Comparative Analysis of Quality Function Deployment Methodologies: A Case Study Analysis

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Quality function deployment has been successfully used to capture the voice of the customer and translate it into technical design requirements. Previous researchers have employed various tools and models in this process. This paper discusses three models used to prioritize customer requirements for developing a service. This paper presents a case study based on outcomes for a service offered by a university, called a Career Opportunity Center, which serves students as its customers. This study analyzed a service dataset using the modified Kano model, SERVQUAL, and analytical hierarchy process, and identified the strengths and weaknesses of each method.

Key words: analytical hierarchy process, Kano model, quality function deployment, service industry, SERVQUAL

INTRODUCTION

Quality function deployment (QFD) has been widely used to capture the voice of the customer (VOC) and translate it into technical requirements in the development of products and services. It is a link between product or service development and technical specifications to achieve customer satisfaction. Applications of QFD range from product development, service development, and product reprojecting (Miguel and Carnevalli 2008).

Assessing customer requirements is a complex task. Traditional approaches have focused on present customer needs; however, Wu, Liao, and Wang (2005) have concluded that, since customer needs are dynamic and may vary drastically over time, analyzing future customer needs is critical to an organization's long-term competitiveness. Customer needs may vary depending on numerous factors, the most important and complex of which is human nature. Other factors may include cultural setting, work environment, age, sex, and so on. The most common way to determine customer requirements is through direct customer interaction, but surveyors must consider what a customer means rather than what he or she says.

Researchers have used various techniques to gather customer requirements, including interviews, surveys, and focus groups with both straightforward and open-ended questions. This study formulated open-ended interview questions for a small target audience, identified consequences and attributes, and then conducted a survey. The attributes were the physical or abstract characteristics of the service,

and the consequences or benefits were the results of using the service (Fisher and Schutta 2003).

Since QFD's introduction, it has been used in conjunction with various techniques such as the Kano model (Sauerwein et al. 1996), SERVQUAL (Parasuraman, Zeithaml, and Berry 1988), analytical hierarchy process (AHP), and maximum difference (MaxDiff), among others. This study compared the Kano model, SERVQUAL, and AHP, analyzing variations in the way each approach prioritizes customer requirements. Existing literature shows that the limitations of these models are that some are more quantitative and some are more subjective in nature, thereby making them hard to compare outcomes and provide validity to the QFD methodologies. The purpose of this study was to analyze the outcome of the same dataset after it had been processed through three existing approaches commonly used in QFD methodologies (Kano, analytical hierarchy process, and SERVQUAL) and to illustrate the findings.

BACKGROUND

This study examined the case of the Career Opportunities Center (COC) at a technological university in an effort to improve its existing services. The data were collected to identify the needs of the customer, which, in this case, are students at the university. These data were analyzed through the Kano model, SERVQUAL, and AHP, and the results of each method were compared. QFD models are inclined to user subjectivity, and this research aims at comparing the outcomes of three models to see if the results were similar or totally different. This paper provides a basis for future researchers to identify and analyze the variation as a result of the user's perspective in using QFD models.

The following discussion will give insight into the development of QFD. QFD was initially used in Japan in the late 1960s and early 1970s. It was invented by Yogi Akao in 1966 and was first implemented in Mitsubishi's Kobe shipyard in 1972. QFD was implemented in the United States in the 1980s, primarily in manufacturing. Since then, it has been widely used in many industries and various functional areas. QFD has been successfully implemented in product development, quality management, customer needs analysis, product design, planning, engineering decision making, management, teamwork, timing, costing, and other areas (Chan and Wu 2002).

Over time, QFD has also been introduced into the service industry. The service sector, including banking, hotels, travel, healthcare, and education, constitutes a significant and growing segment of the U.S. economy. Nonetheless, American Customer Satisfaction Index (ACSI) scores for the service sector are still lower than those for manufacturing (ACSI 2010). Under the circumstances, greater attention to customer satisfaction is needed in service industries.

