Assessment on IT-based Technical Innovation of the Subordinate Company of the Corporation

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Abstract: Information technology (IT) is one of the most important means by which companies can win an advantaged position in drastically competed market. It has a positive effect on the advancement of the corporation’s technical innovation. The application of IT can promote the communication among subordinates of a corporation or group, reduce explicit boundaries of the subordinates, and boost the ripple effect of technical innovation of the subordinates. Not only does any subordinate company within a corporation need to assess both technical and economic benefits brought to the corporation itself by technical innovation, but also it should thoroughly analyze how the ripple effect of technical innovation among subordinate companies plays a significant role in the boosting value of the corporation as a whole. In this paper, a scientific approach to assessing technical innovation of a subordinate company is proposed through analyzing the ripple effect of IT-based technical innovation on subordinate companies.

Key words: corporation; subordinate company; assessment of technical innovation; ripple effect; information technology

The level of corporate technical innovation has increasingly become the key factors deciding the survival and sustainability of a corporation in a competing environment in which science and technology develops rapidly. The organizational boundary of the company has been obscured with the application of IT. For a corporation, integration of corporate benefits dedicates the subordinate companies with a closer relationship of science and technology and a higher level of technical innovation. Accordingly, assessment towards the subordinate company not only must reflect the characteristic of integration of corporate benefits and the interactional benefits amongst all subordinate companies, but also reflect the ripple effect promoted by the application of IT.

1 IT-based Technical Innovation of the Corporation

1.1 The Effect of IT to Technical Innovation
The rapid development of IT has become necessary to obtain the information and seize the position in a competing international market. With the application of IT, the corporation can gather and manage the information and resource concerned with the development of the corporation, assist the technical innovation and heighten the core competence of the corporation. The corporation’s characteristic of integration of benefits impulsion by the advancement of IT would broaden the outside collaboration and strengthen the ripple effect among subordinate companies.

1.2 Significance of Assessment on Technical Innovation of the Subordinate Company
Technical innovation in fact plays a vital role to the development of the corporation. Technical innovation of the subordinate company not only promotes the company’s technical level and economic benefits but also generates the ripple effect among all subordinate companies within the corporation, the ripple effect in the corporation is more prominent than that of external corporation. Given such circumstances, the corporation may acquire further growth than that of each subordinate company.

It is far inadequate to evaluate technical innovation of the subordinate company only from the traditional perception because more attention should be paid to the ripple effect. For the corporation, the ripple effect can be enhanced because of the the subordinate company’s fuzzy boundary caused by the application of IT. The approach assessed technical innovation of the subordinate company embodies characteristic of integration of the corporate benefits, it can evaluate the technical innovation project of the subordinate company more reasonably and motivate the
subordinate company to drive its own development more effectively. Those characteristics, for the purpose of enhancing the corporate overall benefits, are very efficient in helping the corporation decrease economic loss.

2 Status of Research

In consideration of significance of approach to assess technical innovation of the enterprise, researchers both at home and abroad have made a lot of research on it.

The world witnesses a dramatic development in the fields of project selection assessment and decision-making approaches, in particular the assessment model, since Mottley published his first paper on the project selection. More than 150 assessment models were created in 1960's\(^1\). The initial researches were mainly on the establishment of the models, but only from the theoretical viewpoint. Since 1990’s, research on the assessment approach has been gradually suitable for the development of enterprise and figured out the approach for the different enterprise. Upon researching and analyzing the assessment criteria employed by the Singapore’s and Japan’s adventure capital companies, Ray claimed that the most important factors of adventure capital are the personal quality and experience of the entrepreneur\(^2\). Smitham pointed out that when evaluating the opportunities of adventure capitals, more attention should be paid to seeing if creative ideal is valid, the performer is qualified and the enterprise has appropriate strategy and plans\(^3\). Cao and Zhang suggested that the fuzzy theory may be used to further improve the assessment, which was towards hi-tech project investment on the basis of net present value (NPV), and its improved method substantially restrict evaluation of hi-tech project\(^4\). Wei, Xia, and Li applied the analytic hierarchy process (AHP) and fuzzy comprehensive assessment method to study the risks in decision-making for the projects\(^5\). Zhan considered that IT can influence the manner, means, process, source, production and application of technical innovation\(^6\). So, it’s necessary for the company to promote the advancement of IT to seize an advantaged position in the competing environment.

A series of relevant research on the assessment approach has been carried out, and accomplishments have been achieved too. However, quite few researchers concentrate on the assessment approach of technical innovation investment, particularly that of the subordinate company which is influenced by the rapid development of IT. The traditional approach fails to precisely set the standard to stimulate technical innovation of the subordinate company, properly guide the corporation to stimulate, and promote the development of its innovative capability more effectively. To study the assessment approach of technical innovation of the subordinate company and the analysis of its ripple effect are able to promote the development of the subordinate company’s technical innovation and heighten the corporate economic benefits.

3 Study on Technical Innovation of a Subordinate Company

Not only are we required to take into account input and output of technical innovation of each subordinate company and the fuzzy boundary caused by the application of IT but also should put the ripple effect in evaluating the group’s technical innovation. That is, the ripple effect of the corporation’s technical innovation refers to that of its subordinate company. The other subordinate companies within the corporation may acquire the technical benefits by means of technical and economic transference among subordinate companies, which may affect the corporation’s benefits.

3.1 Viewpoint of Research

With the development of IT, new benefits and achievement brought by technical innovation of one subordinate company can be transfered amongst all subordinate companies, which can be reflected by its ripple effect. For this reason, we start mainly with the ripple effect of technical innovation among subordinate companies to analyze the assessment approach. In this paper, we suppose that the development level of IT can adapt to the speed of technical innovation. Accordingly, we can figure out that the coefficient of ripple effect is the coefficient of the subordinate company.

