A Multidimensional Understanding on Innovation Problem

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Abstract. Based on the current research on innovation, this paper summarizes the concept and connotation of innovation, analyzes the types and levels of enterprise innovation, and puts forward the criteria and basic models of enterprise innovation evaluation.

1. Introduction

With the rapid development of economic globalization and the rapid progress of science and technology, international competition is becoming increasingly fierce. Relying on innovation to win the development advantage has become a universal consensus in the world. To grasp the initiative of innovation, people must firstly have a profound and comprehensive understanding of the issues related to innovation in theory.

2. Concept and evolution of innovation

Innovation is an ancient word, originating in Latin. It is intended to have three meanings, the first is the renewal, the second is to create new things, and the third is to change. Innovation became a theory at the beginning of the twentieth Century. In 1912, Joseph Alois Schumpeter, a professor and economist at the Harvard University, forward the concept of "innovation" for the first time in the works "Economic Development Theory". In his works "Unstable Capitalism", he put forward the idea of "innovation is a process". In the book "Business Cycle", "Capitalism, Socialism and Democracy" and other works, his the innovation theory is comparatively elaborated. Joseph Alois Schumpeter believes that innovation is the establishment of a new production function, and a new combination of the elements of production by entrepreneurs, which is a new combination of never production factors and production conditions into the production system, thus forming a kind of new production capacity, in order to obtain potential profits. Joseph Alois Schumpeter thinks that innovation consists of five forms:

A) Create a new product, that is, a product that the user is not familiar with, or a new feature of the existing product.

B) Adopt a new production method, that is, the method of empirical verification which has not been passed in the relevant manufacturing department. This new method is not necessarily based on the new discoveries of science, but also can be used to deal with certain products in the new business way.

C) To open up a new market, that is, a market that a certain manufacturing sector of the state had not previously entered, regardless of whether this market has existed;

D) A new source of supply for the acquisition or control of raw materials or semi-finished products, whether the source is already existing or first created.

E) To achieve any new type of industrial organization or enterprise reorganization, such as a monopoly position, or a monopoly position.

It can be seen that Joseph Alois Schumpeter's definition of innovation is put forward from the perspective of economics, but its covers a wide range, involving technological innovation and organizational innovation of non-technological change. But, because of the influence of Keynes's

economic thought at that time, Joseph Alois Schumpeter's theory of innovation failed to arouse the attention of the academic circle. Until 1950s, with the rise of a new round of technological revolution in microelectronics as the core, creating a rapid growth of nearly 20 years of it to many countries, traditional economics cannot explain this phenomenon, so Joseph Alois Schumpeter's theory of innovation also begin to get understanding of the academic, and not only it become the focus of academic research, and research field of innovative concept is also beginning to be expanded.

In 1950s, a famous American management scientist, Drucker, introduced the concept of "innovation" into the field of management and further developed the theory of innovation. He believes that innovation refers to the behavior of giving resources to new ability to create wealth. Innovation is not only an economic mechanism or technological process, but also a social phenomenon.

In 1960s, the National Science Foundation of U.S.A. began to organize research on technological innovation and technological innovation. In 1962, L. Enos in his paper "oil processing industry in the invention and innovation", for the first time on technological innovation are defined, and points out that technological innovation is the result of several comprehensive, these behaviors include the invention selection, capital investment guarantee, organization establishment, planning, and recruit workers to open up the market. L. Enos about the definition of technology innovation is defined from the angle of behavior set. The first time to define technological innovation from the perspective of innovation timing process is G. Lynn. He thinks that technological innovation is the whole process of "starting from the understanding of the commercial potential of technology and finally converting it to commercial products". In 1969, S. Myers and D .G. Marquis defined innovation as a collection of technological changes in a research report "Successful Industrial Innovation", they think that technological innovation is a complex activity, and starts with new ideas and new concepts, through constantly solving various problems, and ultimately make a new project with economic value and social value to get a successful application. To the second half of the 1970s, their definition of technological innovation greatly widened, in the NSF’s report"1976: Scientific Indicator”, the Innovation is defined as "technological innovation is the introduction of new or improved products, processes, or services into the market", and the imitating and improvement of no needing to introduce the new technical knowledge is clearly defined as the two types of innovation on the final level into the scope of the definition of technical innovation.

In the 70~80 years of twentieth Century, the research on innovation began to go further and began to form a system theory. In 1970s, J. M. U. Merback's research on innovation was unique. In 1974, in his "Industrial Innovation and Technology Diffusion", he thought that "innovation is the actual application or the first application of technology", which is different from inventions or technology samples.