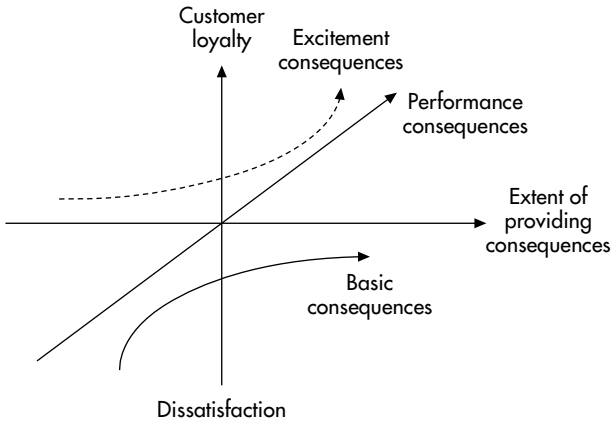
To achieve customer satisfaction, it is important to create and deliver services that satisfy customer needs. Some requirements might be more important to customers than others. An important step was to prioritize these requirements based on customers' inputs. This paper analyzes three QFD models and compares them to see if the results for prioritized customer expectations are the same or if they differ significantly for the COC.

The Kano model is a theory of customer satisfaction developed in the 1980s by Noriaki Kano (Kano et al. 1984). During interviews and focus groups, it can be difficult to elicit from customers clear expressions of the consequences that are important to them. Attributes are the physical or abstract characteristics of the service, whereas consequences are the results of using the service. Sometimes customers are not even aware of important consequences (Fisher and Schutta 2003). This paper uses the modified Kano model, as explained by Fisher and Schutta (2003).

Figure 1 illustrates the three different consequences and indicates the extent to which they can affect customer satisfaction. These consequences include performance, basic, and excitement consequences. Performance consequences are those that customers currently use to evaluate service brands. Basic consequences have a nonlinear relationship with customer satisfaction. For example, if a service

does not provide basic consequences, customers will be dissatisfied; when a service does provide basic consequences, customers are only moderately satisfied. Because these consequences do not provide any competitive advantage, they are necessary characteristics. The third type is excitement consequences, which no service brand currently provides, as far as the customer is aware. If provided, these can lead to a tremendous competitive advantage. If they are not provided, however, customers are neither satisfied nor dissatisfied.

Figure 1 Kano Model.



SERVQUAL is a service quality framework developed in the mid-1980s by Parasuraman, Zeithaml, and Berry (1985). It is one of the most widely used models for the evolution of service quality (Pawitra and Tan 2003). Initially, it reflected 10 aspects of service quality (Parasuraman, Zeithaml, and Berry 1985); however, in the early 1990s, these were condensed into five. The five dimensions of service quality, commonly known as RATER, include (Lim, Tang, and Jackson 2003):

1. Reliability—ability to perform the promised service dependably and accurately
2. Assurance—knowledge and courtesy of staff and their ability to convey trust and confidence
3. Tangibles—physical facilities, equipment, and appearance of staff
4. Empathy—caring, individualized attention provided to its customers
5. Responsiveness—willingness to help customers and provide prompt service

With the help of SERVQUAL, customer satisfaction can be measured in terms of the difference, or gap, between the expected and perceived level of performance. This approach can be applied to any service organization to evaluate the standards of quality for the services provided. "Services are different from goods in many ways: they are intangible, require participation of the customer, simultaneous production and consumption" (Oliveira and Ferreira 2009).

Table 1 Services, attributes, and consequences.

