

# Knowledge Innovation Based on Cooperation of Industry, University and Research Institute

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**Abstract:** At the era of knowledge economy, knowledge innovation is crucial for an enterprise. On the basis of the definition of the cooperation of industry, university and research institute, the paper illustrates the reason why knowledge innovation needs the cooperation of industry, university and research institute, presents what is the cooperative process of industry, university and research institute leads to knowledge innovation, and concludes that the trend of collaborative competition stimulates the cooperation of industry, university and research institute into the developmental direction of knowledge innovation.

**Key words:** Cooperation; Knowledge innovation; Direction; Industry, university and research institute

## 1 Introduction

With the advent of the era of knowledge economy, people attach more and more attention to the production, transmission, transition, and conversion of knowledge. Under the current social background, innovation has become the mainstream. To a great extent, the development of the enterprise depends on the ability of innovation. At the era of knowledge economy, the trend of collaborative competition stimulates the cooperation of industry, university and research institute into the developmental direction of knowledge innovation<sup>[1]</sup>.

The cooperation of industry, university and research institute means that industry, university and research institute forms a sort of union to co-research according to a certain rule or standard. There are some complex non-linear processes of knowledge transmission, knowledge digestion, knowledge transition aimed to establish a new production function that mentioned by Schumpeter and create a type of demand and value.

## 2 Why Knowledge Innovation Needs the Cooperation of Industry, University and Research Institute

In China, many enterprises, especially the high-tech enterprises realize knowledge has played an important role in the knowledge innovation and began to regard knowledge as principal factor of production to go into operation. However, the core status of knowledge in the production, exchange, distribution and consumption would take the new thought qualified by commercial value into commercialized event through close cooperation among industry, university and research institute.

### 3.1 knowledge enters production in two different ways

Firstly, a new market is created by new product, new technique and new material. Secondly, the productivity of human capital is enhanced by the increasing of repository<sup>[2]</sup>. It means that on the one hand, an enterprise needs much capital investment in purchasing scientific achievements and develop new products with high scientific and technological content, on the other hand, university and research institute also throw research findings into productivity and create enormous economic value.

### 3.2 Human capital keeps core effect in the innovative activities

There are generally crowding innovative enterprises around universities and research institutes of the concentrated human capital. Existence of the universities and research institutes provide constant talent flow and advantageous condition on how to utilize library and laboratory for innovative enterprises.

Generally, knowledge is divided into two parts. One is human capital. The other is technique of public goods behind innovative products, which is noncompetitive and incremental infinitely. The result of technical innovation promotes technical progress and advance.

Based on the facts above, the following model is built:

$$\Delta A = \delta HA$$

Where H is human capital included in expenditure of R&D, A represents knowledge inventory of R&D,  $\delta$  is productivity parameter of R&D,  $\Delta A$  is output rate.

Formula indicates that the bigger is H and A, the bigger is  $\Delta A$ , which means the more is human capital and the higher is knowledge inventory, the higher is knowledge inventory of R&D

Because economic growth rate:

$$g = \Delta Y/Y = (\Delta Y/\Delta K)(\Delta k/Y)$$

$\Delta K$  is capital increment

Suppose  $\Delta K=I$ ,  $g=(\Delta Y/\Delta K)(I/\Delta A)(\Delta A/Y)$

$\Delta A$  is inserted,  $\delta = \Delta A/I$ ,

$$g = (\Delta Y/\Delta K)(I/\Delta A)(\delta H A A/Y) = (A/Y)(\Delta Y/\Delta K) H A$$

$$g = a k H$$

Where  $a=A/Y$ ,  $k=\Delta Y/\Delta K$

### 3 What Factors does the Cooperative Process of Industry, University and Research Institute Leads to Knowledge Innovation Have

The cooperation of industry, university and research institute may bring about many innovative achievements, but it does not mean that every result in the cooperation of industry, university and research institute can be translated into knowledge innovation and make enterprises gain more economic benefits.

#### 3.1 Transaction costs in the cooperative process of industry, university and research institute leads to knowledge innovation

Transaction costs exist in the whole process of the cooperation of industry, university and research institute and affect the success or failure of the cooperation of industry, university and research institute. The cooperation of industry, university and research institute belongs to economic behavior and seeks for an established benefit drive. If profits could not compensate transaction costs, the cooperation of industry, university and research institute would be losing. Therefore, there are some urgent problems to solve in the cooperative process of industry, university and research institute.

(1)The economies of cooperative scale. The cooperative scale of industry, university and research institute may be too small, or too big. The bigger cooperative scale increases transaction costs, in the other side, although the smaller cooperative scale reduces transaction costs, it also reduces marginal income<sup>[3]</sup>.

