Determining the Importance of Shaping Requirements Constructing Enterprise Culture Based on QFD

Jun Hu*

Sichuan Zhongyu Construction Engineering Co., LTD., Chengdu 610000, Sichuan Province, China

Corresponding author: Jun Hu, wzqlinger@126.com

Abstract: To effectively improve the core competitiveness of construction enterprises, it is necessary to build a unique enterprise culture. In this paper, the adaptability of the quality function deployment (QFD) method in the process of construction enterprise culture construction is analyzed, and the construction process can be divided into three stages: cultural planning, process planning, and implementation planning. Furthermore, an analysis method of shaping requirements of internal and external customers in the formation of construction enterprise culture is proposed, which allows customer representatives to define shaping requirements using preferred phrases. Finally, an example is given to verify the effectiveness and feasibility of the proposed method.

Keywords: Construction enterprise; Quality function deployment; Shaping requirements; Language phrase

1. Introduction

The escalating competition among enterprises due to economic globalization underscores the importance of not solely depending on management, technology, and talent to gain an advantage. It is equally essential to cultivate a distinctive construction enterprise culture that aligns with market development trends, thereby establishing the core competitiveness of enterprises. Present research predominantly centers on the imperative and evaluation of cultural construction [1], with limited attention given to the strategies for constructing corporate culture and the methodologies employed in the process. Presently, cultural construction leans heavily on the intuition and experience of managers and role models for guidance, lacking systematic and practical methods.

Quality Function Deployment (QFD), which originated in the 1960s, is a whole-process product development technology driven by customer demand and has been widely used in many industries and fields [2]. The core idea of QFD is to transform customer demand into information that designers and producers can understand, and it is reflected in the final products produced and provided by enterprises.

The main contents of this paper are as follows: The adaptability of QFD and construction enterprise culture

construction are analyzed; aiming at the uncertainty of the analysis of construction enterprise culture shaping requirements, a method of determining the importance of shaping requirements based on language phrases is proposed.

2. Adaptive analysis

The basic characteristics of QFD ideas can be summarized as follows: (1) Through product planning, parts planning, process planning, and production planning, a large number of unstructured and qualitative information can be converted into structured and quantitative information that can be measured and calculated [3]; (2) the whole process can be optimized through the house of quality; (3) QFD is a product development and design method based on customer needs, so it can effectively improve customer satisfaction [4]; (4) The application of QFD method requires full cooperation between customers and product designers.

In the process of shaping a unique construction enterprise culture, enterprises often frequently break down the entire process, determining a series of specific analytical steps that integrate objective environmental factors and subjective opinions. Therefore, from the perspective of the construction enterprise culture shaping process and realization mechanism, the basic characteristics of the shaping process can be summarized as follows: (1) A large amount of unstructured and qualitative information can be transformed into structured and quantitative information that can be measured and calculated by analyzing the shaping requirements of internal and external customers, and then designing conceptual schemes, detailed schemes and specific implementation processes [5]. (2) Shaping a construction enterprise culture begins with analyzing the enterprise environment and development trends. It involves determining the objectives and requirements for constructing the enterprise culture. This encompasses the planning and development process of the construction enterprise culture, driven by external demands. (3) The process of shaping the construction enterprise culture should involve more activities, fostering cooperation and collaboration of various relevant departments of the enterprise.

Based on the analysis above, it is clear that the principle of the QFD method and the process of shaping construction enterprise culture are driven by external requirements and objectives. Besides, the basic characteristics, implementation process, and logic relationship before and after the two are very similar. The principle of the QFD method has strong adaptability in the process of shaping construction enterprise culture.

3. Analysis method of construction enterprise culture shaping requirements

During the process of shaping the construction enterprise culture, analyzing the significance of shaping requirements becomes a typical group decision-making challenge. It is essential to choose representatives from both within and outside the enterprise to ensure scientifically and reasonably derived conclusions.

In the complex and uncertain information environment of culture shaping, customer representatives tend to express their preference information using language phrases. Due to diverse backgrounds and experiences, they choose preferred language phrase sets in the analysis process. This paper introduces a method for analyzing the importance of shaping requirements based on language phrases of different granularity. The detailed steps of this method are described below.

Step 1: Some external customers and internal customers of the construction enterprise culture are selected from the target customers of the enterprise to form an evaluation team for shaping requirements. The weight information of each customer is determined by the pair-to-pair comparison method. The project leader of the construction corporate culture reconstruction informs the team members about the requirements of the project and the tasks of the team. Through a detailed and comprehensive questionnaire survey and several key

interviews, the information are sorted out and analyzed, and the key requirements in the construction enterprise culture shaping process are determined.