Services	Attributes	Consequences
Interview preparation	Success rate	professional appearance; no nervousness; know what to expect in interviews; more prepared for interview; impressive body language; confident in communication; more comfortable
Résumé/ Cover letter writing	Effective	professional résumé; content appealing to employer; stand out to company; error free; good impression to employer
Professional behavior training	Impressive Etiquettes	outstanding appearance; correct posture; correct body language; confident gestures; knowledge of cultural sensitivity
Job placement	Job offers	best fit for customer; leads to higher quality of life; good benefits; choice of multiple offers; job offer evaluation; working overseas
	Fast	ease of handling multiple opportunities; save time for coursework
Career fair	Employer exposure	increased participation; better communication skills; job market knowledge; résumé distribution; boost confidence; increase motivation

Research conducted by Baki et al. (2008) concluded that the integration of SERVQUAL, the Kano model, and QFD could serve as an effective tool for assessing quality of services provided by an organization. The linearity assumption in SERVQUAL can be eliminated by integrating SERVQUAL with the Kano model and QFD to develop a way to satisfy customer needs, thus leading to increased customer satisfaction and higher profits.

AHP is a method to rank customer requirements on the basis of relative importance; it is also known as full pair-wise comparison. It was developed by Thomas Saaty in the 1970s and has been extensively studied and refined since then. AHP is a highly developed mathematical system for prioritizing numerous items. Comparing two items is easier than comparing numerous items at the same time (Bayraktaroglu and Ozgen 2008). In dealing with decision requirements, Saaty (1980) recommends that designers apply AHP to determine the ratio-scale weights for rating the importance of requirements. In general, the steps of the process are:

1. List all of the customer attributes and make pair-wise comparisons.
2. Calculate a priority vector for the customer attributes. The priority vector is the eigenvector of the pair-wise comparison matrix (otherwise known as the dominance matrix).
3. For each customer attribute, a pair-wise comparison for each engineering characteristic is performed on the basis of how well an engineering characteristic satisfies a customer attribute compared to the other engineering characteristic in pair. Eigenvectors are then computed for the comparison matrix created for each of the customer attributes.
4. Compute the global priority for each engineering characteristic by multiplying the eigenvector computed in step 3.

These global priority ratings can then be used to flow down functional requirements (Jikar et al. 2007).

Table 2 Affinity diagram.

	Group	Consequences
1	Professional appearance	Outstanding appearance Impressive body language
2	Stand out to employer	Correct posture Correct body language
3	Interview preparation	No nervousness Confident gestures
4	Interview experience	Know what to expect in interviews
5	Interview opportunities	Get opportunities from potential employers
6	Comfortable	More comfortable Confident in communication
7	Professional résumé	Good impression to employer Content appealing to employer
8	Résumé Evaluation	Error-free Impressively distinct
9	Job that fits	Leads to higher quality of life
10	Work overseas	Opportunities working overseas Knowledge of cultural sensitivity
11	Job offer evaluation	Ease of handling multiple opportunities Save time for coursework Choose from multiple offers
12	Job market knowledge	Increased participation Increase motivation
13	Good salary	Job should pay well Good benefits
14	Job offers	Get job offers Boost confidence
15	Résumé accessibility	Résumé distribution

SURVEY AND DATA COLLECTION METHODOLOGY

This section presents a case study using a university Career Opportunities Center (COC) to illustrate the three methodologies and their similarities and differences.

The mission of the COC is to proactively educate degree-seeking students and graduates in their pursuit of professional, full-time, co-op, or summer

Table 5 Survey results for COC.

Consequence	Importance	COC	Ideal career center
	Scale 1-10	Rating (Max. 5.0)	Rating (Max. 5.0)
I have a professional appearance for an interview.	6.8	3.6	4.5
I am comfortable during an interview.	7.3	3.5	4.6
I stand out to a potential employer.	8.1	3.5	4.7
I am prepared for an interview.	7.7	3.5	4.5
I have interviewing experience.	6.9	3.5	4.5
I get opportunities with potential employers.	7.7	3.5	4.6
I can work overseas.	3	2.5	3.7
I know what different jobs are available.	7.2	3.5	4.6
I have a professional résumé.	7.7	3.6	4.6
I get a résumé evaluation.	6.6	3.4	4.5
I have my résumé easily accessible to companies.	7.5	3.7	4.6
I get a job that fits me.	8.4	3.3	4.7
I get a job that pays well.	7.8	3.5	4.6
I have a job that I enjoy.	8.4	3.3	4.6
I get job offers.	8.5	3.3	4.7
Would you recommend this service to your peers?	N/A	3.2	4.5

employment, and to develop and maintain mutually rewarding partnerships with employers and the university faculty and staff.

