Cooperation Model of School Enterprise Cooperation Innovation

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Abstract. In this paper, the cooperation mode of Zhuhai University and enterprise will be studied and analyzed, through establishing a trust system to build collaborative innovation's trust platform. And use the specific example to prove the research methods of this paper, which promote the development of school and enterprises’ cooperation innovation.

Introduction

President Hu Jintao clearly stated at the Tsinghua University Centennial Conference: "to promote collaborative innovation actively, through the system, mechanism innovation and policy guidance, encouraging universities with scientific research institutions, enterprises to carry out in-depth cooperation, the establishment of strategic alliance to promote collaborative innovation’s resource sharing, joint research on major research projects, to achieve substantial results in key areas, effort to make a positive contribution to the construction of an innovation country." [1] In recent year, both home and abroad has researched the cooperation mode of school-enterprise collaboration innovation. May 2016, Xi Jinping of the three science and technology show that: "enterprise, research institution and colleges as the main innovation, promoting collaborative innovation among them, it plays an important role in the thick academic foundation, combined with the subject characteristics, promote collaborative innovation, service industry and society. Cultivating the talent team with requirements of innovation development, can bring greater technical route decision-making power, greater funding control, greater resource mobilization rights for researchers, it has far significance to develop innovation potential."

Singapore's "teaching factory" model [2], Danish "simulation Gang" model [3] is based on school’s school-enterprise cooperation mode. The main feature of this mode is school-based, supplemented by enterprise, cultivating applied talents, cooperation and development level is relatively shallow. The German" dual system"[4] is based on enterprise cooperation mode. The main feature of this mode is enterprise-based, supplemented by school, and profit maker mainly are enterprises, students training level is high and ideal employment. It specifically refers to students' professional knowledge and general knowledge of science and culture, accept enterprise practical skills training later, is the training goal for applied talents in the end. "The significant characteristics of dual mode is healthy and stable relations of cooperation between schools and enterprises, the cooperation relationship once establish, will be a long-term stable cooperation, production’s effectiveness is the most attention to the point between the two sides. The United States "cooperative education" mode [5] is the enterprise and school mode, schools and enterprise to invest in cooperation on equal, mutual benefit and win-win, training is the comprehensive quality talents, and the level of cooperation is depth. The typical industry-based school-enterprise cooperation mode is Australia's "TAFE", namely "technology and continuing education", which is a National vocational education and training institutions by the government, the State Administration of common training, the National Vocational Education Research Center and Industry Training Advisory Committee co-management, it plays an important role [6]. In our country, a classic cooperation model is the Shanxi Industrial Vocational College "before the school after the factory" model, that is in front of the school, behind the factory school-enterprise cooperation, mainly the production and operation of factory will be moved into the
school, as a student training base, the school's "backyard", formed in the school factory, functional partition, production integration’s pattern, in return, the training qualified products owned enterprise, students directed to the enterprise after graduation. But a lot of talents training in Colleges and business need are not closely integrated, the enterprise participate in training awareness is not enough, enthusiasm is not high. In addition, the government is lack of effective fiscal policy, and a series of laws and regulations support and coordinate. Many universities is still superficial in the process of talents training, and did not practice deeper, collaborative innovation has not been well developed. In the paper, aimed at the present situation of cooperative innovation in China, through establishing cooperative innovation platform and ways to promote the development of cooperative innovation.

The Establishment of Collaborative Innovation Trust Platform

Trust in all aspects bear a significant role cannot be ignored, whether enterprise or university, we all want to have an efficient, low-cost cooperation. When the two sides have trust relationship, you can reduce mutual suspicion, thereby reducing the supervision and encourage each other's funds, the total cost is also indirectly reduced. Trust can also ensure effective cooperation between the two sides, because trust between each other can enhance the sense of responsibility, enthusiasm and creativity. For the government, the government is an important promoter and participant of production collaboration innovation, and has a positive role in promoting the cooperation between universities and enterprises. It is the duty for government to formulate and perfect the various systems, and to guide and support the cooperation of university enterprises. At this time, the government has played a role as an intermediary. As a participant of collaborative innovation, universities should fully understand their own advantages and relationship resources give full play to the talent resources and academic achievements of universities, take the initiative to strengthen cooperation with enterprises, and improve their own deficiencies. Enterprises to improve the school-enterprise cooperation and trust, first of all, according to their technical requirements and strength, comprehensive various factors, choose their own universities to cooperate. Second, cooperation in universities, enterprise should take the initiative to communicate with universities, to prepare for the university can fully understand enterprises need, which can be targeted to learn the relevant technology. In the process of cooperation, school and enterprise will sign an agreement to ensure the smooth progress of cooperation, but sometimes there will be breach of contract each other, so between schools and enterprises also need to have a complete trust mechanism to ensure the sustainable development.

Universities and enterprises are through the trust mechanism to understand and judge the other party's trust foundation. The government first formulates the related policy, ensure that there is a policy to control the conditions of both sides in the process of collaborative innovation. Then enterprises and universities have a system of trust to judge each other's trust, so as to decide whether to cooperate with each other. Here, using AHP analytic hierarchy process to determine the degree of trust between the two parties [7].

First, put all the factors into a hierarchical structure, establishing a three-tier collaborative innovation level structure model, as shown in Figure 1.
Figure 1. The hierarchical structure model of collaborative innovation.

Second, construct a pairwise comparison judgment matrix: that is to compare the importance of the factors influencing the trust system, and get the pairwise comparison matrix. Let the standard layer contains five criteria, C1: visibility, C2: capital investment, C3: risk sharing mechanism, C4: communication skills, C5: knowledge sharing. W is the weight of influencing factors, and construct the judgment matrix $A = a_{ij}$ (the weight ratio of every two factors). The matrix elements $a_{ij} = C_i / C_j$ (i, j represents the element, where ij is an integer). Assuming that the C1 - C5 factors of the trust body constitute the comparison judgment matrix is:

Assuming that $a_{12} = 1/2 = C1 / C2$, indicates the importance of C1 (visibility) to the trust system is 1, the importance of C2 (capital investment) to the trust system is 2. Other factors are similar.

