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RESEARCH ARTICLE

A Fuzzy Three-Dimensional House of Quality to Integrate and Coordinate Departments' Activities in Organizations

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ABSTRACT This study aims to introduce a method to integrate and coordinate departments' activities to enhance the service quality of organizations using Quality Function Deployment (QFD). To this purpose, the classical two-dimensional House Of Quality (HOQ) matrix is changed to a three-dimensional form (3D-HOQ). The 3D-HOQ is applied to the marketing and Human Resources (HR) departments of a bank to determine customers' and employees' demands, respectively. The 3D-HOQ is also employed to provide a unique list of technical requirements to satisfy the identified demands. Obtaining a unique list of technical requirements with the cooperation of both departments reduces the inconsistency between departments, saves cost and time by preventing reworks and parallel works, and increases the organization's efficiency. Moreover, 3D-HOQ is combined with the SERVQUAL technique and fuzzy theory to determine the weight of obtained technical requirements. The study is conducted in four main steps: 1) identifying the customers' and employees' demands; 2) identifying the technical requirements for simultaneous satisfaction of both customers' and employees' demands; 3) determining the relationships between the technical requirements and the identified demands; and 4) prioritizing technical requirements. Applying the 3D-HOQ resulted in identifying 30 customers' demands, 30 employees' demands, and 50 technical requirements. The study results show that ''using new banking technologies'' has the highest weight among the customers' demands, and ''job security'' has been found to have the highest weight among employees' demands. Moreover, ''Intra-organizational processes automation'' has been identified as the technical requirement with the highest weight.

INDEX TERMS Customer service, fuzzy theory, house of quality, human resource, quality management, SERVQUAL.

I. INTRODUCTION

The cooperation between different departments and their operations is a challenge for today's organizations, especially large enterprises [1]. Using integrated models leads to more effective utilization of the organization's resources, prevents inconsistency of operations, and saves cost and time by preventing reworks and parallel works [2]. Integrated models cause better cooperation between departments and increase knowledge sharing and knowledge integration between them. Knowledge integration in organizations enhances knowledge creation and enables them to sustainably maintain their businesses [3]. Moreover, it increases the value of the existing knowledge, avoids repeating past mistakes by sharing experiences, and reduces the inconsistency between the departments [4].

The aim of this study is to propose an integrated model to align organizational actions between two departments and

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enhance their service quality using a modified version of House Of Quality (HOQ). In this study, service quality is defined as meeting or exceeding customer expectations [5]. The Quality Function Deployment (QFD) emphasizes recognizing the customers' demands and identifying technical requirements to satisfy these demands, using a 2-dimensional matrix called HOQ (Bao and Li). This research proposes a new version of HOQ named Three-Dimensional House Of Quality (3D-HOQ) to integrate organizational actions between two departments. To show the performance of 3D-HOQ, it is applied to the marketing and Human Resources (HR) departments of an international bank. These two departments have many scopes for cooperation [6]. One of the major functions of the marketing (or HR) department is recognizing customers' (employees') demands and identifying some technical requirements to satisfy them to enhance the service quality of the organization. Satisfying both customers' and employees' demands have critical importance in each organization. It is necessary for organizations in the ever-changing competitive market to formulate a comprehensive strategy to respond to market changes and satisfy their customers' demands in an efficient way [7]. On the other hand, the only way to satisfy these demands is to encourage employees to be more creative and committed to delivering high-quality service [8]. Meeting the employees' demands is critical in enhancing their satisfaction, commitment, performance, and creativity. The work environment and job satisfaction significantly impact perceived quality by employees [8]. Therefore, managers should focus on the demands of their employees in addition to the demands of their customers.

The proposed 3D-HOQ model determines customers' and employees' demands and prepares a unique list of technical requirements to satisfy the determined demands. The weights of technical requirements determine their implementation priority in the organization. In 3D-HOQ, the weight of each technical requirement is determined regarding its impact on both departments.

Additionally, 3D-HOQ is combined with SERvice-QUALity (SERVQUAL) analysis model and fuzzy theory. The implementation of 3D-HOQ requires knowledge sharing between marketing and HR departments about customers' and employees' demands, respectively.

The main research question (RQ) that the present study intends to answer is as follows:

RQ: How should the technical requirements be prioritized to enhance the quality of the marketing and HR departments simultaneously?

The sub-questions (SQ) of this study are as follows:

SQ 1: what are the customers' (or employees') demands?

SQ 2: what is the importance of each identified customers' (or employees') demand?

SQ 3: what are the customers' (or employees') perceptions and expectations of each demand?

SQ 4: what is the weight of each identified customers' (or employees') demand?

SQ 5: what technical requirements should be devised to satisfy the demands of customers and employees?

SQ 6: what is the relationship between technical requirements and customers' and employees' demands?

The remainder of the paper is organized as follows. The literature review is presented in section II. The methodology is explained in section III. The results of implementing the research steps in an international bank are presented in section IV. Discussion and results interpretation are given in section V. Finally, the conclusion and suggestions for future research are presented in section VI.

II. LITERATURE REVIEW

QFD has been used in numerous research studies, and many of these studies applied QFD to real-world case studies. However, they differed from one another in QFD elements, such as the identified demands of customers, the way their weights are determined, and how QFD is combined with other methods and techniques. First utilized in manufacturing industries for product design, QFD has been implemented in service-providing industries for more than twenty years. Several types of service-providing industries have used QFD for quality evaluation. For instance, QFD was used in hotel services [5], [9], restaurants [10], airports and airlines [11], [12], railroad transportation [13], supply chain management and logistics [14], [15], healthcare services [16], [17], [18], power supply [19], seniors [20], insurance [21], library [22], and shipping industry [23].

A number of studies also used the QFD in the banking industry. González et al. [24] used QFD in the banking industry to increase the satisfaction of both internal and external customers. Paltayian et al. [25] proposed a hybrid model combining QFD and the Analytic Hierarchy Process (AHP) to increase the quality level in the financial services context. Pakizehkar et al. [26] discussed prioritizing the bank's subtractions by combining Kano's model, the AHP technique, and QFD. Kecek and Akinci [27] used QFD to increase an insurance company's customer satisfaction. Narteh [28] used a combination of the SERVQUAL and the bank service quality models to evaluate customer satisfaction in retail bank benefits in Ghana, conceding the moderating role of price.

Whereas numerous researchers have used QFD in case studies and real-world problems, some others tried to modify QFD or combine it with other quality management techniques or change HOQ calculations. For instance, Gao and Zhang [18] proposed a hybrid model based on QFD and SERVQUAL in healthcare. Chowdhury and Quaddus [16] used a multi-phased 0-1 optimization model within QFD to design healthcare services in Bangladesh. Huang and Hsu [29] evaluated the service quality of international distribution centers using the combined AHP and QFD. Khorshidi et al. [13] used QFD and SERVQUAL to improve the quality of services provided in trains. Using QFD, SERVQUAL, the knapsack problem, fuzzy logic, and the Kano model, Vaziri and Beheshtinia [21] presented an approach to improving life insurance service quality. Pakizehkar et al. [26] identified and prioritized the demands of customers who use the service of 50 banks in Iran. For this purpose, they combined the Kano model and AHP with the QFD matrix. Enrico et al. [30] added a dimension to QFD to show the relation between two customers and one provider or two providers and one customer. Shahin et al. [31] developed Enrico et al. [30] model by considering three indexes of customer requirements, service design characteristics, and service performance. Kayapınar and Erginel [11] adopted an integrated approach based on fuzzy QFD and SERVQUAL in order to evaluate the service quality of an airport. Using QFD and AHP,Haq and Boddu [14] presented an ideal solution for improving supply chain agility. Farokhnia and Beheshtinia [2] developed the model to increase the quality of services in an Iranian airport. Beheshtinia and Farzaneh Azad [5] proposed a model based on QFD, SERVQUAL, fuzzy logic, and the Kano model to improve the service quality of hotels when budget constraints are considered. Ocampo et al. [32] proposed an integrated approach by merging QFD with some Multi-Criteria Decision Making (MCDM) techniques such as AHP, Decision making trial and evaluation laboratory (DEMATEL), and Analytic Network Process (ANP) along with fuzzy set theory. They proposed approach was implemented in the Philippine meat processing industry.