The first step in the study was to identify what services are offered by the COC and what services need improvement. The rationale behind the selection of services needing improvement is as follows:

1. First impressions are very important when applying for a job, and a career center plays an important role in preparing students and graduates to look professional.
2. A career center should also allow users to earn a higher starting full-time salary due to the potential for multiple offers and opportunities.
3. A career center should facilitate the interview process between students and potential employers and enhance interviewing skills through educational seminars.
4. A career center should target many different groups, including graduate students, transfer students, alumni, and undergraduate students seeking co-ops, internships, and full-time positions.

Based on this rationale, several open-ended questions were prepared, which helped in identifying different services offered by the COC.

DATA COLLECTION

Initially, 30 interviews were conducted to learn about the COC's services. The interviews targeted students across disciplines on a university campus. Interviewers posed the following open-ended questions, asking the interviewee "why" until there were no other logical responses, thus drilling down to the reason the customer desires a service or product.

Table 6 Consequences grid of COC services.

Type	General consequences	Specific consequences
Basic	I have a professional appearance for an interview.	outstanding appearance; impressive body language
	I am prepared for an interview.	confident gestures; not nervous
	I get opportunities with potential employers.	interview opportunities
	I know what different jobs are available.	increased motivation; increased participation in career events
	I have a professional résumé.	good impression on employer; content appealing to employer
	I get job offers.	confidence boosted; job offers
Performance	I am comfortable during an interview.	more comfortable; confident in communication
	I stand out to a potential employer.	correct posture; correct body language
	I have interviewing experience.	know what to expect in interviews
	I get a résumé evaluation.	impressive; error-free
Excitement	I have my résumé easily accessible to companies.	résumé distribution
	I get a job that pays well.	good benefits; good salary
	I can work overseas.	opportunities working overseas; knowledge of cultural sensitivity
	I get a job that fits me.	higher quality of life
	I have a job that I enjoy.	chose from multiple employers; job offer evaluation

1. "What services do you expect to receive from a career placement center and why?"
2. "What do you think would help you find a good job when you graduate?"
3. "If you have ever been on a job interview, what happened? How did it go?"
4. "How could you have been more prepared?"

Once the interviews were conducted, attributes of the services provided by the COC and the benefits as a result of using the services were identified based on the responses from the customers. These are shown in Table 1.

Based on the information retrieved from the interviews, and after identifying attributes and consequences, an affinity diagram was created that groups similar consequences together. An affinity diagram is a tool that gathers large amounts of data (ideas, opinions, issues) and organizes them into groups based on their natural relationships. Table 2 shows an affinity diagram created by grouping consequences. A total of 15 customer requirements were determined using the affinity diagram.

Finally, consequences were narrowed down and a survey questionnaire was created, which targeted a larger sample of the target segment. The questionnaire consisted of two parts. In the first part, each individual rated the importance of each consequence on a scale of 1 to 10, with 10 being the most important. In the second, each individual performed a competitive comparison, rating the COC and an ideal career center on how well they deliver each consequence. A Likert-type scale was used, which required the customer to rate consequences on a 1 to 5 scale, with 5 being the highest.

Tables 3 and 4 (see appendix) show the prepared questionnaire, including the importance rating and the performance rating.

SURVEY RESULTS

Initially, 30 students were interviewed with probing questions. This information was used to finalize

the survey that was then given to 100 students. The average values of the importance of each consequence, and performance ratings for each consequence, were captured for the COC and an ideal career center. Table 5 shows the average values of survey results for all 15 consequences, which were gathered in Table 3 using the affinity diagram.