Since the 1980s of last century, China has carried out the research on the theory of technological innovation, and has obtained a lot of theoretical research results. Some scholars think that technological innovation is the entrepreneur to obtain commercial interests as the goal, to seize the potential opportunities in market, by reorganizing the production conditions and elements and other means to build up production and management methods of greater efficiency and lower cost, so as to introduce new products, new production methods, new (process) the market, get new raw materials or semi-finished products supply or the establishment of new enterprise organization, a comprehensive process includes a series of activities in science and technology, organization, business and finance etc. Some scholars believe that technological innovation is a process of recombining entrepreneurs with production factors, production conditions and production organizations to create a new production system with better efficiency and higher efficiency, and achieve greater profits. These definitions are given from the perspective of the enterprise.

In twenty-first Century, driven by information technology, the formation of knowledge society and its influence on technology innovation further known by people, people began to realize that innovation is essentially based on the existing mode of thinking this is different from conventional

or ordinary people thought opinion oriented, by the use of existing knowledge and material, in particular environment the spirit of the ideal, or to meet the needs of the society, and improve or create new things, elements, methods, path and environment, and can get some beneficial effects of behavior. Moreover, innovative thinking is gradually introduced into the society in various fields, covering politics, military, economy, society, culture, science and technology, and the formation of new areas of innovation and focus, there are three main aspects, namely: the subject field is characterized by the knowledge innovation as the core, performance to industry technical innovation is the core field of occupation--showing as system innovation as the core. and the formation of the three major areas, namely: The field of discipline is manifested in the core of knowledge innovation, the field of industry, technology and innovation as the core, the field of occupation, institutional innovation as the core .

3. The relationship between innovation and invention

The two words of innovation and invention are closely related, but their meaning is fundamentally different, and many people often confuse the two words.

Some scholars think that the invention is a new combination of the existing knowledge which aims to satisfy a certain desire. It is also believed that invention is the creation of thought and its practical test. The test here is to use the model to test the principle, not by introducing the product to the market. Their view of innovation is that when a company produces a new product, provides a service or uses a method, if it is new to the enterprise, it changes in technology. The first enterprise to achieve some kind of technological change is the innovator, and its behavior is innovation. Companies that have made the same technological changes are imitators, and their behavior is called imitation. Actually, bear Pete first made a distinction between innovation and invention. He thought that the function of an entrepreneur is to introduce new invention to the production system, and innovation is the first commercial application of invention.

Some scholars point out that innovation is concerned with the business and practical application of creativity or invention, in short, "innovation turns ideas into reality". Creativity is the most creative part, and it is also the essence of innovation. Because, without creativity, without innovation. Others confuse creativity with innovation. In fact, there are differences between them. Creativity means creativity and innovation. It also includes the idea of turning creativity into reality. The difference between innovation and invention can be explained by the following formula:

Innovation: Theoretical concept + Technical invention + Commercial development

The new concept of innovation is the starting point of innovation. This new idea is neither an invention nor an innovation , it is only a new concept, a new idea or some new ideas. The process of transforming new rational ideas into real, new artificial goods (usually a product or process) is an invention. This is the world where science and technology usually play a significant role. At this stage, inventions need to be combined with the hard work of many different people and convert the invention into a product that improves the company's performance. These follow up work is development. Only this complete process, however, represents innovation. Therefore, innovation is a process that must be managed with many different features. In a word, innovation depends on inventions, and inventions need to be applied to business activities to contribute to the sustainable development of the enterprise.

4. Types and levels of innovation

4.1 Types of innovation

When it comes to innovation, the first thing a lot of people think about is product innovation. In fact, innovation is not limited to product innovation. In general, innovation can be divided into four types:

1) Product innovation. Product innovation refers to the successful introduction of new products,

new technologies and new services into the market in order to achieve commercial value. If the new product launched by enterprises can't bring profit to the enterprise and bring commercial value, it will not be the real innovation. Product innovation usually includes technological innovation, but product innovation is not limited to technological innovation, because the combination of new materials, new technologies, existing technologies and new applications can achieve product innovation.

2) Market innovation. Market innovation is a creative activity for maximizing the market effect or breaking through the sales dilemma, which is based on the existing core products, and in pushing the product to the market stage, aiming at market positioning, overall product, channel strategy, marketing spread and communication (brand, advertising, public relations and promotion, etc.). Market orientation innovation is choosing new market or digging a new product interest point. The so-called overall product innovation is that an enterprise based on existing core products, change packaging design, or change product appearance design, or combine peripheral accessories or complementary products, or providing personalized service. The innovation of the whole product, channel strategy, marketing communication and customer service must be carried out under the guidance of the adjusted market positioning strategy, so as to achieve the best market effect.

3) Business mode innovation. The so-called business mode is a description of how an enterprise operates. A good business model should be able to answer some of the classic questions of Master Peter Drucker: who is our customer? What do customers think are the most valuable to them? How do we make money in this business? How can we provide the customer with the value at the appropriate cost? The innovation of business mode is to successfully change the elements of the existing business mode, and ultimately improve the company's performance in providing customers with better performance.