Altuntas and Kansu [33] combined SERVQUAL, QFD, and Failure Modes and Effects Analysis (FMEA) for service quality improvement in a public hospital in Turkey. In their proposed approach, the score of severity and occurrence in FMEA is calculated based on the weight of the patient demands and the gap between patients' expectations and perceptions, respectively. Haiyun et al. [34] evaluated green supply chain management strategies using an integrated approach. They proposed approach uses QFD and two MCDM techniques, including Interval-Valued Intuitionistic Fuzzy (IVIF) DEMATEL and IVIF Multi-Objective Optimization by Ratio Analysis (MOORA). Kinker et al. [35] employed QFD, fuzzy theory, and the Kano model to enhance the quality of polytechnic education institutes. In the QFD matrix, the national board of accreditation quality parameters is ranked, considering their influence on service quality factors. The proposed approach was implemented in six polytechnic education institutes in India. Ahmadzadeh et al. [36] used a three-phase QFD model to rank the critical success factors in enterprise resources planning based on the enablers of organizational agility. They implemented the proposed method in the banking industry. After identifying the critical success factors of enterprise resources planning and the enablers of organizational agility, an MCDM technique named Decision-Making Trial and Evaluation Laboratory (DEMATEL) is used to rank them. Finally, QFD model is used to rank the influencing and influenced criteria. Vijaya and Prabhu [37] used QFD to enhance the quality of banking services in India. Dincer et al. [38] employed interval-valued intuitionistic fuzzy sets (IVIFSs), DEMATEL and TOPSIS methods, and QFD to enhance the quality of new service development.

Torkayesh et al. [39] employed QFD and BWM to assess the implementation of Industry 4.0 in the mobility sector. They merged the proposed method with a stratified combined compromise solution under a fuzzy environment. Karasan et al. [40] merged QFD with neutrosophic AHP and DEMATEL methods to design products based on customer needs. Zhang et al. [41] use QFD to consider users' needs in designing smart dining tables. Li and Zhang [42] combined the fuzzy analytic hierarchy process method and QFD to design intelligent medical delivery robots. Fang et al. [43] employed fuzzy chance-constrained programming in QFD to design products for multi-segment markets. Aydin et al. [44] proposed a linear programming-based QFD to identify sustainable policies in the apparel retailing industry. They used Interval Valued Intuitionistic Fuzzy (IVIF) sets to consider the ambiguines of problem parameters.

Literature review indicates that QFD is widely used to identify customers' needs and the technical requirements that fulfill these needs. Additionally, some studies have pinpointed the need for human resources and the corresponding technical requirements [45], [46], [47]. Yet, no study to date has integrated these two aspects to formulate a unique list of technical requirements that can simultaneously satisfy the needs of both customers and human resources. To bridge this gap, this study suggested adding an extra dimension to the traditional HOQ matrix, resulting in a three-dimensional (3D-HOQ) model. It is worth noting that implementing a 3D-HOQ necessitates cooperation and knowledge sharing between the marketing and HR departments.

The contributions of this study can be summarized as follows.

- Using QFD to identify customers' and employees' demands and determining a unique list of technical requirements to satisfy the identified demands. In this case, 3D-HOQ could be considered a knowledge-sharing tool between departments.
- Combining 3D-HOQ with SERVQUAL technique and the fuzzy theory to calculate the weights of customers' and employees' demands and eventually the technical requirements (i.e., determining the priority of technical requirements).

III. METHODOLOGY

In this study, the technical requirements for simultaneous satisfaction of customers and employees in the banking industry are obtained and prioritized using the 3D-HOQ, SERVQUAL, and fuzzy theory. To respond to the research questions presented in section I, the customers' and employees' demands in the banking industry are first identified, and their weights are calculated using SERVQUAL analysis and fuzzy logic. Eventually, the technical requirements for satisfying both demands are identified. Finally, the technical requirements are prioritized using 3D-HOQ.

A. THE TOOLS USED

1) QFD

QFD is a multipurpose tool for quality planning, product design, continuous product improvement, and decision-making [5]. The most important matrix used in QFD is the House of Quality (HOQ), which is also utilized in this study. Different segments of HOQ are illustrated in Figure 1. The customers' demands (WHATs) are positioned on the left and the technical specifications (HOWs), which should be implemented to satisfy the customers' demands, are on the top. The relationship matrix is formed in the middle, which determines the type of relationship between each customer's demand and each technical specification. The obtained weights of the demands are depicted on the right, and eventually, the goal values, which are the weights of the technical specifications, are positioned at the bottom.

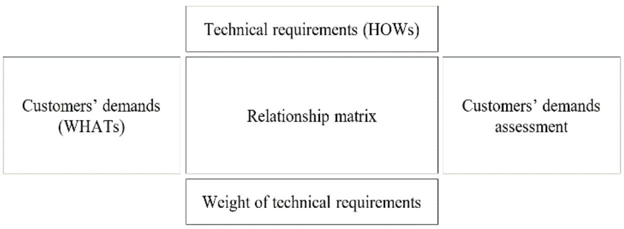

FIGURE 1. **The HOQ segmentations.**

2) FUZZY THEORY

Zadeh [48] first introduced fuzzy theory intending to develop an efficient model describing linguistic parameters' vague and ambiguous nature. Linguistic variables are not directly and mathematically operable [5]. Therefore, in this research, fuzzy logic is used for converting linguistic (qualitative) variables into mathematical (quantitative) calculations. For this purpose, triangular fuzzy numbers are used because of their ease of comprehension [49]. A triangular fuzzy number like $\tilde{A} = (a_1, a_2, a_3)$ is has three components. a_3 is the upper bound, a_1 is the lower bound, and a_2 is the most likely value of $\tilde{A}$. Suppose $\tilde{A} = (a_1, a_2, a_3)$ and $\tilde{B} = (b_1, b_2, b_3)$ are two triangular fuzzy numbers. Then, the mathematical operations between them could be performed using the following equations.

$$\tilde{A} + \tilde{B} = (a_1 + b_1, a_2 + b_2, a_3 + b_3) \tag{1}$$

$$\tilde{A} - \tilde{B} = (a_1 - b_3, a_2 - b_2, a_3 - b_1) \tag{2}$$

$$\tilde{A} \times \tilde{B} = (Min\,(a_1b_1, a_1b_3, a_3b_1, a_3b_3)\,, a_2b_2, Max\,(a_1b_1, a_1b_3, a_3b_1, a_3b_3)) \tag{3}$$

$$\frac{\tilde{A}}{\tilde{B}} = (Min\left(\frac{a_1}{b_1}, \frac{a_1}{b_3}, \frac{a_3}{b_1}, \frac{a_3}{b_3}\right), \frac{a_2}{b_2}, Max\left(\frac{a_1}{b_1}, \frac{a_1}{b_3}, \frac{a_3}{b_1}, \frac{a_3}{b_3}\right)). \tag{4}$$

In order to convert a fuzzy number into a crisp number (defuzzification), Equation 5 is used in this study.

$$D(\tilde{A}) = \frac{a_1 + 4a_2 + a_3}{6} \tag{5}$$

3) SERVQUAL

SERVQUAL is one of the most popular approaches to measuring service quality, used in many applications and developments in the service quality fields [50]. Various gaps are discussed in SERVQUAL, such as knowledge, policy, communication, delivery, and customer gaps. In this research, the customer gap is considered to determine the gap between customer perception and expectation of the bank in every demand individually. In this case, SERVQUAL measures service quality based on a questionnaire that measures both the customer expectations of service quality and their perceptions of the service they receive [50]. The perceived quality is the consumer's judgment about a product or service's overall excellence or superiority [51]. The obtained values for customers' expectations and perceptions are used to determine the improvement ratio of identified demands.