Generally use the proportion of 1-9 scaling method to construct judgment matrix $A = | a_{ij} |$. The meaning of the proportion of 1 to 9 scale such as table 1:

<table>
<thead>
<tr>
<th>value($a_{ij}$)</th>
<th>Express meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>$a_{ij}=1$</td>
<td>Compared with the two elements, with the same importance</td>
</tr>
<tr>
<td>$a_{ij}=3$</td>
<td>Compared with the two elements, the first element is slightly more important than the other element</td>
</tr>
<tr>
<td>$a_{ij}=5$</td>
<td>Compared with the two elements, the first element is significantly more important than the other element</td>
</tr>
<tr>
<td>$a_{ij}=7$</td>
<td>The first element is much more important than the other element</td>
</tr>
<tr>
<td>$a_{ij}=9$</td>
<td>The first element is more important than the other element</td>
</tr>
<tr>
<td>$a_{ij}=2, 4, 6, 8$</td>
<td>The median of these judgments</td>
</tr>
<tr>
<td>$a_{ij}=1/a_{ij}$</td>
<td>Factor i and j compared to determine $a_{ij}$, then the factor j and i to determine the comparison is $a_{ij}=1/a_{ij}$</td>
</tr>
</tbody>
</table>
Thirdly, the factors of the same level are sorted by the sum-product method, calculating the weight of each factor to judge the trust of each other, and \( w = [w_1, w_2, \ldots, w_n] \) is express the influence weight of \( c_1, c_2, \ldots, c_n \) on the trust system, \( n \) is the number of influencing factors, The weighting is calculated as:

1) Each column of the judgment matrix is normalized

\[
a_{ij} = \frac{a_{ij}}{\sum a_{ij}} \quad (i=1, 2, \ldots, n, j=1, 2, \ldots, n)
\]  

2) The normalized judgment matrix is added by the row to get the vector of weights \( \overline{w_i} \), \( i \) is the \( i \)-th factor that affects the trust.

\[
\overline{w_i} = \sum_{j=1}^{n} a_{ij} \quad (i=1, 2, \ldots, n)
\]

3) The vector \( \overline{w_i} = (\overline{w_1}, \overline{w_2}, \ldots, \overline{w_n})^T \) is normalized to get the weight \( w_i \).

\[
W_i = \frac{\overline{W_i}}{\sum W_i} \quad (i=1, 2, \ldots, n)
\]

Fourth, the consistency test. As the judgment matrix may appear inconsistent phenomenon, for example, a more important than 2 times b, b than c important 3 times, and then say c is more important than 2 times, which is a problem, this is the so-called inconsistencies. Since the judgment matrix is given by human, it is necessary to carry out the consistency test that is to evaluate the reliability of the judgment matrix. Where \( n \) is the matrix order and \( w_i \) is the weight of the matrix A, the largest eigenvalue of the judgment matrix is calculated.

\[
\lambda_{max} = \frac{1}{n} \sum_{i=1}^{n} \frac{a_{ij} \times W_i}{W_i} \quad (i=1, 2, \ldots, n)
\]

1) \( I \) is the consistency index, the formula (5) is obtained by the formula (4), and the more the value \( \lambda \) is larger than the value of \( n \), the more the inconsistency of A is. So you can use \( \frac{\lambda - n}{n-1} \) value of the size to measure the degree of inconsistency of A.

\[
I = \frac{\lambda_{max} - n}{n-1}
\]

2) \( R \) is the random consistency index, which is obtained by repeatedly calculating the eigenvalues of the random judgment matrices and then taking the arithmetic mean. The following table shows the stochastic consistency index of the 1-10 rank:

<table>
<thead>
<tr>
<th>Matrix order n</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>0</td>
<td>0</td>
<td>0.58</td>
<td>0.9</td>
<td>1.12</td>
<td>1.24</td>
<td>1.32</td>
<td>1.41</td>
<td>1.45</td>
<td>1.49</td>
</tr>
</tbody>
</table>

3) Calculate the consistency ratio \( K = I / R \), \( K \) is used to determine the inconsistency tolerance of matrix A. When \( K < 0.1 \), it is considered that the consistency of the judgment matrix is acceptable; when \( K \geq 0.1 \), the judgment matrix should be modified appropriately.
Fifth, calculate the weight of each combination (each target relative to the total target weight). Since the judgment matrix is calculated, the characteristic value is obtained only by the weight of each factor under a certain criterion, it cannot calculate the weight of each index relative to the overall goal. Therefore, the final combination of factors must also be calculated weight. According to formula (1) and (2), formula (3) can be obtained, and formula weight can be calculated by formula (3): \( W = W_1 + W_2 + \ldots + W_i \) (i \( \leq \) 5). The higher the value of \( W \), the higher the degree of trust. After this formula, the comprehensive evaluation value of the trust is obtained, determining the certain school-enterprises’ trust level and achieving the trust evaluation.

**Summary**

In this paper, we analyze the factors that affect the trust between the school and enterprise, establish the trust platform to build the school-enterprise cooperation model, try to study the Aah analytic hierarchy process to evaluate the degree of trust, through the hierarchical method to calculate the trust weight. The chance of being selected as a partner is also high. However, there are some limitations in this paper. The subjective nature of Aah is subjective, which leads to the subjectivity of the result. Therefore, it must have more qualitative color. This can be changed by dynamically modifying the weight of the evaluation index.

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