4) Management mode Innovation. Management mode innovation refers to the change of enterprise management process, business operation process and organization form based on new management ideas, management principles and management methods. The management process of the enterprise mainly includes strategic planning, capital budget, project management, performance evaluation, internal communication, and knowledge management. Business operation processes include product development, production, logistics, procurement, customer service and so on. Through management mode innovation, enterprises can solve the main management problem, reduce costs and outlay, improve efficiency, increase customer satisfaction and loyalty. Method of mining new opportunities of the management mode innovation is through: comparing with the enterprises outside the industry for benchmarking; or Challenging the universally accepted norms in the industry or enterprises, rethinking the current working methods, finding new ways and means, and breaking through the "impossible" and "impracticable" thinking constraints; Paying attention to the problem events in the daily operation, and thinking about how to turn these problems into the opportunity for management mode innovation; Reflecting on the relevant dimensions of the existing work, such as what to do, when and where to complete, and so on. The continuous management mode innovation can make the enterprise become a learning organization that has life and can adapt to the change of the environment.

4.2 Level of innovation

All product innovation, market innovation, business mode innovation and management mode innovation can be divided into three basic levels: progressive innovation, major innovation and breakthrough innovation.

1) Incremental innovation. Incremental innovation has little impact on business growth, but incremental innovation can improve user satisfaction and enhance the effectiveness of products or services, which can improve corporate reputation. In the same way, incremental process innovation can improve the efficiency of enterprise production and reduce the cost. Incremental innovation rarely requires fundamental changes in the user and the enterprise. Incremental innovation is the key factor for success in developing new markets and developing new products. Innumerable

incremental innovation is an integral part of the whole innovation process. Therefore, incremental innovation is a useful and indispensable attempt, which should be paid attention to. However, the lack of advanced incremental innovation will make enterprises stop and create impossibly better products, services and markets.

2) Major innovation. For the users and the enterprises wishing to gain rapid growth, the role of major innovation is greater than that of progressive innovation. Through major innovation of products and services, though not a breakthrough, it is also in line with the expected development goals of enterprises, which can increase sales, expand market share and reduce operating costs.

3) Breakthrough innovation. Some new products, new services, or new strategies can significantly increase the income and net profit of the enterprise, which can be called breakthrough innovation. The process improvement is also a breakthrough innovation by improving the quality and significantly reducing the cost through process improvement. Sometimes breakthrough inventions can also make enterprises get breakthrough innovation. Breakthrough invention is the rapid development of mankind in the way of development. It can brew a new industry, such as computers, televisions, Internet, mobile phones and so on, all of which are breakthrough innovative achievements.

4.3 Global Innovation

The new way of innovation in twenty-first Century is global innovation. US Business Weekly has repeatedly ranked the world's most innovative companies in the annual rankings. Apple, Google, TOYOTA, General Electric and Microsoft have been the most creative companies. The innovation of these enterprises is global innovation, and the work mode of each department and business unit of the enterprise will be affected and changed. First, executive and departmental leaders are the direct promoters of enterprise innovation. The importance of their innovation is not on slogans, but in action, with great enthusiasm, through the establishment of goals, performance evaluation, incentive mechanism, resource allocation and other work to support the comprehensive development of enterprise innovation.

The outstanding feature of these enterprises is that in order to achieve the strategic goal of innovation from the top to bottom, the whole enterprise is committed to bottom up innovation.

These enterprises are very clear that accelerating the growth of enterprises must promote innovation, and the promotion of innovation can guarantee the formation and Realization of new ideas. No matter where these new ideas come from, they are managed by new methods, constantly stimulating and improving new ideas, improving the chances of innovation success, and ultimately creating updated products, processes, services and strategic models, reducing costs and improving profitability.

Of course, it is the most difficult for enterprises to find innovative ideas that can promote the growth of the enterprises. Only through systematic and continuous systematic methods can we find new ideas of value. In addition, some unconventional techniques are also required to seek the needs of potential users and find new opportunities for the future.

5. Innovation evaluation standard and evaluation index system

5.1 Principles for formulating the standard of innovation evaluation

For most enterprises, it is an important thing to make an innovative evaluation standard, because without these criteria, the effect of innovation can’t be measured. The leading innovative enterprise leaders believe that the way you evaluate the innovation process determines what type of innovation you choose, and the effect of this innovation. Innovation evaluation standards can help enterprises to make decisions on innovation type selection, product, process, and business model innovation.
The principles of making innovative evaluation criteria are as follows:

1) Evaluating the proportion of income created by new products and new services to the total income

The general practice of evaluating the effect of innovation is to calculate the proportion of new products and new services invested in the market in the past few years (usually 4~5 years) in the year. In recent years, many famous innovative enterprises have been very happy to see that this proportion has reached a high level.