B. DATA COLLECTION

Three types of statistical samples are used in this study. The first sample includes 385 customers, and the second includes 385 people of bank employees. The sizes of these two samples are obtained by the Cochran formula with an error of 5%. The third sample comprises 8 experts with more than ten years of experience in the banking industry. Five types of questionnaires, with details provided in Table 1, are used in this study. All the questionnaires used in this study are standard, and their validity has been confirmed [21]. The reliability of all questionnaires is verified using Cronbach's alpha test. The values of Cronbach's alpha for all questionnaires are presented in Table 1.

In Questionnaires 1 to 4, Likert's scale is used to define the answer choices.

Due to the ambiguous nature of the linguistic variables used in this study, triangular fuzzy numbers were used to represent these variables. The scales, linguistic terms, and associated fuzzy numbers were extracted from the literature [21]. The notations used in the questionnaires and their corresponding fuzzy numbers are displayed in Table 2.

C. RESEARCH STEPS

To answer the research questions, the research steps are illustrated in Figure 2. This figure shows that this research comprises seven steps divided into two phases. In the first phase, the demands of customers and employees are identified, and their final weights are calculated. The technical requirements are identified in the second phase, and their final weights are obtained. The mathematical notations used in this study are presented in Table 3.

TABLE 1. Types of questionnaires used in this study.

No.	Function	Sample type	Cronbach's alpha
1	Identify the importance degree of the customers' demands	Customers sample	0.89
2	Determine the difference between the perceived and expected quality level of each customers' demand (SERVQUAL)	Customers sample	0.88
3	Identify the importance degree of the employees' demands	Employees sample	0.86
4	Determine the difference between the perceived and expected quality level of each employees' demand (SERVQUAL)	Employees sample	0.87
5	Determine the relationship matrix	Experts sample	0.82

TABLE 2. Fuzzy scale for converting the linguistic variables of the questionnaires in the study.

Linguistic values in Questionaries 1-4	Fuzzy number	Type of relationship in Questionnaire 5	Notation	Fuzzy number
Very Low	(0,0,0.75)	Weak	Δ	(1,1,1)
Low	(0.5,1.25,2)	Moderate	○	(3,3,3)
Medium	(1.75,2.5,3.25)	Strong	●	(9,9,9)
High	(3,3.75,4.5)	No relationship	Blank	(0,0,0)
Very High	(4.25,5,5)			

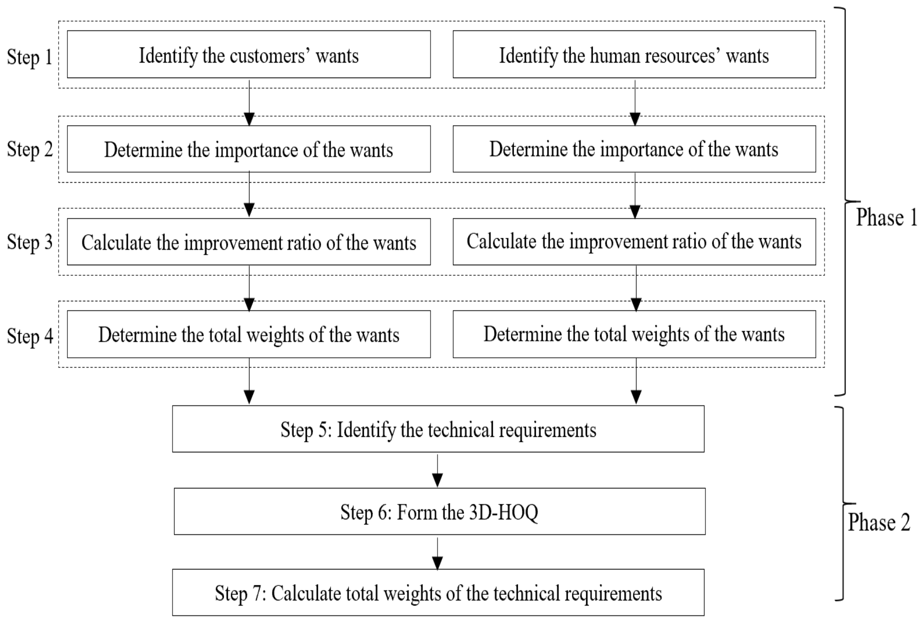

FIGURE 2. Research steps.

Step 1: Identify the customers' and employees' demands (answer to sub-question 1)

The demands of the customers and employees in the banking industry are identified using the literature review and the interviews with 385 random customers and 385 employees from various branches of the cast study bank. The customers are randomly selected from those who visited the bank from October 2021 to December 2021 (385 random customers from various bank branches). Using dialectical inquiry, a group decision-making method with a sample of

TABLE 3. List of notations.

Notation	Description
n_1 (n_2)	Number of the customers' (employees') demands
$\tilde{I}_i^c(\tilde{I}_i^e)$	Importance degree of the i^{th} customers' (employees') demand
$\tilde{E}_i^c(\tilde{E}_i^e)$	Expected quality level from the i^{th} customers' (employees') demand
$\tilde{P}_i^c(\tilde{P}_i^e)$	Perception of quality level from the i^{th} customers' (employees') demand
$\widetilde{Ir}_i^c(\widetilde{Ir}_i^e)$	Improvement ratio of the i^{th} customers' (employees') demand
C_i^c (C_i^e)	Absolute weight of the i^{th} customers' (employees') demand
W_i^c (W_i^e)	Relative weight of the i^{th} customers' (employees') demand
m	Number of technical requirements
R_{ij}^c (R_{ij}^e)	Relationship between the j^{th} technical requirement and the i^{th} customers' (employees') demand
$A_j^{activity}$	Absolute weight of the j^{th} technical requirement
$W_j^{activity}$	Relative weight of the j^{th} technical requirement
α	The weight that indicates the relative importance of the customers' demands compared with the employees' demands

experts, these demands are verified, categorized and some of them are removed due to their overlaps, lower impotence, or conflict issues.

Step 2: Determine the importance of the customers' and employees' demands (answer to sub-question 2)

Once the customers' and the employees' demands are identified, their importance values are determined through Questionnaires 1 and 3.