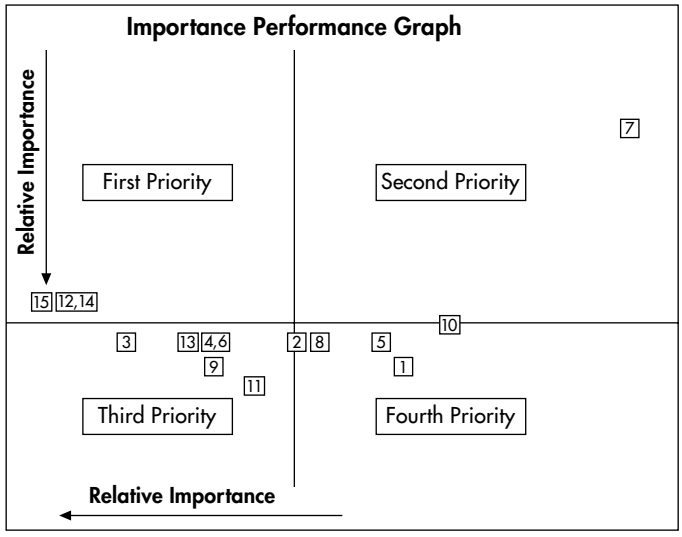
Case I: Using Modified Kano Model to Prioritize the Requirements

Based on the modified Kano model, the consequences used in the survey were categorized as basic consequences, performance consequences, and excitement consequences. Table 6 categorizes the various consequences of the COC services according to type. The basic consequences are essential; their absence causes dissatisfaction among customers. Performance consequences are one-dimensional consequences that cause satisfaction if performance is high and dissatisfaction if performance is low.

Excitement consequences cause satisfaction if delivered, but do not affect customers if they are not provided. The priority ranking is clearer when seen through an importance grid that explains which services are effective and which require improvement. In Figure 2, the importance rating is plotted against performance ratings, and the four quadrants show the priority levels. To create this graph, the average importance ranking and average COC rating were taken from Table 5. These values were then used to determine the location of each consequence on the graph.

The consequences were prioritized on the basis of quadrants. Within the same priority quadrant, they

Figure 2 Importance performance graph.



Marker	Benefit	Quadrant
1	I have a professional appearance for an interview.	4
2	I am comfortable during an interview.	4
3	I stand out to a potential employer.	3
4	I am prepared for an interview.	3
5	I have interviewing experience.	4
6	I get opportunities with potential employers.	3
7	I can work overseas.	2
8	I know what different jobs are available.	4
9	I have a professional résumé.	3
10	I get a résumé evaluation.	4
11	I have my résumé easily accessible to companies.	3
12	I get a job that fits me.	1
13	I get a job that pays well.	3
14	I have a job that I enjoy.	1
15	I get job offers.	1

Table 7 Kano ranking.

Benefit	Type	Quadrant	Importance	Rating	Rank
I get job offers.	Basic	1	8.5	3.3	1
I get a job that fits me.	Excitement	1	8.4	3.3	2
I have a job that I enjoy.	Excitement	1	8.4	3.3	2
I can work overseas.	Excitement	2	3	2.5	4
I stand out to a potential employer.	Performance	3	8.1	3.5	5
I am prepared for an interview.	Basic	3	7.7	3.5	6
I get opportunities with potential employers.	Basic	3	7.7	3.5	7
I have a professional résumé.	Basic	3	7.7	3.6	8
I have my résumé easily accessible to companies.	Excitement	3	7.5	3.7	9
I get a job that pays well.	Excitement	4	7.8	3.5	10
I am comfortable during an interview.	Performance	4	7.3	3.5	11
I know what different jobs are available.	Basic	4	7.2	3.5	12
I have interviewing experience.	Performance	4	6.9	3.5	13
I have a professional appearance for an interview.	Basic	4	6.8	3.6	14
I get a résumé evaluation.	Basic	4	6.6	3.4	15

were further ranked on the basis of importance; that is, the higher the importance, the greater the preference. If two consequences had the same importance, then they were ranked on performance rating. Lower performance had a higher priority. Table 7 shows the final Kano model rankings.

