A Quality Management System Model Based on Quality Information Technology Integration

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Abstract. The article first provides a brief overview of the quality management system model, and then analyzes the information integration and resource models of the quality management system based on quality information technology integration, providing a certain reference for enterprises to build quality management system models.

Keywords: Quality information technology integration; Quality management; system model

1   Introduction

In the production process of enterprises, in order to ensure the quality of products, higher requirements need to be put forward for product raw materials, management models, and labor technical skills, and this is the embryonic form of quality management. In modern society, with the progress of science and technology, enterprises can integrate quality information technology to create a new quality management system model in order to improve production efficiency and ensure product quality.

2   Overview of Quality Management System Model

Enterprise quality management refers to the activity of product and service operators managing quality through internal control systems. In this activity, business operators need to rely on quality information in order to have a clear understanding of the quality management process[1]. Quality information mainly comes from the entire lifecycle of the product, with characteristics such as large data volume, complex data, and multiple parameters. By processing quality information well, business operators can identify useful quality information, predict, make decisions, and control it, ultimately achieving full control over the company's products and services. The implementation of quality management aims to improve the market competitiveness of enterprises, with advanced information technology and effective organizational management as the basic guarantee. By arranging and combining information technology and organizational

management, enterprises can develop a long-term quality management innovation path for their future development[2]. The quality management system mode is a series of management systems built around the integration of quality information technology on the basis of quality management, as shown in Figure 1.
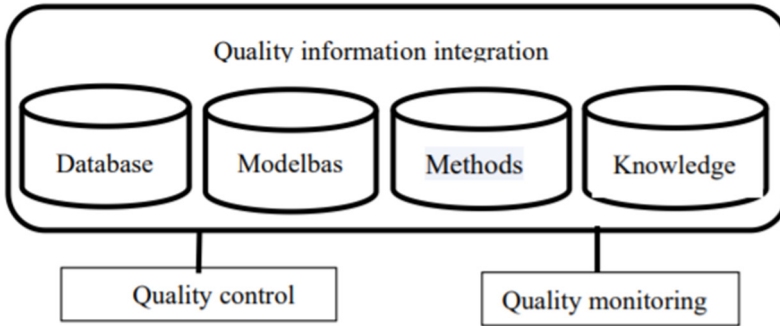

Fig. 1. Quality Management System Model

From Figure 1, it can be seen that the quality management system model mainly consists of four parts: database, model library, method library, and knowledge library. The four basic libraries are coordinated and unified by quality management and quality monitoring technologies[3]. In addition, the four basic libraries are not simply model stacking relationships, but can be combined to form the optimal model combination.

3   A Quality Management System Information Integration Model Based on Systems Engineering

3.1   A Three-dimensional Structural Model for Information Integration in Quality Management Systems

In the 1960s, the famous American engineer Hall proposed the "three-dimensional structure" analysis method, which is an important tool for the development of systems engineering theory. The "three-dimensional structure" analysis method mainly consists of three dimensions: time dimension, logical dimension, and knowledge dimension[4]. By effectively applying the "three-dimensional structure" analysis method, it is possible to achieve full coverage of the entire product information cycle of the enterprise.

Firstly, in the "three-dimensional structure" analysis method, the time dimension is the most important part, covering the entire process of quality activities throughout the entire product lifecycle of the enterprise, which can be divided into five stages. It is divided into product design stage, product manufacturing stage, product sales stage, product service stage, and product recycling stage.

Secondly, in the "three-dimensional structure" analysis method, the logical dimension refers to the different levels of expression of quality management ideas and

methods, which can include five levels: quality information acquisition, quality information transmission, quality information storage, quality information processing, and quality information evaluation[5].

Finally, in the "three-dimensional structure" analysis method, the knowledge dimension refers to the professional knowledge required to master the completion time and logical dimensions, including management, information technology, engineering technology, and other contents.

3.2   Method Matrix for Information Integration Model of Quality Management System Based on Systems Engineering

According to the description of the "three-dimensional structure" analysis method mentioned above, the method matrix of the quality management system information integration model based on systems engineering is shown in Table 1.

Table 1. Method Matrix for Information Integration Model of Quality Management System Based on Systems Engineering

Time dimension Logical dimension	Quality information acquisition	Quality information transmission	Quality information storage	Quality information processing	Quality information evaluation
Product Design	a11	a12	a13	a14	a15
Manufacturing	a21	a22	a23	a24	a25
Product Sales	a31	a32	a33	a34	a35
Product Services	a41	a42	a43	a44	a45
Product Recovery	a51	a52	a53	a54	a55

In addition, the matrix formula of the information integration model for quality management systems based on systems engineering is shown below.

$$A = \begin{bmatrix} a_{11}a_{12}a_{13}a_{14}a_{15} \\ a_{21}a_{22}a_{23}a_{24}a_{25} \\ a_{31}a_{32}a_{33}a_{34}a_{35} \\ a_{41}a_{42}a_{43}a_{44}a_{45} \\ a_{51}a_{52}a_{53}a_{54}a_{55} \end{bmatrix}$$

(1)

Through the method matrix, it can be seen that each point is a combination of logical and temporal dimensions, for example, a11 is a quality information acquisition method in product design[6]. By utilizing the "three-dimensional structure" analysis method, enterprises can more accurately and scientifically obtain information on product quality management.