Step 3: Calculate the improvement ratio of the customers' and employees' demands using the SERVQUAL method (answer to sub-question 3)

The SERVQUAL method is used to calculate the gap between the customers' and employees' perceptions and expectations of each demand. The expected and perceived quality levels of customers' and employees' demands are determined using questionnaires 2 and 4. Then, the improvement ratio of the i^{th} customers' demand is calculated by Equation (6). Similarly, the improvement ratio of the i^{th} employees' demand is obtained using Equation (7).

$$\widetilde{Ir}_i^c = \frac{\widetilde{E}_i^c}{\widetilde{P}_i^c} \tag{6}$$

$$\widetilde{Ir}_i^e = \frac{\widetilde{E}_i^e}{\widetilde{P}_i^e} \tag{7}$$

Step 4: Determine the final weight of the customers' and employees' demands (answer to sub-question 4)

In this step, using the results obtained from Step 2 (questionnaires 1 and 3) and Step 3 (questionnaires 2 and 4), the demands' total weights are determined. For this purpose, Equations (8) and (9) are used to calculate the total weights of the customers' and the total weights of the employees' demands, respectively. I_i^c and I_i^e are obtained using the first and third questionnaires, respectively. In the first and third questionnaires, the importance degree of each customer and employee demand (obtained from the first step) are asked from customers and employees, respectively.

The relative weights of the customers' and the employees' demands are obtained by Equations (10) and (11), respectively. It is worth mentioning that the weight of customer demand might be different from its importance degree [21]. Usually, the resource limitation of an organization does not permit it to satisfy all the customer or employee demands simultaneously. In general, the weight of each demand is affected by the importance degree and the improvement ratio.

$$\widetilde{C}_i^c = \widetilde{I}_i^c \times (\frac{\widetilde{E}_i^c}{\widetilde{P}_i^c}) \tag{8}$$

$$\widetilde{C}_i^e = \widetilde{I}_i^e \times (\frac{\widetilde{E}_i^e}{\widetilde{P}_i^e}) \tag{9}$$

$$W_i^c = \frac{C_i^c}{\sum_{i=1}^{n_1} C_i^c} \tag{10}$$

$$W_i^e = \frac{C_i^e}{\sum_{i=1}^{n_2} C_i^e} \tag{11}$$

Step 5: Identify the technical requirements (answer to sub-question 5)

The technical requirements for satisfying the customers' and employees' demands are identified using the brainstorming method with the experts. The technical requirements are categorized into three groups:

- First group: technical requirements, which only influence customers' demands.
- Second group: technical requirements, which only influence employees' demands.

- Third group: technical requirements that influence customers' and employees' demands.

Step 6: Form the 3D-HOQ (answer to sub-question 6)

The 3D-HOQ is formed as shown in Figure 3. Using the expert's opinions, the relationship matrix is formed between the technical requirements and customers' demands on the one hand and between the technical requirements and the employees' demands on the other hand. The matrix has three dimensions, shown by the X, Y, and Z axes, representing respectively the technical requirements, the employees' demands, and the customers' demands. The XY plane shows the relationship matrix between the technical requirements and the employees' demands, named the Employees' Relationship Matrix (E-RM). In E-RM, the weights of the technical requirements are calculated regarding the weights of employees' demands. The XZ plane shows the relationship matrix between the technical requirements and customers' demands, named the Customers' Relationship Matrix (C-RM). In C-RM, the weights of the technical requirements are calculated regarding the weights of customers' demands. The types of relationships are defined using predetermined notations, which are shown in Table 2, along with their corresponding fuzzy numbers.

Step 7: Calculate the total weights of the technical requirements

Usually, simultaneous implementation of all the technical requirements in an organization is impossible. In this case, their implementation priorities are determined by calculating the weight of technical requirements. Once the 3D-HOQ is formed, the final and relative weights of the technical requirements are obtained, respectively, by Equations (12) and (13), according to the demands and the relationship matrix. Where $R_{ij}^{c}(R_{ij}^{e})$ is the relationship between the j^{th} technical requirement, and the i^{th} customers' (employees') demand.

A coefficient (α) is used to represent the relative importance of the customers' demands compared with the employees' demands, which is a number between 0 and 1. The coefficient is determined according to the organization's strategies. The closer α it is to 1, the more the importance of the customers' demands compared with the employees' demands and vice versa.

$$A_j^{activity} = \alpha \times \sum_{i=1}^{n_1} R_{ij}^{c} W_i^{c} + (1-\alpha) \times \sum_{i=1}^{n_2} R_{ij}^{e} W_i^{e} \quad (12)$$

$$W_j^{activity} = \frac{A_j^{activity}}{\sum_{j=1}^{m} A_j^{activity}} \quad (13)$$

D. METHOD JUSTIFICATION

Implementing 3D-HOQ fosters cooperation and knowledge sharing between the marketing and HR departments. This can assist the managers of these departments in preventing reworks and inconsistencies, thereby saving resources for the organization. For instance, the technical requirement of ''Developing and expanding e-banking systems'' impacts both customers' and human resources' demands. If these departments use QFD separately, they might end up contracting with different suppliers to develop their e-banking system, leading to potential inefficiencies and conflicts.

Moreover, utilizing 3D-HOQ allows more accurate identification of the weights of technical requirements and their overall benefits for the organization. For instance, consider three technical requirements A, B, and C. Technical requirement A only affects customers' demands with a weight of 0.5, while technical requirement B solely impacts human resources' demands with a weight of 0.6. On the other hand, technical requirement C influences both customers' demands (with a weight of 0.3) and human resources' demands (with a weight of 0.4). If QFD is implemented separately, technical requirement A has a higher priority than C in the first QFD matrix, and technical requirement B holds a higher priority than C in the second QFD matrix. As a result, technical requirement C does not receive priority for implementation in either scenario. However, if 3D-HOQ is utilized, the total weights of technical requirements are calculated based on their impacts on satisfying both customers' and human resources' demands. In this case, technical requirement C, with a total weight of 0.7, gains higher priority for implementation within the organization than technical requirements A and B. In other words, it provides more benefits for the organization.

This research also integrates SERVQUAL analysis with QFD to more accurately determine the weight of each demand. In this case, the weight of each customer (or human resource) demand is calculated by multiplying its degree of importance by the corresponding gap between customer expectations and their perception of the quality level provided by the organization. This gap is represented by a measure called the improvement ratio.

To better clarify the role of SERVQUAL analysis, consider two demands, D1 and D2, with importance degrees of 4 and 3, respectively. Demand D1 has no gap between customer expectation and perception, so its improvement ratio is 1. However, demand D2 displays a gap between the customers' expectations and perceptions, denoted by an improvement ratio of 2. In other words, the organization has fallen short in delivering the expected quality level for this demand.

If SERVQUAL analysis is not applied, D1, with a higher importance degree, would have more impact on increasing the weight of the technical requirements that satisfy it. It would thus have a better chance of drawing on the organization's resources for its fulfillment. However, when SERVQUAL analysis is applied, demand D2 (with a weight of 6, calculated as 3×2) gains a higher weight and is more likely to absorb the organization's resources for its satisfaction. In other words, SERVQUAL analysis directs the organization's resources to satisfy the demands with a higher degree of importance and a

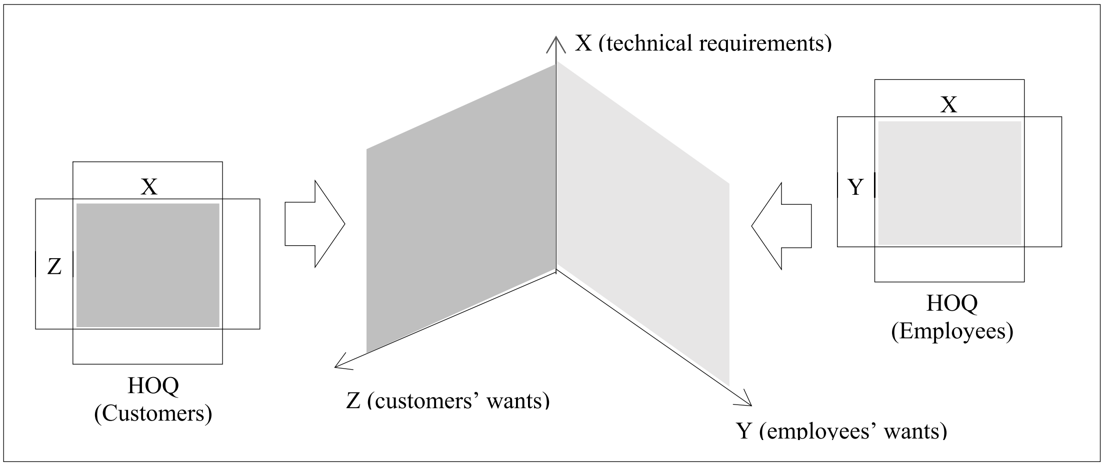

FIGURE 3. 3D-HOQ structure.

