Research on the Coupling Interaction Innovation of Knowledge of the University-industry Collaboration Institutions

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Abstract—This paper proposes that the essence of coupling interaction innovation of knowledge of university-industry collaboration institutions is the coupling, sharing, creating and transferring of knowledge. It then further explores the process of the coupling interaction innovation of knowledge in the modes of commissioned research, technical cooperation and joint institute and finally provides with three basic approaches to follow in order to enhance the effect of coupling interaction innovation of knowledge of university-industry collaboration institutions.

Keywords—university-industry, knowledge, coupling interaction, innovation

I. INTRODUCTION

In this era of knowledge-based economy, university-industry collaboration is becoming more and more important in aspects such as to accelerate technical innovation, to promote the commercialization of research findings and to further integrate the development in science and technology with the economy. The university-industry collaboration is to bring out a cooperative innovation via an interactive knowledge flow and transfer in the course of the collaboration: the transfer of knowledge in between improves the integration of knowledge resources, optimizes the allocation and combination of the production factors, and accordingly promotes the knowledge innovation (Giuliania and Arzab, 2009). And therefore, researches from the perspective of knowledge on university-industry collaboration are worth to carry out and significant in improving the current university-industry collaboration.

II. THE ESSENCE OF THE COUPLING INTERACTION INNOVATION OF KNOWLEDGE

Knowledge, according to the definition by Organization for Economic Cooperation and Development (OECD) in the report titled “The Knowledge-based Economy”, is divided into know-what (knowledge about objective facts), know-why (knowledge about natural laws and principles), know-how (knowledge about technical knacks, of skills and abilities), know-who (knowledge about the abilities and knowledge of the man you know). In this paper, considering the practice of innovation of university-industry collaboration, the author subdivides knowledge into knowledge of science, knowledge of experimental techniques, knowledge of manufacturing techniques and knowledge of commerce.

Knowledge of science refers to scientific theories of objective facts, natural laws and principles, and mainly means knowledge needed for technical research and development. Next, knowledge of experimental techniques is about technical knacks of skills and abilities which are required in both laboratories and pilot-scale experiments. And knowledge of commerce refers to economic management knowledge for the marketing of the products, primarily about how to commercialize the products.

Generally speaking, universities or research institutions enjoy more scientific knowledge and experimental techniques while enterprises focus on manufacturing techniques and commercial knowledge. Thus, only through mutual
cooperation their advantages could be maximized while their disadvantages minimized and in the end, the scale effect could thus be achieved and the surplus value gained. Therefore, the foundation of university-industry collaboration is the effective knowledge coupling between universities or research institutions and enterprises. Knowledge coupling between both ends depicts a static relationship while the dynamic interaction between them contributes to the knowledge innovation. The interaction between both ends facilitates the sharing, integrating, creating, transferring and spreading of the knowledge that has been coupled, and thus the technical innovation and its transferring could be accomplished. To draw a short conclusion here, the essence of coupling interaction innovation of knowledge of university-industry collaboration is the coupling, sharing, creating and transferring of knowledge.

III. PROCESS ANALYSIS OF THE COUPLING INTERACTION INNOVATION OF KNOWLEDGE

A. The process of coupling interaction innovation of knowledge in the mode of commissioned research

The mode of commissioned research refers generally to a mode carried out by universities or research institutions while the enterprises supply them with funds as well as technical need for the product to be researched on, and besides urgent technical problems that enterprises come up with during the manufacturing. This mode applies to universities or research institutions with excellent research and development abilities and in the other end, enterprises with relatively good absorption and assimilation ability towards new knowledge.

The knowledge goes through three steps in this mode, as Strambach (2001) has said, they are external knowledge integration, knowledge acquisition of specific techniques and detailed knowledge encoding to meet the need of enterprises. Based on Strambach’s findings and considering the relationship between enterprises and universities or research institutions, in this paper, the author also proposes three steps in knowledge innovation process: (1) universities or research institutions acquire explicit and implicit knowledge from the enterprises; (2) universities or research institutions integrate the knowledge acquired in step(1) with their own and out of which they create some new knowledge; (3) universities or research institutions transfer and spread the new findings to the enterprises. As showed in the figure1 below:

In this mode, knowledge acquisition is the principal interaction in the early knowledge coupling between universities or research institutions and enterprises, that is, the learning activity of universities or research institutions after taking on the commission from the enterprises.

Universities or research institutions acquire both explicit and implicit knowledge of key techniques, and with this acquisition as a base they embark on the research and development task. And the knowledge integration and creation is therefore a process carried out with the task as a guide, and with knowledge manufacturing and producing as its purpose.

The knowledge manufactured here comprises the knowledge acquired from the enterprises and as well as that has been accumulated long before by universities or research institutions on their own. And the main approach is to re-encode all the knowledge acquired, to call upon the knowledge base of the whole research and development team and then to create new solutions to technical problems. The transfer and spread of knowledge refers to the coupling interaction after solving the technical problems when the universities or research institutions recommend new solutions to the enterprises. Finally, the knowledge transfer and spread finishes in this stage.

To be noticed in the commissioned mode, universities or research institutions might operate in batches and by stages when recommending to the enterprises new solutions to technical problems, and thus finally the knowledge innovation process between universities or research institutions and enterprises could form a closed loop, with the spread of
knowledge in the last step as the foundation for knowledge innovation in the next stage (Eom and Lee, 2010).