# 4	A Resource Model of Quality Management System Based on Quality Information Technology Integration

To establish a basic quality management system, enterprises need to receive basic resource support, including human resources, funds, material equipment, technology, information, and knowledge. Among them, human resources, funds, materials and equipment belong to the "hardware" of resource support, and their characteristics are easy to quantify. Technology, information, and knowledge are the "software" in resource support, characterized by being difficult to quantify[4]. By building a quality management system resource model based on quality information technology integration around the above six items, enterprises can achieve effective management of resource support. The specific situation is shown in Figure 2.
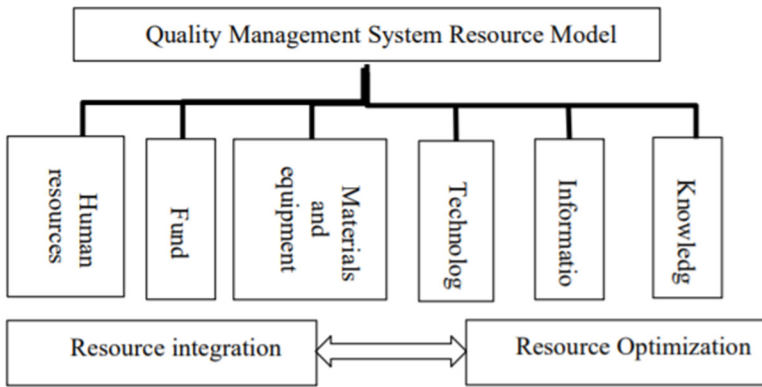

Fig. 2. Quality Management System Resource Model Based on Quality Information Technology Integration

In Figure 2, human resources are the key to the development of an enterprise, and the competitiveness of the enterprise relies entirely on human resources. In addition, if enterprises want to do a good job in quality management, quality decision-making, quality control, quality improvement, etc., they also need human resources as support, which are implemented by the employees of the enterprise; Funds are the lifeblood of enterprise development. In the process of operation and management, enterprises need to rely on funds for external investment and pay salaries to employees. At the same time, one of the fundamental purposes for enterprises to establish a quality management system resource model is to improve the efficiency of fund utilization; Material and equipment are the raw materials and auxiliary tools for enterprises to carry out various social activities, and the quality management system resource model also needs to rely on material and equipment to build hardware equipment; Technology is the specific scientific practice of applying knowledge, and it is also the key to supporting the effective application of quality information technology integration in quality management system resource models; Information refers to the objects transmitted and processed by audio, messages, and communication systems, and generally refers to all things

disseminated in human society. The types of information are divided into knowledge-based information and non knowledge-based information. After analyzing, organizing, and refining information, it can provide support and assistance for enterprise quality management decisions; Knowledge is the summary of past experiences by humans in the process of understanding and transforming the world. Its specific manifestation is the psychological perception of things, such as perception, representation, concepts, and rules. In quality management, knowledge can interact with the quality management environment to obtain quality knowledge and information[7].

5   A Functional Model of Quality Management System Based on Quality Information Technology Integration

With the help of integrating various quality information technologies such as big data, cloud computing, and artificial intelligence, enterprises can build functional models of quality management systems[8]. This model can endow enterprise quality management with more functions, making enterprise quality management and quality monitoring more convenient[9]. The quality management system functional model based on quality information technology integration is mainly composed of two parts: quality management and quality monitoring, and each part is further divided into multiple subsystems. Among them, there are supplier quality management subsystems (used to evaluate the quality capabilities of suppliers), quality goal monitoring subsystems (used to statistically and track quality management indicators and nodes), measurement system management subsystems (used to manage measuring instruments and record measurement results), market quality management subsystems (used to record, analyze, rectify, track market quality issues, etc.), resource and working condition information collection subsystems (used to effectively manage enterprise resources), research and development design management subsystems (used to help technical personnel complete product development and design planning, verification, etc.), quality decision-making and planning subsystems (used to record, analyze, rectify, track market quality issues, etc.), resource and working condition information collection subsystems (used to effectively manage enterprise resources), research and design management subsystems (used to help technical personnel complete product development and design planning, verification, etc.), quality decision-making and planning subsystems (used to make quality decisions, quality goal formulation, contract review, etc.) Management, Quality Cost Management Subsystem (responsible for preventing and controlling product production costs), and Quality Inspection Plan Subsystem (responsible for inspecting product processes, parts, components, and finished products)[10]. There are status data collection subsystem, data preprocessing subsystem, quality identification diagnosis and prediction subsystem, quality feedback control subsystem, and quality evaluation subsystem under quality monitoring. By utilizing the functional model of the quality management system, enterprises can effectively integrate quality management and quality monitoring. By using the above subsystems, enterprises can not only effectively handle quality management related matters, but also continuously improve and innovate around their performance goals.

6   Conclusion

In summary, through the study of the quality management system model based on quality information technology integration, it can be found that quality information technology plays a key role in enterprise quality management. By using quality information technology and building one quality management system model after another around the technology, enterprises can significantly improve their quality management level, thereby creating higher economic value for the enterprise.

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