TABLE 4. Customers' demands.

	Customers' demand description	No.
Staff	Accountability and responsibility	A_1
	Adequate knowledge, skills, and Expertise	A_2
	Well manner and ability to create a sense of trust in the customers	A_3
	Appropriate personal appearance	A_4
Organization	Respecting the customers' time and short waiting times	A_5
	24/7 response to complaints and criticisms	A_6
	Providing the promised services with precision	A_7
	Providing consulting services	A_8
	Disseminating clear information regarding regulations to prevent fines	A_9
	Providing services out of working hours on emergency occasions	A_{10}
	Facilitation of direct communication between customers and senior managers	A_{11}
Environment	The branch's proper location in terms of car accessibility and parking spots	A_{12}
	Clear guidance to different sections of the branch	A_{13}
	Beautiful building structure and interior design	A_{14}
	Convenient amenities (comfortable furniture, fresh water, etc.)	A_{15}
	Well-organized documents, booklets, brochures, etc.	A_{16}
	Effective security systems	A_{17}
Technology	Usage of modern equipment in queue management, etc.	A_{18}
	Using new banking technologies (Mobile banking, ATMs, etc.)	A_{19}
	Providing mobile banking units and enough ATMs	A_{20}
	Electronic communications with other banks	A_{21}
Service	Providing information regarding the location of the branches	A_{22}
	Compliance with international standards	A_{23}
	Free notification messages	A_{24}
	Revision of the payment and repayment of bank facilities	A_{25}
	Revision of interest rates	A_{26}
	Implementation of the customer information security policy	A_{27}
Advertisement	Identifying VIP customers and offering Encouragement packages	A_{28}
	Printing bulletins and monthly magazines	A_{29}
	Presenting occasional small gifts to customers	A_{30}

larger gap between customer perception and expectation. This approach helps the organization compensate for its shortcomings in providing the expected quality level and helps reduce customer and human resources dissatisfaction.

IV. THE CASE STUDY

Banks play an important role in economic systems and relationships, as they comprise a huge part of market liquidity. In order to evaluate the performance of the proposed model,

TABLE 5. Employees' demands.

	Employees' demand description	No.
Organization	Fair wages and salaries compared to other organizations	B_1
	Fair wages and salaries according to the job types	B_2
	Fair compensation and benefits policy	B_3
	Good employee promotion possibilities	B_4
	Clear and transparent promotion policy	B_5
	Receiving feedback on the performance quality	B_6
	Meritocracy in employee promotion	B_7
	Using the evaluation results for improving the employees' performance	B_8
	Job security	B_9
	Observance of ethics in organizational decision-making	B_{10}
	Proper working hours and holidays	B_{11}
Environment	Proper workplace environmental conditions (temperature, light, air quality, etc.)	B_{12}
	Modern office equipment	B_{13}
	Employee motivational and recreational programs	B_{14}
	Friendly and polite relationships between colleagues	B_{15}
	Supportive colleagues	B_{16}
	Easy access to the required information	B_{17}
Job	Congruence between jobs and employees' education and skills	B_{18}
	Interest in the jobs	B_{19}
	Clear perception of the job's goals and objectives	B_{20}
	Feeling valued and appreciated in doing the jobs	B_{21}
	Active and challenging jobs	B_{22}
	Continuous improvement in employee skills	B_{23}
	continuous on-the-job training for employees	B_{24}
	Setting standards for job roles and tasks	B_{25}
	Self-determination in doing the jobs	B_{26}
Management	Trust in managers	B_{27}
	Managers' competence and capability	B_{28}
	Managers' supportiveness	B_{29}
	Satisfaction with the management style	B_{30}

it is applied to a major bank that contains a vast network of 3400 branches. This section presents the results of applying the research steps to the case study bank.

A. IDENTIFY THE CUSTOMERS' AND EMPLOYEES' DEMANDS

As previously mentioned, the customers' and employees' demands are identified in this step. Through a combination of customer and employee opinions, as well as a review of the literature, 45 customer and 39 employee demands are identified. The collected information was then reviewed by experts to identify any overlapping or conflicting demands. Finally, the 30 most crucial demands from each department were selected and included in the corresponding questionnaires. Tables 4 and 5 display the final lists of customers' and employees' demands, respectively.

B. DETERMINE THE IMPORTANCE OF THE CUSTOMERS' AND EMPLOYEES' DEMANDS

Using Likert's scale, Questionnaires 3 and 1 are used to determine the importance of the customers' and employees' demands, respectively. Tables 6 and 7 show the importance of the customers' demands and employees' demands, respectively.

C. CALCULATE THE IMPROVEMENT RATIO OF THE CUSTOMERS' AND EMPLOYEES' DEMANDS USING THE SERVQUAL METHOD

The SERVQUAL questionnaire is used to determine the gap between expected and perceived quality levels in each demand. Questionnaires 2 and 4 are used to determine this gap in customers' and employees' demands, respectively. The improvement ratio of the customers' and employees' demands are obtained by Equations (6) and (7). The ratios are presented in Tables 6 and 7, respectively.

D. DETERMINE THE FINAL WEIGHT OF THE CUSTOMERS' AND EMPLOYEES' DEMANDS

The demands' total weights are calculated by Equations (8) to (11). The obtained results for the customers' and employees' demands are shown in Tables 6 and 7, respectively.

TABLE 6. Importance, improvement ratio, and final weight of the customers' demands.