3.2 Establishment of Indicator System

None of the indicator systems at home and abroad is deemed to be the standard in appraising the new project of technical innovation owing to its complexity. In the corporate technical innovation’s context, input and output indicators of technical innovation of the subordinate company as well as the corporation itself were set up by consulting Deng and Chen\(^7\&8\),
respectively. However, the sum of technical innovation investment of the subordinate company is by no means equivalent to that of the corporation. The difference is in fact affected by many factors, among which the ripple effect of technical innovation is crucial and it explains why we do the research on this topic. The indicator system we built must combine with technical innovation of the subordinate company and reflect the characteristic of technical innovation of the subordinate company.

We assess input on technical innovation of a corporation from three aspects as follows.

1) The assessment indicators: R&D investment capital, non-R&D investment capital, per capital R&D investment capital, profit margin of new product, cost reduction of new product, and sales of new product.

2) The ripple effect indicators: investment coefficient of technical innovation, inverse matrix coefficient, and ripple effect coefficient.

We incorporated Chen and Gan results with identification of characteristic of ripple effect of technical innovation within the corporation so as to determine the ripple effect indicators. The ripple effect of the corporation is to determine its coefficient by building the coefficient models, the result of the ripple effect coefficient multiply technical innovation investment of the subordinate company equals to the ripple effect benefits of technical innovation.

3) Indicators of the corporation’s benefits growth: the corporation’s benefits growth rate, ratio of product costs reduction, and ratio of the corporation’s sales increase.

The overall benefits of the corporation arising out of technical innovation are equivalent to the sum of benefits of technical innovation of the subordinate company plus its ripple effect, other factors should be taken into account.

3.3 Ripple Effect Indicator

3.3.1 Ripple Effect

The ripple effect means that, after the investment project enters into the economic system, may build up the various technical and economic contacts with the economic departments and social environment outside of the project. The project is affected by the external factors and also affects outside of the project. Vividly speaking, it is like a ripple that is caused by a stone thrown into water.

Benefits of the investment project caused by technical innovation in the subordinate company may be transferred among all subordinate companies. The degree of transferring (directly and indirectly) relies on the intimacy of technical and economic relationship of all subordinate companies. On a large scale, the correlation of technology and economy is decided by the development level of IT.

3.3.2 Identification of Indicators of the Ripple Effect

1) Model of input coefficient chart

Input coefficient:

\[ a_{ij} = \frac{q_{ij}}{Q_j} \]  \hspace{1cm} (1)

where \( q_{ij} \) (\( i, j = 1, 2, \cdots, n \)) is the \( i \)th company’s consumption of the quantities of the products that produced by \( j \)th company; \( Q_j \) is the total output of the \( j \)th company.

Input coefficient is calculated as follow:

\[ A = (a_{ij})_{n \times n} \]  \hspace{1cm} (2)

where \( A \) refers to the input coefficient, \( a_{ij} \) means that the unit value of production of the \( i \)th company directly consumes the products or service of the \( j \)th company, so \( a_{ij} \) indicates the intimacy of the subordinate \( i \)th company and \( j \)th company in terms of production and technology, that is, the bigger value \( a_{ij} \), the closer relationship of production and technology between the subordinate company \( i \) and \( j \). If \( a_{ij} \) = 0, it indicates that the two subordinate companies have no direct production and technical contacts. The \( i \)th row in \( A \) refers to the direct input product quantities that \( i \)th company dedicates to all other company’s per unit of production value; the \( j \)th column refers to the unit value of production of the \( j \)th company intermediarily consumes the products or service of other subordinate company.

2) Model of Inverse Matrix Coefficient Chart

We can use the inverse matrix coefficient chart to calculate the subordinate company’s ripple effect, specified as follows:

\[ B = (b_{ij})_{n \times n} = (I - A)^{-1} \]  \hspace{1cm} (3)

Where \( B \) is the inverse matrix coefficient chart, \( b_{ij} \) refers to the production output of the subordinate \( j \)th company when the subordinate company invests one more unit of technical innovation investment, and \( I \) refers to the unit matrix.

According to the inverse matrix coefficient chart, we can calculate the coefficient of ripple effect of the subordinate company. The coefficient of ripple effect equals to the sum of the column elements of the inverse matrix.
4 Features of Assessment Approach

In comparison with the traditional approach, the IT-based assessment approach of the subordinate company’s technical innovation has evaluated the subordinate company’s technical innovation influenced by the ripple effect (In this paper, we only take the promotion effect that IT makes to the ripple effect into account). The ripple effect coefficient is calculated to identify the influence of ripple effect upon all subordinate companies and the indicator system of technical innovation is divided to review economic benefits of technical innovation input from the subordinate company and the corporation respectively. The approach combined with the modern IT to assess technical innovation of the subordinate company within the corporation embodies integration of the corporation’s benefits, containing its ripple effect promoted by the application of IT, which is more reasonable in assessing technical innovation of the subordinate company under the corporation in comparison with the traditional approach. Hence, the approach we has created is more realistic and plays an active role in guiding the subordinate company on technical innovation investment.

5 Conclusions

From the corporate perspective, considering the characteristic of the corporation’s IT, this paper has established the systematic and improved indicator system for assessment, determined the assessment standard and achieved a reasonable evaluation of technical innovation of the corporation. For technical innovation of the corporation, as suppose, the effect of IT has been considered, we only took the influence of ripple effect among all subordinate companies to the corporation’s total benefits into account, other factors affecting the corporation’s economic benefits as well as the degree of their effects should be decided by further studying.

References

Brief Introduction to Author(s)

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