

Equipment Manufacturing Standard System Innovation Method Research

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Abstract: Equipment manufacturing industry standard system became the basis intelligent manufacturing. In view of the current situation of the development of equipment manufacturing industry standard system, finding weak links for the existence, and solve practical problems although applies the method of information science and technology theory, and design Material&field model, and the method precision calibration, came up with the optimized solution feasible standard system innovation, and provides a new thought and method for the equipment manufacturing industry standard system construction.

1. Introduction

With the rapid development of information technology, the “Made in China 2025” national strategy and the “equipment manufacturing industry standardization and quality improvement plan” are strongly promoted, Equipment manufacturing standards in the market economy under the conditions and role of the more prominent. According to the authoritative statistics of the National Bureau of Statistics, China's equipment manufacturing industry witnessed a growth rate of 6.8% in 2015 and a share of 31.8% of the industries above designated size. The total number of manufacturing equipment standards accounts for about 80% of all China's standards^[1]. Since 21st century, equipment manufacturing industry standard system is in a stage of rapid development. Therefore, earnestly studying the innovation of equipment manufacturing standard system is not only the need of national innovation and development strategy, but also the proper meaning of wisdom manufacture. Based on TRIZ, this paper research equipment manufacturing industry standard system.

2. Development Status of Equipment Manufacturing Industry Standard System

Abroad, ISO/IEC and other international standardization organizations and industrialized countries equipment manufacturing industry standard system is very mature. The standard systems of the developed countries such as the United States, France, Germany and Japan all operate under the conditions of a market economy^[2-4]. In the operation of the standard system, firstly, there is a big gap between the developed countries in setting standards, formulating, examining and submitting reports, etc., which are manifested in the long period of standardization of equipment manufacturing industry, the relatively closed process and the relatively backward service means, the lack of information service platform, and smart manufacturing and smart factory requirements gap. Second, the traditional industrial standards of the transformation and upgrading of traditional industry standards in the past, although the production and operation played an important role, but with the rapid development of information technology, traditional industries more or less into the information elements, how to upgrade Industry standards are also a real issue. Thirdly, the implementation, supervision and service of the standard system are mainly based on the government's vigorous efforts to promote the



implementation of the standard system. There is no effective mechanism for extensive participation of the whole society. The above problems, we need to combine the actual situation, the use of scientific method theory innovation to solve the problem.

3. TRIZ theory

TRIZ theory was put forward by Soviet scientist Georges Altshuller on the basis of a careful study of 2.5 million high-level patents in all countries in the world. It is a set of scientific guidelines for the solution of invention problems. Mainly can be summarized as the following theoretical system^[5-7]: evolutionary law, final ideal solution, invention principle, contradictory matrix, matter-field analysis, standard solution, invention problem solving algorithm, scientific effect and knowledge base.

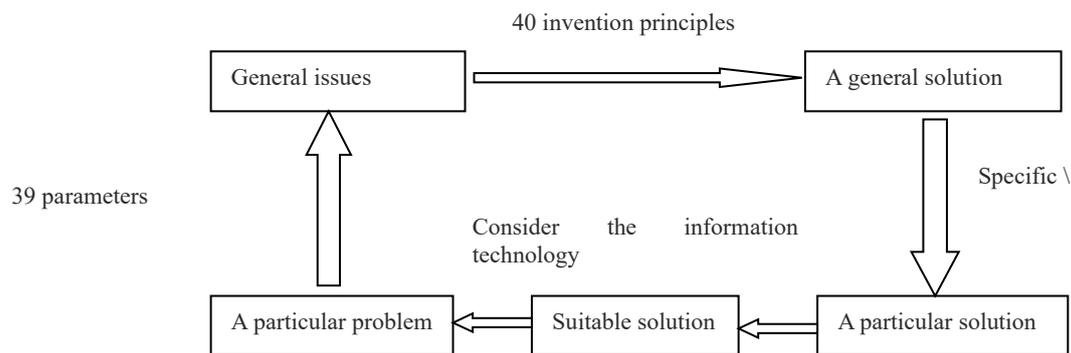


Figure 1 principle in solving the problem

With standard solutions, solutions to practical problems can be found and innovative designs can be completed. The object-field analysis model is a highly generalized model, which can be summarized into four types: ① effective model. The three elements of the function exist, and each other can fully play the role of the system to achieve the best results. ② inadequate model. Three elements of the function are complete, but can not achieve or only partially achieve the designer's intended interaction. ③ missing model. Three elements of the function is not complete, may only function and field, it may be only material and field. ④ harmful model. Although the three elements are complete, the resulting interaction is an inverse of what is expected and ways should be found to eliminate these harmful interactions. According to the actual conditions to further amend the best solution, in order to achieve innovative solutions to the problem. In order to optimize the above-mentioned many kinds of innovative schemes, need to use the intelligent algorithm, this text uses ANFIS network model to carry on the optimization assessment, and then find the optimal solution.