No.	Importance of the demands	Improvement ratio	Final weight	Relative weight (%)
A_1	(4.094,4.844,4.938)	(0.321,0.476,0.73)	(1.313,2.307,3.606)	3.099
A_2	(3.781,4.531,4.813)	(0.337,0.5,0.786)	(1.273,2.266,3.781)	3.092
A_3	(3.938,4.688,4.875)	(0.468,0.639,0.945)	(1.844,2.997,4.609)	4.04
A_4	(2.609,3.359,4.016)	(0.553,0.884,1.425)	(1.442,2.969,5.725)	4.171
A_5	(3.781,4.531,4.813)	(0.218,0.367,0.627)	(0.824,1.661,3.018)	2.297
A_6	(2.688,3.438,4.141)	(0.28,0.543,0.95)	(0.753,1.868,3.936)	2.664
A_7	(3.469,4.219,4.594)	(0.268,0.456,0.751)	(0.929,1.924,3.45)	2.646
A_8	(2.531,3.281,3.984)	(0.375,0.644,1.09)	(0.948,2.115,4.344)	3.012
A_9	(3,3.75,4.359)	(0.454,0.708,1.12)	(1.362,2.656,4.881)	3.695
A_{10}	(2.266,2.969,3.625)	(0.475,0.8,1.342)	(1.077,2.375,4.864)	3.383
A_{11}	(2.141,2.891,3.594)	(0.455,0.775,1.336)	(0.973,2.241,4.8)	3.228
A_{12}	(2.297,3.047,3.75)	(0.365,0.643,1.13)	(0.838,1.959,4.236)	2.828
A_{13}	(3.078,3.828,4.344)	(0.568,0.824,1.232)	(1.749,3.153,5.351)	4.318
A_{14}	(2.219,2.969,3.625)	(0.591,0.974,1.62)	(1.311,2.891,5.871)	4.106
A_{15}	(2.219,2.969,3.672)	(0.523,0.919,1.569)	(1.162,2.728,5.761)	3.907
A_{16}	(2.688,3.438,4.094)	(0.519,0.822,1.299)	(1.395,2.827,5.32)	3.948
A_{17}	(3.391,4.141,4.609)	(0.386,0.615,0.981)	(1.31,2.548,4.521)	3.51
A_{18}	(3.156,3.906,4.469)	(0.643,0.94,1.386)	(2.03,3.672,6.195)	5.019
A_{19}	(3.703,4.453,4.734)	(0.634,0.842,1.177)	(2.347,3.75,5.573)	5.021
A_{20}	(3.156,3.906,4.422)	(0.498,0.745,1.135)	(1.573,2.911,5.021)	3.995
A_{21}	(2.969,3.672,4.234)	(0.502,0.76,1.178)	(1.49,2.791,4.989)	3.865
A_{22}	(2,2.656,3.406)	(0.354,0.667,1.211)	(0.708,1.77,4.124)	2.61
A_{23}	(2.922,3.672,4.234)	(0.369,0.617,1.032)	(1.079,2.266,4.37)	3.179
A_{24}	(2.922,3.672,4.281)	(0.153,0.286,0.599)	(0.447,1.049,2.565)	1.579
A_{25}	(3.234,3.984,4.594)	(0.324,0.519,0.849)	(1.049,2.068,3.901)	2.896
A_{26}	(3.547,4.297,4.719)	(0.252,0.418,0.718)	(0.893,1.797,3.389)	2.512
A_{27}	(3.859,4.609,4.797)	(0.466,0.655,0.984)	(1.797,3.02,4.718)	4.073
A_{28}	(1.797,2.5,3.25)	(0.526,0.97,1.733)	(0.945,2.424,5.633)	3.565
A_{29}	(1.156,1.719,2.469)	(0.319,0.667,1.351)	(0.369,1.146,3.335)	1.816
A_{30}	(1.234,1.797,2.547)	(0.328,0.667,1.41)	(0.405,1.198,3.59)	1.925

As shown in Table 6, the most important customers' demands are A_1, A_3, A_{27}, $A_{2,}$ and $A_{5,}$ respectively. Moreover, A_{28}, A_{14}, A_{18}, $A_{15,}$ and A_4 have the highest improvement ratio, respectively. As can be seen in Table 6, A_{19}, A_{18}, A_{13}, $A_{4,}$ and A_{14} have the highest weights based on customers' opinions, respectively.

Regarding the employees' demands, it is shown in Table 7 that B_2, B_1, B_3, B_7, and B_{28} have the highest importance for employees. Results from the SERVQUAL questionnaire suggest that in the HR department, the demands B_{16}, B_{10}, B_{15}, $B_{11,}$ and B_{30} have the greatest improvement ratios, respectively. Finally, based on employees' opinions, B9, B30, B10, B27, and B11 gained the greatest total weights.

E. IDENTIFY THE TECHNICAL REQUIREMENTS

The technical requirements necessary for fulfilling both customers' and employees' demands were identified with the help of the experts, who also verified the final list. The finalized list of technical requirements presents no conflicts in terms of satisfying the needs of either customers or human resources.The technical requirements and their notations are shown in Table 8.

F. FORM THE 3D-HOQ MATRIX

Figures 4 and 5 show the customers' relationship matrix and employees' relationship matrix, respectively.

G. CALCULATE THE TECHNICAL REQUIREMENTS' TOTAL WEIGHTS

In the final step, the technical requirements' total and relative weights are obtained by Equations (12) and (13). It is assumed in the calculations that $\alpha = 0.5$, which means that the customers' demands and the employees' demands have equal importance. Table 9 shows the obtained weights for technical requirements in three cases: 1) considering their effects only on customers' demands; 2) considering their effects only on employees' demands; 3) considering their effects on both customers' and human resource's demands.

As shown in Table 9, the technical requirements C_{43}, C_{38}, C_{18}, $C_{11,}$ and C_9 have the greatest weights, respectively, if only the customers' demands are considered. Moreover, the technical requirements C_{19}, C_{20}, C_5, $C_{9,}$ and C_4 have the greatest weights, respectively, if only employees' demands are considered. However, considering the impact of technical

TABLE 7. Importance, improvement ratio, and final weight of the employees' demands.

No.	Importance of the demands	Improvement ratio	Final weight	Relative weight (%)
B_1	(4.094,4.844,4.938)	(0.404,0.574,0.868)	(1.656,2.779,4.284)	3.856
B_2	(4.172,4.922,4.969)	(0.386,0.548,0.832)	(1.61,2.699,4.134)	3.739
B_3	(4.094,4.844,4.938)	(0.375,0.55,0.845)	(1.535,2.664,4.173)	3.699
B_4	(3.625,4.375,4.656)	(0.014,0.038,0.267)	(0.051,0.165,1.244)	0.442
B_5	(3.859,4.609,4.844)	(0.03,0.052,0.26)	(0.114,0.238,1.261)	0.526
B_6	(3.078,3.828,4.391)	(0.132,0.347,0.675)	(0.405,1.328,2.964)	1.963
B_7	(4.094,4.844,4.938)	(0.133,0.29,0.527)	(0.544,1.406,2.6)	1.982
B_8	(3.391,4.141,4.563)	(0.161,0.358,0.659)	(0.545,1.484,3.006)	2.145
B_9	(3.703,4.453,4.781)	(0.697,0.929,1.263)	(2.583,4.135,6.038)	5.689
B_{10}	(2.625,3.281,3.844)	(0.821,1.19,1.72)	(2.155,3.906,6.613)	5.515
B_{11}	(3.234,3.984,4.5)	(0.691,0.961,1.372)	(2.235,3.828,6.175)	5.363
B_{12}	(2.734,3.438,3.953)	(0.472,0.767,1.253)	(1.29,2.639,4.953)	3.798
B_{13}	(2.734,3.438,4.047)	(0.48,0.791,1.282)	(1.313,2.718,5.19)	3.928
B_{14}	(2.297,3.047,3.797)	(0.126,0.395,0.866)	(0.29,1.203,3.289)	1.897
B_{15}	(2.344,3.047,3.75)	(0.763,1.175,1.806)	(1.789,3.58,6.774)	5.174
B_{16}	(2.313,2.969,3.578)	(0.795,1.211,1.858)	(1.839,3.594,6.647)	5.169
B_{17}	(3.391,4.141,4.563)	(0.65,0.907,1.31)	(2.205,3.757,5.979)	5.248
B_{18}	(3.625,4.375,4.75)	(0.126,0.315,0.599)	(0.456,1.377,2.845)	1.992
B_{19}	(3.859,4.609,4.844)	(0.138,0.31,0.57)	(0.531,1.43,2.762)	2.038
B_{20}	(3.313,4.063,4.531)	(0.61,0.863,1.295)	(2.021,3.506,5.868)	4.954
B_{21}	(3.547,4.297,4.719)	(0.363,0.585,0.935)	(1.287,2.513,4.414)	3.562
B_{22}	(2.391,3.047,3.609)	(0.009,0.026,0.358)	(0.021,0.08,1.292)	0.369
B_{23}	(2.922,3.672,4.141)	(0.027,0.043,0.319)	(0.078,0.159,1.319)	0.46
B_{24}	(2.922,3.672,4.188)	(0.042,0.089,0.384)	(0.123,0.327,1.609)	0.687
B_{25}	(3.547,4.297,4.672)	(0.432,0.648,1.004)	(1.532,2.785,4.692)	3.925
B_{26}	(2.703,3.359,3.875)	(0.008,0.024,0.325)	(0.022,0.082,1.26)	0.364
B_{27}	(3.703,4.453,4.781)	(0.654,0.875,1.25)	(2.424,3.896,5.976)	5.422
B_{28}	(4.016,4.766,4.906)	(0.615,0.8,1.131)	(2.471,3.812,5.548)	5.261
B_{29}	(3.281,3.984,4.406)	(0.675,0.94,1.366)	(2.215,3.745,6.018)	5.248
B_{30}	(3.422,4.219,4.688)	(0.701,0.942,1.368)	(2.399,3.975,6.412)	5.586