Case II: Using SERVQUAL to Prioritize Requirements

SERVQUAL is widely used in service industries to assess the gap between desired and actual performance. It takes into account customer's perceptions of the relative importance of service characteristics and thus allows an organization to focus its resources according to priority rankings. The 15 customer requirements that were determined using the affinity diagram were categorized on the basis of the five dimensions of service quality (Lim, Tang, and Jackson 2003). These dimensions are reliability, assurance, tangibles, empathy, and responsiveness. From the data collected through the survey, an improvement ratio was calculated for each requirement considering the average performance rating of the COC and the average rating for an ideal career center from Table 5.

The customer importance rating for each requirement was then associated with the improvement ratio to give a raw weight, which in turn gave the priority ranking for each requirement. This ranking signifies the order in which a service provider should focus on consequences in order to maximize service quality while controlling costs. It helps service providers fill the gap between customer expectations for service and perceived performance. Table 8 shows the calculations; Table 9 shows the priority rankings.

Case III: Analytical Hierarchy Process

The concept behind AHP is to construct a pairwise comparison matrix. This matrix includes

Table 8 SERVQUAL

Customer requirements		Importance rating	Performance rating	Performance goal	Improvement ratio	Raw weight
Tangibles	I have professional appearance for interview.	6.8	3.6	4.5	1.25	8.50
	I can work overseas.	3	2.5	3.7	1.48	4.44
	I got a job that pays well.	7.8	3.5	4.6	1.31	10.25
Reliability	I get opportunities with potential employers.	7.7	3.5	4.7	1.34	10.34
	I get a résumé evaluation.	6.6	3.4	4.5	1.32	8.74
	I know what different jobs are available.	7.2	3.5	4.5	1.29	9.26
	I have interviewing experience.	6.9				
Responsiveness	I get job offers.	8.5	3.3	4.7	1.42	12.11
	I stand out to potential employers.	8.1	3.5	4.6	1.31	10.65
	I am prepared for an interview.	7.7	3.5	4.6	1.31	10.12
Assurance	I have professional résumé.	7.7	3.6	4.6	1.28	9.84
	My résumé easily accessible to companies.	7.5	3.7	4.6	1.24	9.32
	I am comfortable during interview.	7.3	3.5	4.6	1.31	9.59
Empathy	I get a job that fits me.	8.4	3.3	4.6	1.39	11.71
	I have a job that I enjoy.	8.4	3.3	4.7	1.42	11.96

m customer requirements or consequences, and each a_{ij} represents a pair-wise comparison of the i^{th} and j^{th} consequences.

$$\begin{bmatrix} a_{11} & \dots & a_{1j} \\ \vdots & \ddots & \vdots \\ a_{i1} & \dots & a_{ij} \end{bmatrix}$$

In step 1 of AHP, a matrix was created considering all of the 15 consequences; this matrix is shown in Table 10 (see Appendix). The matrix was created by dividing the importance rating of the first requirement by that of the second requirement.

In step 2, each entry in column i of the matrix was divided by the sum of all of the entries in column i, which yielded another matrix, $A_{weights}$, shown in Table 11 (see Appendix).

From this matrix, a consistency check was performed:

$$CI = \frac{\lambda_{max} - n}{n + 1}$$

where CI is the consistency index (equal to 0.000106279), RI is the random consistency index a standard value equal to 1.586 (Tummala and Ling 1998), and λ_{max} is the maximum eigenvalue (here, 15.0014879).

The consistency ratio is calculated as:

$$CR = {}^{CI}/_{RI} = {}^{0.000106279}/_{1.586} = 6.7 \times 10^{-5}$$

The matrix is highly consistent; thus, taking the averages of elements in i^{th} row yields a column vector. This vector represents the final weights for the priority ranking using AHP; it is shown in Table 12.