4. ANFIS Network Model

Its mainly refers to imitate human brain neural information processing function of intelligent systems. Its special fuzzy adaptive information data processing ability, can carry on the training with the help of outside of the sample data, using the trained network model to deal with the reality of the more difficult problem. ANFIS marked characteristics is based on a large number of sample data to study concluded that the fuzzy membership functions and fuzzy rules, not according to the experience of individual experts or any specified. Its core idea is first constructed Sugeno fuzzy inference system, the conditions in the hybrid algorithm parameters on the concrete practice of still take back propagation algorithm, using the linear least squares estimation method to adjust the parameters of the corresponding conclusion, in the process of approximation error function, use for optimal square estimation error, this network can maintain a steady and overcome in local minimum points, and can speed up the training data, further improve the learning efficiency, to ensure that assess a quantitative result can converge to the global minimum point of the parameter space. Its structure shown in Fig.2.

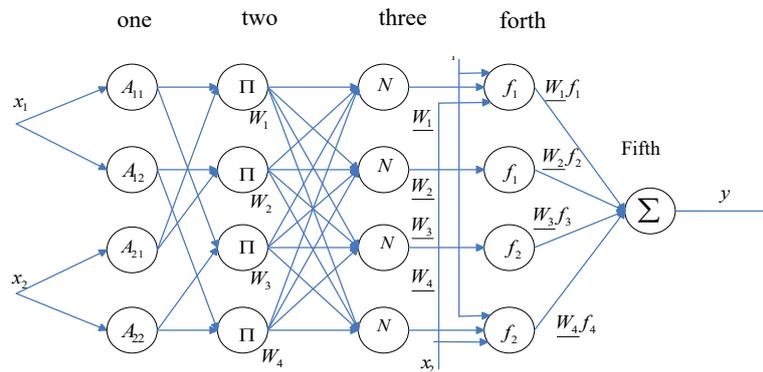


Figure 2 ANFIS network structure (double input single output)

5. Equipment manufacturing industry standard system innovation path choice

Equipment manufacturing standard system innovation, the main elements can be divided into manufacturing, standards and external field. As a specific material property, the manufacturing industry defines the scope of the problem that needs to be solved. Standards, as another material property, are used to regulate the means and methods of manufacturing industry. The external field can be understood as the macro, middle and micro levels Elements, the macro is mainly the top-level national level design, strategic planning and overall principles and policies; the concept of the main aspects of the standardization of research institutes and research institutes and professionals and so on; microscopic mainly in the standard equipment manufacturing industry Specific implementation and application, as well as other micro-elements of the manufacturing standards formulated collectively.

6. Process analysis

According to the research train of thought, according to TRIZ innovation method, the innovation process of equipment manufacturing standard system is described, and the object-field model diagram is obtained, as shown in Fig.3.

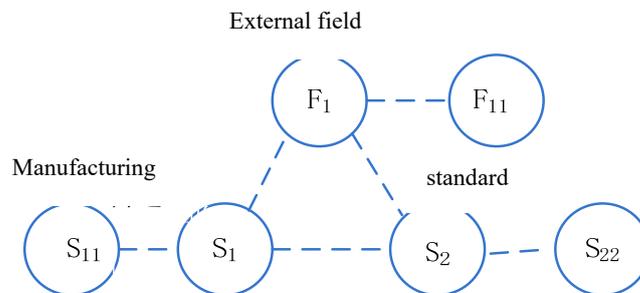


Figure 3 equipment manufacturing industry standard system model

After analyzing and solving, the first kind of innovative solution changes the external field, carries out the top-level design from the national level, integrates all kinds of standardized information resources, establishes the national standard information network platform, and achieves the sharing and cooperation of standardized information resources, interconnection and communication and perfecting the promotion mechanism , Set up a system of supervision and assessment, stepped up the training of standardized personnel, shorten the time interval for the revision of the standard system, and transform the current standard system of single government supply into a new standard system composed of government-led standards and market-driven standards. The second innovation solution is to develop a series of material S1 manufacturing enterprises to upgrade the emerging artificial intelligence and information technologies and to use research and development of big data, cloud computing, industrial internet of things, smart factories, intelligent robots and intelligent

