Structure of Innovation Ability Evaluation System for Industrial Design Service Enterprises in Hebei Province

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Abstract: To improve innovation ability of industrial design service enterprises, we used methods like literature review, expert interviews and survey analysis, and constructed to adapt to present situation in Hebei province from four aspects of industrial design service enterprise innovation ability index system: allocation of resources, knowledge production, social influence and economic output preliminary. And we use AHP to determine the index weight coefficients. It is advantageous to the enterprise control index system to evaluate and improve their ability to innovate. The evaluation system is of guiding significance to both enterprises and governments.

1. Introduction

Nowadays when “manufacture” turns to “intelligent manufacture”, the development of industrial design service enterprises has an increasingly far-reaching impact on a country or region, and innovation ability is the core competitiveness of enterprise development. How to improve the innovation ability of industrial design service enterprises is particularly important. Establishing an suitable evaluation system for present innovation ability of industrial design service enterprises in Hebei province can help enterprises accurately position themselves in the competitive market, and cultivate their own innovation ability so as to promote the development of the design industry and even the manufacturing industry, and facilitate the industrial transformation and upgrade in Hebei province.

2. Current Situation of Industrial Design Service Enterprises in Hebei Province

Industrial design service industry is the core production unit of industrial design. It provides industrial design services based on the idea and innovative design of industrial designers to manufacturing enterprises from the aspects of conceptual innovation, design appearance and design marketing plan, etc. Hebei province and industrial design related arts and crafts, graphic design and other technical services institutions nearly 200. Its business covers advertising design, cultural industry design, industrial design, product design, appearance design and many other industrial design fields. According to data under industry classification from the tax bureau of Hebei province, Hebei province has more than 1222 industrial design services company. Annual operating income distribution of industrial design service enterprises in Hebei province is shown in table 1.

Table 1 Distribution of Annual Operating Income of Industrial Design Service Enterprises in Hebei Province (Unit: Home)

Less than 0.5 million	0.5-1 million	1-5 million	5-10 million	More than 10 million	Total
993	80	129	14	6	1222

3. The Research Status of Enterprise Innovation Ability At Home and Abroad

In fact, enterprise innovation ability is the comprehensive ability of using the market, and technical ability to complete innovation activities. In recent years, some scholars have carried out researches on the influencing factors of enterprise innovation [1]. For example, according to Jing Li

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(2016), based on grounded theory, research and development strength, entrepreneurship, market demand and other factors determine the innovation of enterprises. Curado (2018) explained the impact of interpersonal relationship, knowledge sharing and other factors on innovation of smes from the perspective of human resource management [2]. In the research on the index system of innovation ability, many scholars make in-depth exploration. For example, Yao Liu and Xinjian Huang (2008) established an index system mainly including innovation input ability, innovation implementation ability, innovation realization ability and management system innovation ability [3]. Liping Xu, Xiangrong Jiang and Chong Yin (2015) established an index system mainly including innovation input ability, innovation implementation ability, innovation realization ability and innovation ability of management system [4]. Based on the current (domestic and overseas) research situation, the innovation ability of existing enterprises is greatly affected by human factors. Therefore, this paper is suitable for the innovation ability evaluation system of industrial design service enterprises in Hebei province, and has reference significance for the innovation ability evaluation of industrial design service enterprises.

4. Contents of the Evaluation Index System of Innovation Ability of Industrial Design Service Enterprises in Hebei Province

On the basis of in-depth study of relevant literature, experts conducted field research and interviews for many times, and combined theories with practice, obtained the index system applicable to the innovation ability evaluation of industrial design service enterprises in Hebei province at the present stage, which is as follows:

4.1 Source of First-Level Indicators of Innovation Ability of Industrial Design Service Enterprises in Hebei Province

Industrial design services to enterprise innovation ability evaluation system index should be less as possible and valuable and to be able to fully reflect the size of the industrial design ability and level in Hebei province, but also connect with the existing statistical system, the selection of indicators must cover all aspects of the input and output of enterprise, mainly including the allocation of resources, knowledge production, social influence and economic output four aspects.

4.2 Sources of Indicators for Each Subcategory of Innovation Ability of Industrial Design Service Enterprises in Hebei Province

4.2.1 Resource Allocation

In order to understand and master the innovation ability of industrial design service enterprises in Hebei province, the selected resource allocation index must reflect the investment of enterprises[5].Therefore, the selected index includes not only the talent resources within the enterprise, but also the capital of the enterprise.