(2)Technical capability. The cooperation of industry, university and research institute is based on the core technical capability. The core technical capability can make the cooperative process of industry, university and research institute more effective and energetic.

(3)Operation and management capability. Operation and management capability is good lubricant of reducing transaction costs, which makes industry, university and research institute cooperate in harmony.

#### 3.2 The cooperative organization of industry, university and research institute leads to knowledge innovation

According to the close degree, the cooperative organization of industry, university and research institute is divided into four classes which are contract connection, government push, voluntary participation, join entity<sup>[4]</sup>:

(1)The pattern of contract connection is an organization of cooperation of industry, university and research institute which brings about greater short-term interests, not beneficial for continuity of the cooperative process of industry, university and research institute as well as knowledge innovation that can easily and likely to result in waste of human resource, knowledge.

(2)The pattern of government push is that government guides university and research institute against industry. Under the background of the pattern, university and research institute can go in for interdisciplinary research and develop new subject and high technology. At the same time, the pattern can attract industry investment into university and research institute, which will enhance the research efficiency.

(3)The pattern of voluntary participation is that industry, university and research institute are connected by economic contracts on the basis of transfer and development of scientific research achievements. The pattern has strong practical relevance and brings about round economic benefits.

(4)The pattern of join entity is that respective essential factor of industry, university and research institute would be recombined, planned and arranged in an unified way and management. The pattern could keep respective core-competitiveness with a common objective to create more wealth of society

**3.3 Knowledge transfer and knowledge innovation of the cooperative process of industry, university and research institute**

The cooperative process of industry, university and research institute does with transfer and flow of knowledge. In fact, the process of knowledge transfer is the process of information transfer and integration. Industry, university and research institute would launch co-research and marginal benefit on the basis of credit and legal contract. In the process of knowledge transfer, the following problems would be emphasized:

(1)The price friction of knowledge transfer. Knowledge transfer is not free. On the contrary, it must involve the interests of the parties involved. So the parties of cooperation would build a rational price mechanism to reduce the price friction of knowledge transfer and consider the interests of all parties.

(2)The policy direction of knowledge transfer. There is a regularity and directivity in the process of knowledge transfer<sup>[5]</sup>. The government and affected offices, bureaus and commissions must lay down a series of policies to shorten the period of knowledge transfer and lay the foundations of knowledge innovation<sup>[6]</sup>.

(3)The cooperation mechanism of knowledge transfer. Because the process of knowledge transfer is relatively complex, the parties of cooperation would build a cooperation mechanism and form a stable relation among industry, university and research institute to promote industrialization and commercialization of research findings<sup>[7]</sup>.

**3.4 Establishment of a favorable return distribution system**

In the cooperative process of industry, university and research institute, the most difficult work is how to divide up the profits. Thereby, a favorable return distribution system can be established to make all the parties of cooperation gain respective profit.

A conclusion that the all parties can gain greater economic or social effects by collaboration with each other than independent action would be proved by Shapley cooperation game model

Presuming  $I = \{1, 2, \dots, n\}$  is the  $n$  part of cooperation game

A group of participants (a subset of  $I$ ) is  $S$ , taking  $v(S)$  as corresponding benefit

$P_i$  is that  $i$  of  $I$  gains profits from collaboration,

$P = [P_1(v), P_2(v), \dots, P_n(v)]$  is quantitative value of Shapley, which is determined by  $v(S)$

$$P_i = \sum_{s \in S_i} w(|S|) [v(s) - v(S \setminus i)], \quad i=1, 2, \dots, n$$

Where  $S_i$  is all subsets of  $I$  contains  $i$

$|S|$  is number of elements of subset  $S$

$$w(|S|) \text{ is weighting factor, } w(|S|) = \frac{(n - |S|)! (|S| - 1)!}{n!}$$

It can be proved that the distributional programme must meet the requirements below:

- i What contributes nothing can not gain profits;
- ii The sum of interests from all parts of cooperation equals gross earnings.

**5 Conclusions**

It can be seen from the analysis above, the cooperative organization of industry, university and research institute has several forms. In the process of cooperation of industry, university and research institute, every enterprise would select suitable form to improve competition ability in the market. The establishment of Wuhan -Optical valley is a good example. In fact, Wuhan -Optical valley is a cooperation base of industry, university and research institute . It is comprehensive new town park with the integration of having influences on district, combining technological research with knowledge innovation, commercialization and industrialization of scientific and technological fruits, cultivation and centralization of high-quality creative and pioneering talents, new and hi-tech enterprises incubation, specialized service and logistics service, etc, which locates at the Optical valley, National High-tech Development Zone, Wuhan, Hubei Province. The approaches to cooperation of industry, university and research institute improve the competitiveness of enterprises and accelerate the pace of knowledge innovation.

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