



Research on Management Mechanism of Higher Education Based on Big Data Analysis

Zhili Ni^(✉)

Wuhan Railway Vocational College of Technology, No. 1 Canglong Avenue, Jiangxia District,
Wuhan 430205, China

Abstract. With the development of the era of knowledge economy, higher education in various countries is facing more and more fierce competition and challenges. In order to improve the quality of higher education and the pursuit of high performance of higher education, all countries intend to introduce total quality management into higher education, so as to improve the quality of Education and management efficiency. European and American countries applied TQM to higher education earlier, and have formed a more mature and perfect management system. The overall quality management of higher education should be oriented towards students' satisfaction, adopting the management method of all staff participation and forming a culture atmosphere of continuous improvement.

Keywords: Higher education · Total quality management · Management mechanism

1 Introduction

With the development of knowledge-based economy, the rapid updating of scientific and technological information, and the increase of international cultural exchanges, higher education in the 21st century is facing new and more intense global challenges. At the same time, due to the importance of higher education in the social economy, all countries in the world take it as a consensus to improve the management of higher education. In recent years, in order to effectively improve the quality of higher education and pursue high performance of higher education output, all countries intend to introduce the concept of total quality management into higher education management, which is regarded as a new opportunity for the development of higher education. However, we need to point out that the dilemma of the application of total quality management in higher education lies in the difficulty of clearly defining the autonomy of academic staff and the needs of students. First of all, employee empowerment is an important dimension in the quality management system. However, the academic staff's participation in university decision-making and management is still low. Secondly, students' needs are more and more diversified and personalized, which also brings challenges to the design of curriculum and training methods [1]. Therefore, the university should combine the resources, conditions and characteristics of the University, formulate quality standards

and performance indicators, comprehensively enhance the quality and competitiveness of university education, and achieve excellence.

2 Confidence K-means Clustering Algorithm for Structure Recognition of Confidence Rule Base

Belief rule reasoning (rmer) is an expert system based on evidence reasoning, decision theory and production rule reasoning under uncertain information. Belief rules can effectively model uncertainty and nonlinearity, and ensure reasonable accuracy and the interpretability of language.

2.1 Belief Rule Reasoning

2.1.1 Main Introduction

In traditional methods, the structure and parameters of the confidence rule base are determined by experts or decision-makers in advance according to experience knowledge or other original models. However, it is very difficult and unreliable to use only expert knowledge to determine the structure and parameters of the confidence rule base in the case of large-scale confidence rule base and rapidly changing patterns. The small difference between rule weight and attribute weight of belief rule will bring great changes to the performance of belief rule reasoning. For this reason, Yang et al. Proposed several single objective and multi-objective nonlinear optimization models (OM tbrbs) for training confidence rule base and applied them to graphite composition detection. The remarkable feature of these models is that the input and output information can only be given partially, such as incomplete or fuzzy, mathematical or judgmental, or mixed.

2.1.2 Application Algorithm

The production rule reasoning model can be represented by the following four tuples:

$$R \leq X, A, D, F > \quad (1)$$

By extracting the evaluation level of the antecedent variables of each rule from the historical data, the reasonable structure of the confidence rule base is obtained. The optimal clustering of the algorithm is proportional to the distance between any two adjacent evaluation grades, and ensures the shortest distance between the historical data and the nearest evaluation grade.

2.1.3 Belief Rule Reasoning Algorithm Based on Evidential Reasoning

Since the independence of belief rules meets the requirement of recursive evidential reasoning (RER), Yang et al. Proposed a belief rule reasoning algorithm based on recursive evidential reasoning. In order to generate the excitation weight of each confidence rule, the relationship between the current input and the evaluation level reference value of the antecedent variable of each rule must be determined before reasoning [2]. The main

idea is to check the evaluation level of each rule's antecedent variable to determine the matching degree of the current input corresponding to each evaluation level.