The reason for this principle is based on the reliable results of a certain study. The proportion of new products and new services is a key indicator for the success of enterprises (not a direct causal relationship, but a correlation), not only in raising revenue but also in investor returns.

2) Prevent innovation goals from disjointing the results of innovation

Innovation is a very complicated work, for enterprises that have just begun to set up innovative standards, they should not only prevent innovation objectives from breaking away from innovation results, also encourage the leaders of all sectors to change their habit of thinking, and encourage them to put innovation at the top of the thinking question.

Some innovative enterprise leaders concluded: assuming that all sectors have allocated profit indicators and the year-end bonus of departmental leaders is determined according to profit growth, they will not be willing to develop new products, because they do not want to bet on profits. Therefore, this practice is harmful to innovation. However, if the sales growth is rewarded, the department leaders will disregard the profits and promote the growth of sales. Therefore, there is a balance between profit and sales growth. In this balance, the factors of the new business should also be considered, and the development of the new business should be supported with the existing profit.

It is the main responsibility of business leaders to design an innovative evaluation standard that can play an incentive role without adverse consequences. It needs careful consideration, reflecting fairness and clarity, and preventing future disconnection between goals and results.

5.2 Establishment of evaluation index system and evaluation model of innovation ability

How to evaluate the innovation ability of a unit is a hot topic. Because of the different nature of the units and the different of its environments, the factors reflecting their innovation ability are also different, so it is difficult to evaluate their innovation ability by a general evaluation criterion. Here we give a more general construction method of the evaluation index system and the evaluation modeling method.

1) Constructing the evaluation index system of innovation ability. Generally speaking, first of all, we should establish an evaluation index system that can reflect the innovation ability of the unit, combining with its own characteristics. The index system is usually composed of a total goal and a number of indicators that affect its role, and each index can also have a sub-index that affects its role. A business unit as an example, the total index is the enterprise innovation ability; the lower level index is mainly described by the enterprise innovation investment ability, the enterprise innovation management ability, the enterprise innovation output ability and so on; each index can also be composed of several indicators to describe, for example, the innovation input ability of enterprises can also be described by the ratio of innovation investment to total investment, the proportion of innovative R&D team in the organizational system, and the proportion of innovative talents in all employees. Finally, they are built from top to bottom into a hierarchical hierarchy.

2) Establishing the evaluation model of innovation ability. At present, the more feasible evaluation methods include the analytic hierarchy process (AHP) and the comprehensive index method.

The basic steps of using AHP is: On the basis of the hierarchical hierarchy structure, Establishing a judgment matrix for each layer of each layer on the upper layer; Using a unified scale (1~9),Comparing between each index (element); then the weight vector is calculated by the computing software and the consistency check is carried out. We should emphasize that we use the analytic hierarchy process to get the relative weight of each element (evaluation index), and each index is usually a specific quantitative index, so we should establish membership function of each index and normalize different ranges of values, the general form is shown as formula (1) and

formula (2):

$$f(x) = (x - x_{\min}) / (x_{\max} - x_{\min}) \tag{1}$$

$$f(x) = (x_{\max} - x) / (x_{\max} - x_{\min}) \tag{2}$$

The formula (1) is the bigger the better the model, the formula (2) is the smaller the better the model. Then the value of innovation ability is calculated by using the weighted mean method. The general form is as shown in formula (3):

$$S = \sum_{i=1}^{m} \sum_{j=1}^{n} f_{ij} \cdot w_{ij} \tag{3}$$

The basic steps of the comprehensive index method is: using the AHP method or expert scoring method to determine the weight of each index value (w_i); according to the actual experience or expectations to determine the standard value of each index (x_i'); the actual value of each quantitative index (x_i) is divided by its standard value respectively, and the evaluation index of each index is obtained.; finally, the weighted average of each evaluation index is calculated. The general form is as shown in formula (4):

$$S = \sum_{i=1}^{m} x_i \cdot w_i / x_i' \tag{4}$$

In addition, it is possible to make use of other decision-making methods such as network analytic hierarchy process（ANP）to calculate the ability of innovation.

6. Conclusion

In a word, innovation is the soul of a nation's progress, and it is also an inexhaustible motive force for a country and an enterprise to flourish. Based on the current research on innovation, this paper summarizes the concept and connotation of innovation, analyzes the types and levels of enterprise innovation, and puts forward the criteria and basic models of enterprise innovation evaluation. Since innovation is a complex systematic project involving all fields of human social life, it is impossible to study the problem of innovation comprehensively, but I believe it will be meaningful to do this research.

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