B. Knowledge innovation process in the mode of technical cooperation and joint institute

The mode of technical cooperation means that universities or research institutions allow scientific and technical transfer with payment to enterprises and further assist enterprises in the product manufacturing of the first batch. This mode quickens the conversion of technology into productive forces and hence beneficial for enterprises to bring out new products and improve manufacturing ability in a relatively short period.

The mode of joint institute refers to an institute established through joint efforts by both the universities or research institutions and enterprises, and they respectively invest some funds, human resources and equipment, including research and development center, pilot-scale experiment bases, open laboratories, other research institutions and so on.

The mode of technical cooperation and joint institute demand both the two parties to be closely interacted during the research and development, and especially on technical problems and technical development. The knowledge innovation process could also be subdivided into three steps: (1) the cooperative parties should share mutually their respective explicit and implicit knowledge; (2) the cooperative parties need to re-integrate all the knowledge acquired and then create new knowledge; (3) the knowledge spread both to the universities or research institutions and to the enterprises, as presented in figure2 below:

![Figure2 The knowledge innovation process in the modes of technical cooperation and joint institute](image)

In the modes of technical cooperation and joint institute, knowledge sharing are the learning activities of both universities or research institutions and enterprises in the beginning of coupling interaction, during which explicit and implicit knowledge is exchanged in between, and thus a foundation for technical research and development is firmly laid.

And the knowledge integration and creation is therefore a process carried out with the task of solving the technical problems as a guide, and with knowledge manufacturing and producing as its purpose. The principle approach is to re-encode all the knowledge acquired, to enrich the knowledge base of the cooperative parties and to create new knowledge and finally solve the technical problems of the enterprises. The knowledge spread and transfer is achieved through cooperation between relevant parties after solving the technical problems in the end.

During the practice in the modes of technical cooperation and joint institute, and with the three steps accomplished, the spread and transfer of the knowledge would promote in return the improvement in skills and enrichment of knowledge in related aspects and if the cooperative parties agree, another loop of the sharing, integrating, creating, spreading and transferring of the knowledge is to be further carried out, and finally a closed loop of knowledge innovation is achieved.

The process of knowledge innovation in the mode of technical cooperation and joint institute also follows the “Knowledge Innovation Model” put forward by Nonaka and Takeuchi (1995), which is the classical SECI model.

During the process of coupling interaction innovation, there exist four knowledge transformation processes. Firstly, through coupling interaction, universities or research institutions and enterprises share its experiences with each other, which produces a great deal of explicit knowledge, that is, the socialization of the knowledge. Secondly, a further coupling interaction between cooperative parties could convert the explicit knowledge into the implicit knowledge which is new to both ends, and this is the externalization of the knowledge. Thirdly, explicit and implicit knowledge of different stages are blended, redefined, combined, exchanged, structuralized and therefore enriched during all the steps of coupling interaction, which is the combination of the knowledge. And finally, the explicit knowledge out of coupling interaction is further transformed into implicit
knowledge of cooperative parties, and this is named the internalization of the knowledge.

IV. COUNTERMEASURES OF IMPROVING COUPLING INTERACTION INNOVATION OF KNOWLEDGE OF UNIVERSITY-INDUSTRY COLLABORATION INSTITUTIONS

A. Emphasizing the construction of the mechanism of university-industry collaboration

The mechanism of university-industry collaboration impacts on knowledge innovation through coupling interaction. The mode of commissioned research, the mode of technical cooperation and the mode of joint institute enjoy an ascending coupling interaction degree in sequence and the same is true with their effect of knowledge innovation. Thus, when collaborating, universities or research institutions and enterprises should choose the mode with a high degree of coupling interaction, and besides, the organizational structure of the cooperative parties in the modes of technical cooperation and joint institute also influences the coupling interaction, and so when planning the organizational structure of the cooperative parties, the self-management and boundary penetration of the institutions are to be optimized so as to facilitate the knowledge innovation and transfer.

B. Perfecting the operating mechanism of university-industry collaboration

The operating mechanism of University-Industry collaboration should emphasize on sharing profits as well as risks. The coupling interaction innovation of knowledge is not only highly rentable but also risky and thus a reasonable mechanism of sharing profits as well as risks could enhance mutual trust for a stable and long-time relationship. With a long-time coupling interaction, more and more knowledge transfer and innovation would undoubtedly be attainable, especially the implicit knowledge, which in return could promote further more loops of innovation accordingly.

C. Enhancing the cultural construction of university-industry collaboration

Culture plays an underlying role in molding the active subjects living within, and with different cultures the mental model differs accordingly, which influences the approaches and degree of the coupling interaction innovation of the knowledge. Universities or research institutions and enterprises differ apparently in culture, and the cultural conflicts thereof would impede the effect of the coupling interaction innovation. Therefore, during the coupling interaction innovation, cultural construction of the cooperative organizations should be emphasized, and cultural integration and mutual cooperation are to be promoted, so as to reduce the barriers to knowledge sharing, creating and transferring.

V. CONCLUSION

The coupling, sharing, creating and transferring of knowledge is the essence of the coupling interaction innovation of knowledge. In this paper, the author discovers that the transfer of the implicit knowledge during the innovation process plays a crucial part in determining innovation performance, and thus should be given sufficient attention. Also, with the different modes of collaboration, the time and intensity of coupling interaction differ and that in sequence make a difference in knowledge coupling and creation. Through an effect on the coupling of knowledge, the operating mechanism and the organizational culture act on the innovation performance. In order to improve the innovation performance, countermeasures could be found in the combination, operation and the cultural integration of the coupling interaction innovation of the knowledge of university-industry collaboration institutions.

References