$$S(X_i) = \{(A_{i,j}, \alpha_{i,j}); j = 1\} \quad (2)$$

The function mapping between input and output of belief rule reasoning and the distributed form of reasoning output can be expressed as follows:

$$S(X_i) = \{(D_n, \beta_n); j = 1\} \quad (3)$$

2.2 Advantages of Belief Rule Reasoning

When the belief rule reasoning is applied to the problem of only input variable historical data, it is necessary to put forward the corresponding algorithm to mine information from the input variable historical data to identify the structure of the confidence rule base because of the volatility and nonstationarity of the antecedent variables. In this paper, based on K-means 1 and fuzzy c-means 1, a confidence K-means clustering algorithm is proposed to dynamically identify the structure of the confidence rule base for system control. Each data in K-means belongs to only one cluster, and each data in fuzzy c-means belongs to each cluster in the form of membership function. In the framework of evidential reasoning, each historical data in the confidence K-means belongs to two adjacent clusters (evaluation grades) in the form of confidence. By extracting the evaluation level of the antecedent variables of each rule from the historical data, the reasonable structure of the confidence rule base is obtained. The optimal clustering of the algorithm is proportional to the distance between any two adjacent evaluation grades, and ensures the shortest distance between the historical data and the nearest evaluation grade. These two characteristics show that the algorithm can improve the identification degree of the optimal structure and the accuracy of identification and reasoning.

3 Application Pattern and Structure Recognition of Belief Rule Reasoning

3.1 Confidence Rule Base Process

The application of confidence rule reasoning can be divided into system approximator and system controller. The application mode of confidence rule reasoning as system approximator and system controller can be shown in Fig. 1. As a system approximator, the training and adjustment of the confidence rule base is driven by the error of observation output and reasoning output [3]. The reasoning output of the confidence rule is the prediction of the actual system output. As a system controller, the training and regulation of the confidence rule base is driven by the system performance, and the reasoning output of the confidence rule is the control or decision variable in the actual system operation process. In the application mode of system approximator and system controller. For the application of the confidence rule base shown in Fig. 1 as a system approximator, the historical data is given in the form of input and output data pairs. Based on the definition of the random utility of the confidence rule, Zhou et al. Proposed the sequential algorithm of adding rules and deleting rules to adjust the structure of the confidence rule base. letter.

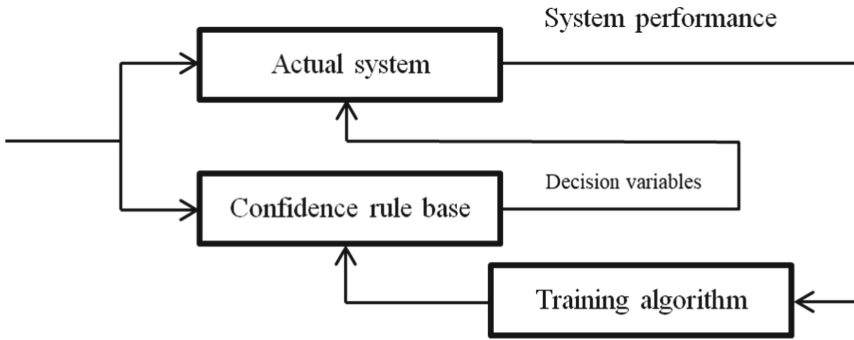


Fig. 1. Application mode of confidence rule reasoning as system controller

3.2 Structure Recognition of Confidence Rule Base

The structure recognition in this paper is to mine information from the historical data of input variables to determine the evaluation level and utility of each rule antecedent variable under the condition of determining the logical relationship between the antecedent variables of the rule base and the cascade hierarchical framework of the confidence rule base. In order to build the rule base, it is necessary to determine the evaluation level of each preceding variable and the number of evaluation levels [4]. The structure of the confidence rule base and the number of its rules depend on the position and number of the evaluation level in the input variable domain. To find the optimal structure of the confidence rule base is to find the most appropriate number and location of the evaluation level set, which can ensure that the confidence rule base can form the best fit to the sampling data and system pattern. The antecedent of each confidence rule is composed of all antecedent variables and each evaluation grade.

4 Quality Assurance System of Higher Education

4.1 Improving the Quality of University Education

The pursuit of excellence is not only the goal and ideal of the University, but also the spirit and soul of the University. The pursuit of excellence in the quality of university education has become the mainstream concept of the development of higher education in various countries. Higher education quality management is developed according to the quality management and quality assurance standards of the international organization. In the past two decades, the concept of quality has replaced the concept of “efficiency” and become the primary goal of higher education. As Green said, “the 1980s is the era of efficiency, while the 1990s is the era of attaching importance to quality. Especially in the 1980s, the government’s investment in universities is decreasing, the public management movement is rising, the society and the public demand for university performance is higher and higher, and the global international competition is intensifying. Universities need to effectively evaluate their own school running performance, so as to be able to cope with internal and external challenges and improve the overall quality of university running.