requirements on customers' and employees' demands, C_{20}, C_{19}, C_9, C_{18}, and C_5 have the top five priorities, respectively.

V. DISCUSSION AND RESULTS INTERPRETATION

In today's competitive market, process integration is the critical factor in reducing costs and increasing flexibility and coordination between different departments in an organization. This study integrated and prioritized the technical requirements for satisfying the customers' and employees' demands. The integrated model with a comprehensive viewpoint guides managers toward assigning the limited budget and resources of the organization to more effective technical requirements with greater impacts on the whole organizations' service quality. Organizations' managers are usually faced with financial limitations, and it is not possible to implement all identified technical requirements. This makes it challenging for organizations' managers to select the appropriate technical requirements for implementation. In this case, the technical requirements with a more significant impact on the organization's service quality should receive a higher priority for implementation. In such circumstances, a 3D-HOQ was proposed in this study to prioritize each requirement by assigning them a weight. In general, the weight of each technical requirement shows its priority for implementation by the managers. In the proposed 3D-HOQ, a technical requirement gains a higher weight if (1) it impacts more identified demands, (2) it has a higher impact on the identified demands in the relationship matrix, and (3) it impacts demands with a higher relative weight.

This study showed that the 3D-HOQ provides a more reliable weight than traditional HOQ. The reason is that 3D-HOQ considers the impact of each technical requirement on both departments, while traditional HOQ considers its impact on only one department. The results also indicate that if QFD is implemented in each department separately, different weights are obtained for the technical requirements compared to when it is applied on integrated departures.

The results of this study also showed that "intra-organizational processes automation" has the top priority among the technical requirements. Business correspondence and communication methods have changed drastically due to rapid developments in technology. Many researchers have studied the impact of "intra-organizational processes automation", the results of which indicate that utilizing

TABLE 8. Technical requirements for satisfying the customers' and employees' demands.

Technical requirement	No.	Technical requirement	No.
Hiring professional experts and academic elites	C_1	Establishing a database containing	C_{26}
Hiring professional and experienced managers	C_2	Utilizing social networks	C_{27}
Employing financial and economic experts and advisors	C_3	Automating customer and employee complaints management systems	C_{28}
Continuous work-related training for employees	C_4	Purchasing queue management equipment	C_{29}
Developing an employee performance evaluation system	C_5	Installing guidance signs	C_{30}
Recognizing the employees' problems and making efforts to resolve them	C_6	Installing hot and cold-water dispensers	C_{31}
Implementing employee discount programs	C_7	Proper air-conditioning and automatic air-freshener dispensers	C_{32}
Providing benefits such as Health and life insurance	C_8	Acquiring suitable furniture	C_{33}
Embracing new opinions and ideas and giving financial rewards	C_9	Regular cleaning	C_{34}
Material and non-material Incentive plans	C_{10}	Proper lighting	C_{35}
Providing staff transportation services	C_{11}	Installing shelves and folders for organizing documents	C_{36}
Assigning float times to employee work-hours	C_{12}	Pinning bank posters on bulletin boards	C_{37}
Recruiting sufficient workforce	C_{13}	Providing business cards and other necessary phone numbers for customers	C_{38}
Increase the number of work shifts	C_{14}	Constructing parking lots	C_{39}
Creating a Customer-Focused Culture	C_{15}	Installing ATMs	C_{40}
Individual customer guidance	C_{16}	Increasing the number of portable units	C_{41}
Online customer consulting and training courses	C_{17}	Teaching safety tips to customers by providing training brochures	C_{42}
Proper uniforms designed in accordance with the bank's values	C_{18}	Installing CCTV cameras and fire alarm systems	C_{43}
Simplification of administrative measures	C_{19}	Using modern bank vaults	C_{44}
intra-organizational processes automation	C_{20}	Implementing a safety training program to improve emergency preparedness capabilities	C_{45}
Deploying new and updated computers	C_{21}	Printing monthly bank magazines and placing them on special stands	C_{46}
Developing and expanding e-banking systems	C_{22}	Sending different types of notification SMSs	C_{47}
Establish quality assurance principles	C_{23}	Contacting the customers when debt repayments are delayed	C_{48}
Setting up an HR department	C_{24}	Giving customers occasional small gifts	C_{49}
Establishing evaluation units to check the branch's compliance with the standards	C_{25}	Providing incentive packages for VIP customers	C_{50}

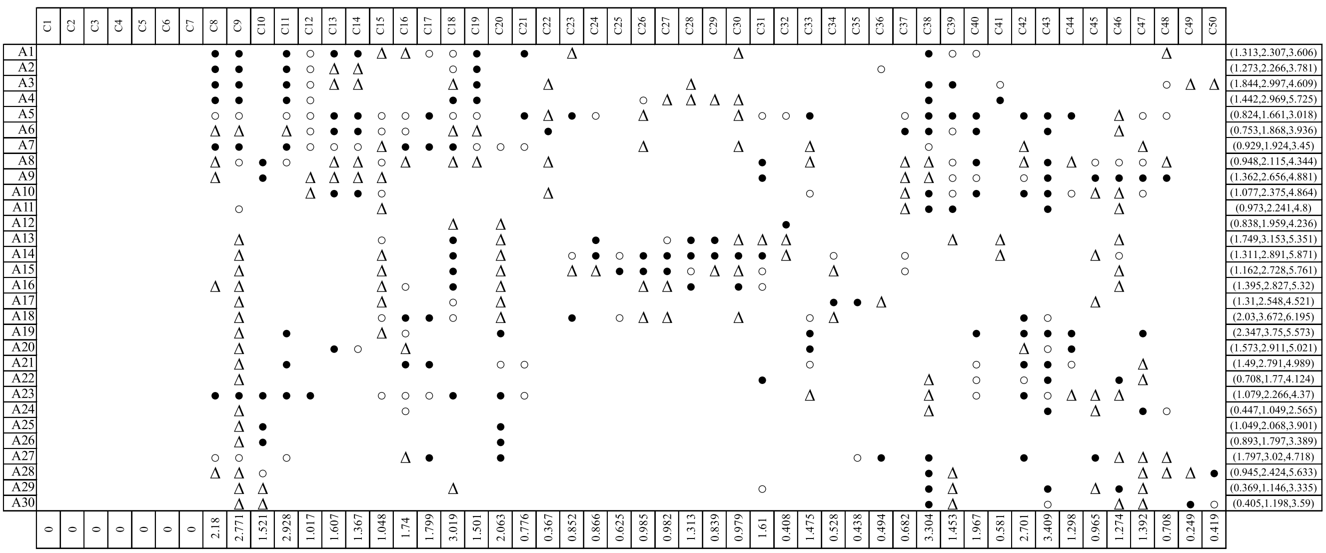

FIGURE 4. Customers' relationship matrix.

new information and communication technologies in different departments of an organization brings about accuracy in business activities, increases efficiency, reduces errors in recording information, helps make better decisions, facilitates information exchange processes, improves the employees' performance, and enhances customer satisfaction [52].