manufacturing services standard system of intelligent equipment manufacturing industry, all types of enterprises to establish technological advances to promote and adapt to the needs of the market competition standardization mechanism for enterprises, the standard as a production and management, to provide services and quality control basis and means to improve product quality of service and production and management benefits, Create a well-known brand. The third innovative solution, starting from the material S2 standard, is to improve the standard setting process, widely listen to the opinions of all parties, enhance the openness and transparency of the standard setting work and ensure the scientific and fair standard technical indicators.

7. Optimization evaluation

Using Delphi method, according to the consultation of experts on the relative importance of the design of the two indicators score the judge, at the same time accept continuous feedback and modifications. In order to ensure the objective and fair, to minimize the impact of human factors, this paper uses the combination of Delphi method and analytic hierarchy process to determine the weight of each indicator, using the combination of incentives and penalties to deal with the initial sample data to ensure the formation of Sample data is more objective and accurate. The indicators system needs to be considered as follows: top-level design, industrial upgrading, updating standards, integrating information resources, establishing a network platform, improving institutional mechanisms, improving service system and focusing on personnel training. Of which 1-10 groups for the construction of the sample training data, 11-13 three sets of data for the standard system solutions, respectively, as shown in Table 2, Table 3 below.

Table 1 Sample data

Num	Top-level design	Industrial upgrading	Update standard	Integration resources	Network platform	Improve institutional	service system	Cultivation talents	Experts assess
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.51	0.65	0.86	0.79	0.77	0.83	0.78	0.78	0.75
3	0.67	0.74	0.71	0.69	0.64	0.84	0.74	0.73	0.72
4	0.74	0.76	0.74	0.68	0.76	0.71	0.83	0.69	0.81
5	0.86	0.73	0.76	0.88	0.83	0.71	0.77	0.78	0.85
6	0.78	0.66	0.82	0.88	0.66	0.79	0.76	0.71	0.88
7	0.74	0.82	0.84	0.82	0.89	0.81	0.72	0.74	0.83
8	0.76	0.88	0.85	0.83	0.75	0.76	0.83	0.68	0.74
9	0.78	0.87	0.88	0.76	0.72	0.75	0.63	0.82	0.84
10	0.74	0.89	0.89	0.83	0.69	0.79	0.68	0.73	0.77

Table 2 three solutions

Num	Top-level design	Industrial upgrading	Update standard	Integration resources	Network platform	Improve institutional	service system	Cultivation talents	Experts assess	sorting
11	0.78	0.79	0.71	0.78	0.82	0.88	0.75	0.87	0.86	2
12	0.63	0.86	0.81	0.89	0.86	0.82	0.71	0.86	0.85	3

13	0.84	0.77	0.91	0.86	0.83	0.89	0.77	0.88	0.87	1
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From the above assessment results, the number 13 corresponds to the third innovation solution, we can draw from the enterprise standards as the focal point, to further improve the standard setting process, build a scientific standard information database, establish and improve the exchange of feedback and monitoring service mechanism, Take the initiative to participate in the development of international standardization work, we will speed up the standardization of equipment manufacturing industry in our country towards internationalization.

8. Conclusion

With the rapid development of cloud computing, industrial cloud and Internet of Things, China's equipment manufacturing industry standard system has become more and more popular in many countries in the world. Most domestic enterprises also started the intelligent manufacturing engineering. The standard system of equipment manufacturing industry will surely Usher in new opportunities for development. In this paper, the object-field model in TRIZ theory is used to realize the innovative solution to the standard system of equipment manufacturing industry. The artificial intelligence algorithm model is used to find the optimal solution to the innovation scheme, which is specific to the innovation path selection of equipment manufacturing standard system Method, in order to achieve the transformation and upgrading made in China, to promote digital, networking, intelligent manufacturing, leading the rapid development of equipment manufacturing industry has provided data support.

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