergetic innovation. The trust can enhance the communication of information, trust can make the subject of knowledge be willing to exchange and communicate their own technologies

with partners.

It should extend the diffusion modes and channels to create a good environment for diffusion in connection with the diffusion mechanism of knowledge alliance synergetic innovation. Diffusion modes or channels are the medium for the transmission of innovations among the subjects of knowledge. Whether the innovations are transmitted to the knowledge subjects successfully will be directly related to the performance of knowledge alliance synergetic innovation. Knowledge subject can use many kinds of transmission mode, such as technology transfer, joint venture cooperation, intellectual property investment, seminars and technical guidance, etc.. Subject of knowledge can be used by one or more diffusion modes or channels to promote the transmission of innovations among the knowledge subjects. On the one hand, the diffusion environment of knowledge alliance synergetic innovation can promote the diffusion process, for example, the good protection of intellectual property rights can protect the rights and interests of subject of knowledge, to transmit innovations orderly among the knowledge subject. On the other hand, diffusion environment will also restrict its diffusion process, for example, the innovative products of the knowledge alliance are without the protection of the property. Therefore, creating a good diffusion environment will be conducive to the transmission of innovations and enhance the communication and exchange between subjects.

It needs to establish synergetic innovation organization and management knowledge alliance to strengthen the investments of personnel, technology, and capital, and to develop appropriate incentive measures. Rational and efficient alliance management organization is an important organizational guarantee of knowledge alliance synergetic innovation, to promote mutual knowledge circulation and resolve the organization and management issues in the alliances. Incentive guarantee plays an important role for the motivation mechanism and operation mechanism of knowledge alliance synergetic innovation. For employees, it is considered that most of the staff involved in knowledge alliance synergetic innovation is knowledgeable workers. It can take appropriate incentive measures according to their demands in connection with the explicit demands, implicit demands and active demands (Sun Xinbo, Fan Meili, 2012) of knowledgeable workers in the knowledge alliance. The subjects involved in knowledge alliance synergetic innovation naturally vary in corporate culture, due to some extent differences in the nature, management philosophy and management models of the knowledge subjects. The existence of these differences will lead to the subject of knowledge on the same issue to take different actions, make knowledge alliance partnerships affected, and damage to each other’s interests. Therefore, the subject of knowledge should strengthen the construction of culture of innovation and knowledge sharing culture.

In summary, the research conclusions will contribute to further development of research of knowledge alliance synergetic innovation, and provide important scientific theories for further comprehensive evaluation of collaborative innovation effect, analysis and assessment of collaborative innovation risk and return, early warning synergetic parameters of collaborative innovation risk mechanism, collaborative innovation management and other aspects of in-depth study. Although it carries out the research in strict accordance with the steps of grounded theory, and verifies and improves the results through the empirical analysis, but there may also have some limitations. First of all, the researcher is as an outsider, has certain limitations in understanding of the collaborative innovation operation in the enterprise, there may be the rises of “excessive” or “insufficient”. Secondly, the case data is mainly for university-enterprise knowledge alliance to construct synergetic innovation mechanism, and may still not be perfect for other

forms of knowledge alliance. In addition, this paper adopts the method of questionnaire and on-site questionnaire, so questionnaire issued by quantity is less, and the result of empirical analysis has a certain limitation. Therefore, it is necessary to enrich sample data in the future's study, enlarge the knowledge alliance types of survey, and hope to get more results.

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