Results of the study also suggested that "simplification of administrative measures" is the top second technical

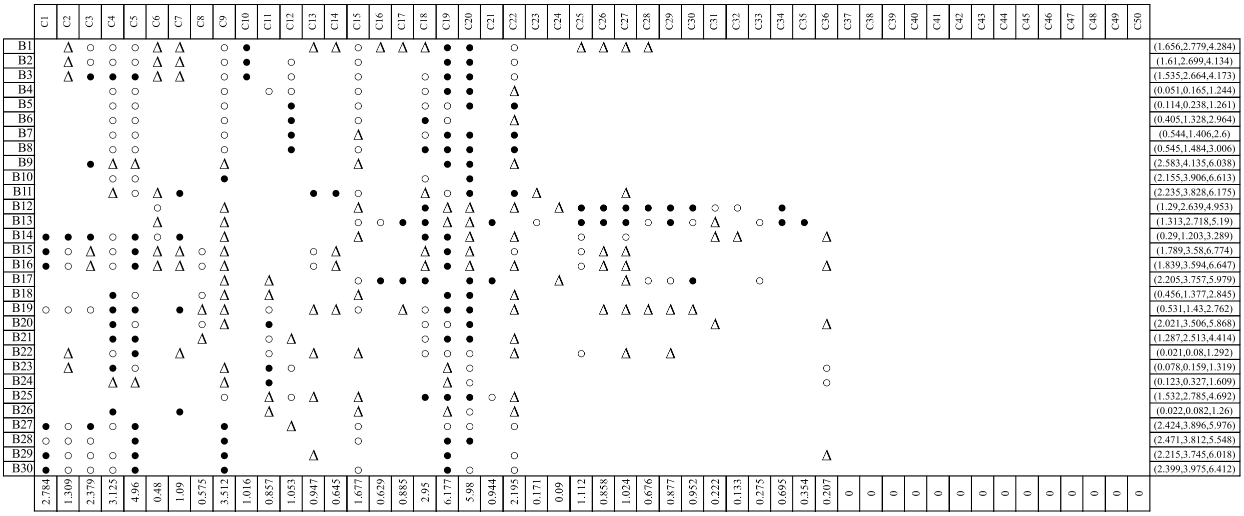

FIGURE 5. Employees' relationship matrix.

TABLE 9. Total weights of the technical requirements.

No.	Weight in C-RM	Weight in E-RM	Total weights	Relative (%)	No.	Weight in C-RM	Weight in E-RM	Total weights	Relative (%)
C1	0	2.784	1.392	2.478	C26	0.985	0.858	0.922	1.641
C2	0	1.309	0.654	1.165	C27	0.982	1.024	1.003	1.786
C3	0	2.379	1.189	2.118	C28	1.313	0.676	0.994	1.771
C4	0	3.125	1.562	2.782	C29	0.839	0.877	0.858	1.528
C5	0	4.96	2.48	4.416	C30	0.979	0.952	0.966	1.72
C6	0	0.48	0.24	0.427	C31	1.61	0.222	0.916	1.631
C7	0	1.09	0.545	0.97	C32	0.408	0.133	0.27	0.481
C8	2.18	0.575	1.378	2.453	C33	1.475	0.275	0.875	1.558
C9	2.771	3.512	3.141	5.594	C34	0.528	0.695	0.612	1.089
C10	1.521	1.016	1.269	2.259	C35	0.438	0.354	0.396	0.705
C11	2.928	0.857	1.893	3.37	C36	0.494	0.207	0.351	0.625
C12	1.017	1.053	1.035	1.843	C37	0.682	0	0.341	0.607
C13	1.607	0.947	1.277	2.274	C38	3.304	0	1.652	2.941
C14	1.367	0.645	1.006	1.792	C39	1.453	0	0.726	1.293
C15	1.048	1.677	1.362	2.426	C40	1.967	0	0.984	1.752
C16	1.74	0.629	1.184	2.109	C41	0.581	0	0.29	0.517
C17	1.799	0.885	1.342	2.39	C42	2.701	0	1.351	2.405
C18	3.019	2.95	2.984	5.314	C43	3.409	0	1.704	3.035
C19	1.501	6.177	3.839	6.836	C44	1.298	0	0.649	1.155
C20	2.063	5.98	4.022	7.161	C45	0.965	0	0.483	0.859
C21	0.776	0.944	0.86	1.531	C46	1.274	0	0.637	1.134
C22	0.367	2.195	1.281	2.281	C47	1.392	0	0.696	1.24
C23	0.852	0.171	0.512	0.911	C48	0.708	0	0.354	0.63
C24	0.866	0.09	0.478	0.852	C49	0.249	0	0.125	0.222
C25	0.625	1.112	0.869	1.547	C50	0.419	0	0.21	0.373

requirement priority. The findings of other studies also show that complex administrative and bureaucratic practices in organizations hinder providing on-time services to customers, influence the HR department, and result in administrative corruption [53].

Analyzing the results also revealed that "Embracing new opinions and ideas and giving financial rewards" is the top third priority among the technical requirements. Lawler and Porter's study also supports this finding, as they argued that job satisfaction theory signifies the profound impact of financial reward on employees' job satisfaction [54].

VI. CONCLUSION AND SUGGESTIONS FOR FUTURE RESEARCH

In this study, an integrated model was presented to prioritize the technical requirements for simultaneously satisfying the demands of customers and employees in the banking industry. To achieve the goal of the study, a novel model was proposed by combining the 3D-HOQ matrix, SERVQUAL, and fuzzy logic. To better explain and test the model, a case study was conducted on an international bank with a vast network of branches. As a result of applying the proposed model to the marketing and human resource departments of the studied bank, 30 customers' demands, 30 employees' demands, and 50 technical requirements are identified. The analysis of the results showed that ''intra-organizational processes automation'', ''simplification of administrative measures'', and ''Embracing new opinions and ideas and giving financial rewards'' have the highest weight among all the 50 identified technical requirements, respectively. The results of the study also suggested that ''using new banking technologies (e.g., mobile banking, ATMs, etc.)'' has the highest weight among the customers' demands. Additionally, ''job security'' was found to have the highest weight among employees' demands.

As for the practical implication, the introduced model in this study helps departments integrate and coordinate their activities to enhance the organization's quality, prevents inconsistency of operations in various departments, and increases resource usage effectiveness. It also causes cost and time-saving in the organization by preventing reworks and parallel works and increasing efficiency in the organization. Moreover, it increases knowledge and experience sharing and knowledge integration between departments.

This research also helps managers identify customers' and employees' demands. The importance and improvement ratio of the identified demands helps managers to concentrate on the most critical demands. In addition, it helps the managers to identify the technical requirements for satisfying these demands. The weights obtained for the technical requirements help the managers assign the limited resources to more appropriate technical requirements, having more impact on their organizations' service quality.

Future research might take advantage of the proposed model in this study to improve the service quality in the banking industry or other organizations by considering the integration of the same or other departments. Moreover, multi-criteria decision-making techniques could be utilized to develop the model further and prioritize the demands. Adding additional dimensions to the HOQ to cover more departments could be considered as another scope for future research.

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