Step 2: According to their familiarity with the construction enterprise culture and shaping requirements, internal and external customers determine their favorite language phrase set. Then, they judge the importance of each key shaping requirement and gave the corresponding preference information, forming a judgment matrix of the importance of cultural shaping requirements. In order to facilitate evaluation, the language phrase sets that can be selected are listed as follows:

$$S^3 = \{S^3_{-2} = \text{very unimportant}, S^3_{-2/3} = \text{unimportant}, S^3_0 = \text{normal}, S^3_{2/3} = \text{important}, S^3_2 = \text{very important}\};$$

$$S^4 = \left\{ \begin{array}{c} S^4_{-3} = \text{very unimportant}, S^4_{-4/3} = \text{unimportant}, S^4_{-1/3} = \text{less important}, S^4_0 = \text{normal}, S^4_{1/3} = \text{more important}, \\ S^4_{4/3} = \text{important}, S^4_3 = \text{very important} \end{array} \right\};$$

$$S^5 = \left\{ \begin{array}{c} S^5_{-4} = \text{extremely unimportant}, S^5_{-2} = \text{very unimportant}, S^5_{-1} = \text{unimportant}, S^5_{-0.4} = \text{less important}, S^5_0 = \\ \text{normal}, S^5_{0.4} = \text{more important}, S^5_1 = \text{important}, S^5_2 = \text{very important}, S^5_4 = \text{extremely important} \end{array} \right\}.$$

Step 3: The consistency processing function of different language phrases is used to transform these different language phrases into the same granularity of preference information, forming a judgment matrix of the same granularity. In the conversion process, the language phrase set used most by internal and external customers is generally defined as the basic phrase set. Then, the preference information used by other customers is converted into the language phrase set.

Step 4: According to the judgment matrix of the same granularity, the evaluation vector of the importance of each molding requirement can be listed, and the positive and negative ideal points of the judgment vector of the importance of each molding requirement can be determined using Equation (1).

$$\begin{cases} x_i^+ = \max\limits_j\{\lambda_{ij}\} \\ y_i^- = \min\limits_j\{\lambda_{ij}\} \end{cases}, i = 1,2, ..., t. j = 1,2, ..., m \tag{1}$$

Step 5: The deviation between the basic importance vector and the positive and negative ideal points of each shaping requirement are calculated individually using Equations (2) and (3)

$$d_j^+ = \theta_1 d(\lambda_{1j}, x_1^+) \oplus \theta_2 d(\lambda_{2j}, x_2^+) \oplus ... \oplus \theta_t d(\lambda_{tj}, x_t^+) \tag{2}$$

$$d_j^- = \theta_1 d(\lambda_{1j}, y_1^-) \oplus \theta_2 d(\lambda_{2j}, y_2^-) \oplus ... \oplus \theta_t d(\lambda_{tj}, y_t^-) \tag{3}$$

Step 6: The evaluation value between the basic importance vector of each shaping requirement and the positive and negative ideal points is calculated by Equation (4).

$$z_j^* = \frac{d_j^-}{d_j^+ + d_j^-} \tag{4}$$

Step 7: The evaluation value of each shaping requirement was standardized and the importance of each shaping requirement is obtained using Equation (5).

$$\rho_j = \frac{z_j^*}{\sum_{j=1}^m z_j^*} \tag{5}$$

4. Application examples

This study takes the cultural reconstruction of a construction enterprise as an example to illustrate the feasibility of the proposed method in the importance analysis process of shaping requirements. In order to deepen the construction of corporate culture, improve the cohesion and execution of the enterprise, enhance the cultural consciousness and self-confidence of employees, and shape the unified cultural brand image of the enterprise, the QFD method can be introduced to create a good internal and external corporate environment.

Step 1: The project team in charge of the reconstruction of the construction enterprise culture invites two internal employee representatives (cu_1 and cu_2), one personnel of relevant government department (cu_3) and one customer (cu_4)to form a decision-making team for the evaluation of shaping requirements. The project leader states the necessity and significance of the project to the decision-making team, and on this basis informed the work and tasks that the team needed to complete. Through pairwise comparison, the decision-making team can determine the weight vector of each member as $\theta = (0.286, 0.239, 0.265, 0.210)$. The key requirements for the construction enterprise culture shaping are determined as higher customer satisfaction, better corporate environment, stronger cohesion, better corporate image, higher sense of social responsibility, good professional ethics, stronger resource allocation ability.

Step 2: The language phrase sets selected by each customer are as follows, cu_1 and cu_4 are S^4, cu_2 is S^3, cu_3 is S^5. According to the preference information of the shaping requirements given by these decision-makers, the judgment matrix of the shaping requirements importance can be obtained, as shown in **Table 1**.

Table 1. The judgment matrix of the shaping requirements importance

	kc_1	kc_2	kc_3	kc_4	kc_5	kc_6	kc_7
cu_1	$S^5_{4/3}$	$S^4_{1/2}$	$S^4_{1/2}$	S^4_0	$S^4_{4/3}$	$S^4_{1/2}$	$S^4_{-1/2}$
cu_2	$S^3_{2/3}$	S^3_0	$S^3_{2/3}$	S^3_0	S^3_2	$S^3_{2/3}$	$S^3_{-2/3}$
cu_5	S^5_4	S^5_1	$S^5_{-0.4}$	S^5_1	S^5_2	S^5_1	$S^5_{0.4}$
cu_6	$S^4_{4/3}$	$S^4_{-4/3}$	S^4_0	S^4_0	S^4_3	S^4_0	$S^4_{1/2}$

Step 3: The language phrase conversion function is used to deal with the preference information uniformly, and the information matrix with the same granularity as the shaping requirements is obtained. The detailed information of the matrix is shown in **Table 2**.