4.2 Management Mechanism Adopted Abroad

In 1997, the quality assurance agency for Higher Education (QAA) was set up to audit the teaching quality and academic quality of universities, so as to reduce the duplication of institutions and waste of resources. At the same time, it ensures the tradition of university autonomy and effectively combines external audit with self-management. Since 90% of French higher education funds are borne by the government, it is an important responsibility of the government to audit and evaluate the quality of higher education. French higher education quality assurance is mainly responsible by its national evaluation committee. In the declaration of “quality and diversity of higher education”, Australia proposed to independently audit the policies and procedures of university quality assurance, recommended to the government the allocation of annual school running funds, and established the Australian university quality management as a national institution to supervise and audit the quality of higher education in Australia. So far, American universities have basically adopted total quality management to ensure and improve their education quality.

5 Total Quality Management Mechanism of Higher Education

5.1 On the Quality of Higher Education

5.1.1 Cardinal Principle

For the country, the quality of higher education is the guarantee to enhance the competitiveness of the country. For the society, receiving higher education is the driving force to realize social mobility and the catalyst to promote economic development. For enterprises, in the era of global competition, high-quality talent training and supply is the basis for enterprise innovation and R & D. Moreover, high-quality talent output can also improve the popularity of the University in the world, which can improve the quality of students and form a good and orderly cycle. Therefore, from the above point of view, the quality management of higher education is the key factor of school competitiveness and performance management.

5.1.2 Student Satisfaction Oriented

Education is one of the important products in global service trade. According to the classification of WTO, education has been listed as “service sector” together with 14 departments, such as business services, communication, sales and finance. It is an important service product in Global trade. Students and parents are regarded as customers. “The development of higher education based on customer orientation attaches great importance to the response of external customers (parents and students) and timely corrects the education service. The improvement of students’ satisfaction will also lead to the improvement of students’ loyalty. The United States is one of the countries with the highest degree of marketization of higher education, and its student satisfaction is a very important evaluation index of higher education [5]. Paying attention to the needs of students and using student satisfaction assessment to continuously improve and improve the quality of education are the key factors for the success of American higher education.

5.2 Adopt the Management Method of Full Participation

The implementation of total quality management must be supported and participated by all employees. Some studies show that about 70% to 75% of the failure of organizational change is due to the failure to meet the expectations of key stakeholders. The choice of goals in an organization should be recognized and committed by all members, and enable members to work hard to achieve the goals. As UNESCO put forward in the global initiative for quality assurance capability, “quality assurance is effective only when all stakeholders understand and accept the challenges and benefits they face. To form an atmosphere of attaching importance to quality requires strong and firm management stakeholders from higher education leaders to participate in quality management, which is the value demand of quality management. The stakeholders here include internal and external stakeholders, including staff, students, alumni and community, etc. In the knowledge society, the purpose of organization is to make knowledge more productive.

6 Conclusion

The optimal confidence k-clustering ensures that the sampling points are close to the evaluation level with the minimum distance, that is, the input variables are close to the antecedents of the confidence rules as much as possible, which improves the accuracy of recognition and reasoning of the confidence rule base. The algorithm is also suitable for the application of confidence rule base as system approximator. In this paper, the number of evaluation grades in the confidence rule base is still given by the decision maker. The next step is to propose the corresponding data mining algorithm, which not only dynamically determines and adjusts the position of evaluation grade utility, but also identifies its number.

References

1. Dong, C.: Eight Principles of Quality Management. Guangdong Economic Publishing House, Guangdong (2008)
2. Yang, G.: Specific strategies for improving the quality of Higher Education. In: Proceedings of the Second Cross Strait Forum on Higher Education: Higher Education Quality, School Running Mode and Development Strategy. South China University of Technology, Guangzhou (2006)
3. Lin, T.: Total quality management supported by IBM. *World Educ. Inform.* **4**, 32 (1995)
4. Yang, C.: Challenge, transcendence and excellence of high energy education in Taiwan. *Educ. Mater.* **44**, 1–28
5. Jinli, S.: New development of higher education quality assurance system in UK: Practice of QAA institutional review. *Educ. Res. Dev.* **1**, 173–206 (2006)