4.2.2 Knowledge Output

The knowledge output capacity of industrial design service enterprises includes patent output capacity and the number of industrial design awards. The number of patent and copyright applications reflects the degree of technological innovation of enterprises and the enthusiasm of inventors to seek patent protection and copyright [6]. There are four kinds of such indicators: number of invention patents, number of utility model patents, number of design patents and number of copyright registration.

4.2.3 Social Influence

Industrial design works can represent the strength of the company, will be recognized by the domestic and international industrial design industry, and reflect the status of industrial design service enterprises in Hebei province in the international and domestic, so choosing domestic and international awards to reflect the social impact of enterprises. In addition, the integration of industrial design industry and related industries is also very important. After experts' discussion and

investigation of enterprises, they concluded that the amount of design contracts signed can reflect the interaction and integration between industrial design service enterprises and related industries as well as the innovation and development potential of enterprises.

4.2.4 Economic Output

In addition to knowledge output, economic output is also a major consideration in this paper. After experts' discussion and enterprises investigation, they concluded that the annual income of design activities can reflect the current economic situation of enterprises and the development potential of enterprises, which mainly includes design service income, other service income and product sales income.

Finally, the evaluation factors reflecting industrial design service enterprises in Hebei province are shown as follows.

(1) Resource allocation. Including the proportion of personnel engaged in industrial design activities in all employees, the proportion of designers in all employees, the proportion of senior or senior designers in all employees, the original value of industrial design hardware equipment, the original value of industrial design software, the proportion of annual investment in design activities in the main business cost.

(2) Design output. Including the number of industrial design products, the proportion of original industrial design products in the number of industrial design products, the number of invention patents, the number of design patents, the number of copyright registration.

(3) Social influence. Including the number of awards won abroad, the number of awards won in China, the number of design contracts signed, and the amount of design contracts signed.

(4) Economic output. Including the proportion of the annual revenue of design activities in the operating revenue, the proportion of the annual revenue of design services in the annual revenue of design activities, the proportion of additional design revenue in the annual revenue of design activities, and the sales revenue of self-run brand products.

5. Use Analytic Hierarchy Process to Determine the Weight Coefficient

In this paper, the index system is weighted by the analytic hierarchy process. First, the judgment matrix is constructed $A=[a_{ij}]_{m\times n}$, $0<a_{ij}\le 9$.And the judgment matrix is obtained according to the expert interview. Then, the only maximum positive characteristic root corresponding to the vector itself is obtained according to the judgment matrix [7]. Finally, consistency test was carried out to obtain the weight vector of each factor in the evaluation index system of innovation ability of industrial design service enterprises in Hebei province, as shown in table 2.

Table 2 the Weight of Each Factor in the Evaluation Index System of Innovation Ability of Industrial Design Service Enterprises in Hebei Province

First-level	Index weight (%)	Second-level	Index weight (%)
Economic output	56.77	Annual income from design activities	45.65
		The proportion of annual revenue of design activities in operating revenue	29.17
		The proportion of design service income in the annual income of design activities	12.35
		The proportion of additional design income in the annual income of design activities	5.02
		Self-brand product sales revenue	7.81
The allocation of resources	23.96	Personnel engaged in industrial design activities account for the proportion of all employees	41.49
		Designers account for the proportion of all employees	17.85
		Senior or senior designers account for the proportion of all staff	19.44
		Original value of industrial design hardware equipment	9.55
		Original value of industrial design software	7.95
		The proportion of annual investment of design activities in the cost	3.70

		of main business	
Knowledge output	14.11	Industrial design product quantity	44.07
		The proportion of original industrial design products in industrial design products	29.25
		Number of invention patents	14.28
		Number of utility model patents	5.15
		Number of design patents	3.53
		Copyright registration approval	3.72
Social influence	5.16	Number of overseas awards	25.75
		Number of domestic awards	28.94
		Quantity of design contract signed	14.30
		To sign the design contract amount	31.01

6. Conclusion

Through the further research of enterprise innovation ability and the core of industrial design, combining with the analysis of the investigation, interviews of experts and enterprises to design and innovation as the core, the output from the allocation of resources, knowledge, social influence and economic output four aspects, preliminary built to adapt to the present situation of industrial design services in Hebei province enterprise innovation ability index system, for industrial design service enterprises in Hebei province has a certain universality. Industrial design service enterprise can according to the service enterprise innovation ability evaluation system of industrial design, self diagnosis, and digging their own potential as a reference or self innovation, strengthen management, leak fill a vacancy, improve their innovation ability, to adapt to the current development of market economy, so as to win in the fierce competition in the market.

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