Table 2. The same granularity matrix of the shaping requirements importance

	kc_1	kc_2	kc_3	kc_4	kc_5	kc_6	kc_7
cu_1	$S^4_{4/3}$	$S^4_{1/2}$	$S^4_{1/2}$	S^4_0	$S^4_{4/3}$	$S^4_{1/2}$	$S^4_{-1/2}$
cu_2	S^4_1	S^4_0	S^4_1	S^3_0	S^4_3	S^4_1	S^4_{-1}
cu_5	S^4_3	$S^4_{3/4}$	$S^4_{-3/10}$	$S^4_{3/4}$	$S^4_{3/2}$	$S^4_{3/4}$	$S^5_{3/10}$
cu_6	$S^4_{4/3}$	$S^4_{-4/3}$	S^4_0	S^4_0	S^4_3	S^4_0	$S^4_{1/2}$

Step 4: Based on Equation (1), the positive ideal points and negative ideal points of the importance vector of each shaping requirement are obtained respectively as $x^+ = \{S^4_{4/3}, S^4_3, S^4_3, S^4_3\}$, $y^- = \{S^4_{-1/2}, S^4_{-1}, S^4_{-0.36}, S^4_{-4/3}\}$.

Step 5: The separation degree between the basic importance vector of each shaping requirement and the positive ideal point is calculated by using Equation (2). The separation degree between the basic importance vector of each shaping requirement and the negative ideal point is calculated by using Equation (3).

Step 6: The separation evaluation values of each shaping requirement are obtained based on Equation (4):

$Z_1^* = 0.746$, $Z_2^* = 0.181$, $Z_3^* = 0.372$, $Z_4^* = 0.497$, $Z_5^* = 0.701$, $Z_6^* = 0.349$, $Z_7^* = 0.217$.

Step 7: The evaluation value can be standardized by using Equation (2) to determine the importance of each shaping requirement as follows:

$\rho_1 = 0.244$, $\rho_2 = 0.059$, $\rho_3 = 0.121$, $\rho_4 = 0.162$, $\rho_5 = 0.229$, $\rho_6 = 0.114$, $\rho_7 = 0.071$.

In short, the decision-making team believes that the two shaping requirements of higher customer satisfaction and a higher sense of social responsibility are of paramount importance. The ranking results reflect customers' requirements for the construction enterprise culture, which should be fully considered in the subsequent design of the construction enterprise culture reshaping plan, and more resources should be invested.

5. Conclusion

Excellent construction enterprise culture is an important part of the core competitiveness. This paper analyzes the shaping process of construction enterprise culture based on the QFD principle, and makes a preliminary analysis of the internal and external customers' requirements for the shaping of culture, and puts forward the importance analysis method of shaping requirements based on multi-granularity language phrases.

Based on the existing research, this paper analyzes the principle of QFD and the basic characteristics of the construction enterprise culture-shaping process. The results show that both are driven by external requirements and objectives, and there are great similarities in the specific implementation process and the logical relationship before and after. Therefore, it is effective and feasible to apply the principle of QFD to the construction enterprise culture-shaping process.

To deal with the uncertainty of information in the construction enterprise culture-shaping process effectively, this paper invites decision-makers to use preferred language phrases to represent their preferences, and uses a company as an example to verify the accuracy of this method.

Disclosure statement

The author declares no conflict of interest.

References

[1]   Zabala K, Campos JA, Narvaiza L, 2022, Moving from a Goods- to a Service-Oriented Organization: a Perspective on the Role of Corporate Culture and Human Resource Management. Journal of Business & Industrial Marketing, 37(6): 1197–1207. https://www.doi.org/10.1108/JBIM-11-2020-0497

[2]   Wang ZQ, Chen ZS, Garg H, et al., 2022, An Integrated Quality-Function-Deployment and Stochastic-Dominance-Based Decision-Making Approach for Prioritizing Product Concept Alternatives. Complex & Intelligent Systems, 8(3): 2541–2556.

[3]   Li F, Chen CH, Lee CH, et al., 2020, A User Requirement-Driven Approach Incorporating TRIZ and QFD for Designing a Smart Vessel Alarm System to Reduce Alarm Fatigue. Journal of Navigation, 73(1): 212–232.

[4]   Altuntas S, Kansu S, 2020, An Innovative and Integrated Approach Based on SERVQUAL, QFD and FMEA for Service Quality Improvement: A Case Study. Kybernetes, 49(10): 2419–2453.

[5] Fisk SRK, 2021, A Fresh Perspective on the Role of Corporate Culture in Performance. The Environmental Forum, 38(1): 201–219.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.