Performance ratings were used for the final priority ranking of the consequences.

RESULTS AND DISCUSSION

The goal of this study was to see if the outcomes of the three models, when used to prioritize customer requirements in a service industry, were the same or different, in order to provide additional credibility to QFD. Using the dataset generated from the survey, the relative rankings of 15 customer requirements are formed using the modified Kano model, SERVQUAL, and AHP. Table 13 shows the results of the three methods used in the study.

From Table 13, it was observed that the three most important requirements were close for all of the models. The variation in rankings increases as one moves toward the lower ranks in the ranking table. Looking beyond the third row in the ranking chart, the variation in ranks of the modified Kano model and AHP increases drastically, while the rankings of SERVQUAL and the AHP model were still consistent to a fair extent.

The modified Kano model for service industries used a mixed approach, first classifying the consequences as performance, basic, or excitement and later using an importance performance grid for ranking. This method is helpful in identifying not only the basic, performance, and excitement requirements, but also in evaluating customer rankings. The Kano model has the disadvantage of occasionally assigning the same rank to two requirements and thus risking displacement of the customer's perception by that of the service provider's.

The SERVQUAL method is specifically used in developing or improving a service. In this method, the requirements are ranked based on service characteristics typically desired by the customers and ranked according to importance. Unlike the Kano model, SERVQUAL is a one-step method that gives a clearer picture of the ranking.

The AHP method, on the other hand, is quantitative and the consequences are ranked according to relative importance. It gives a precise ranking scale based on quality improvement. One disadvantage of the AHP method is the calculation involved and the development of a complex matrix that grows depending on the number of customer requirements. In the COC case presented in this study, the matrix was 15×15.

Table 9 SERVQUAL rankings.

Rank	Customer requirements	
1	responsiveness	I get job offers.
2	empathy	I have a job that I enjoy.
3	empathy	I get a job that fits me.
4	responsiveness	I stand out to potential employers.
5	reliability	I get opportunities with potential employers.
6	tangibles	I got a job that pays well.
7	responsiveness	I am prepared for an interview.
8	assurance	I have professional résumé.
9	assurance	I am comfortable during interview.
10	assurance	My résumé is easily accessible to companies.
11	reliability	I know what different jobs are available.
12	reliability	I have interviewing experience.
13	reliability	I get a résumé evaluation.
14	tangibles	I have professional appearance for interview.
15	tangibles	I can work overseas.

The results for the Kano model differ significantly from those for SERVQUAL and AHP. The SERVQUAL and AHP rankings are similar with some degree of variation, as shown in Figure 3. Variation in ranking among these three models increases with the number of customer requirements. This means for designing a product or service with few identified customer requirements that all three methods will result in similar rankings. On the other hand, in the case of complex service designs where there are a large number of customer requirements, the variation between the rankings can grow exponentially. Moreover, the choice of methodology may also depend on the type of service under consideration. In a product service

Table 12 AHP rankings.

Benefit	Ranking	AHP Weights	COC Rating	Ideal COC	Quality Improvement
I have a professional appearance for an interview.	14	0.0620	3.6	4.5	-0.056
I am comfortable during an interview.	7	0.0666	3.5	4.6	-0.073
I stand out to a potential employer.	4	0.0739	3.5	4.7	-0.089
I am prepared for an interview.	9	0.0703	3.5	4.5	-0.070
I have interviewing experience.	12	0.0630	3.5	4.5	-0.063
I get opportunities with potential employers.	6	0.0703	3.5	4.6	-0.077
I can work overseas.	15	0.0274	2.5	3.7	-0.033
I know what different jobs are available.	8	0.0657	3.5	4.6	-0.072
I have a professional résumé.	10	0.0703	3.6	4.6	-0.070
I get a résumé evaluation.	11	0.0602	3.4	4.5	-0.066
I have my résumé easily accessible to companies.	13	0.0684	3.7	4.6	-0.062
I get a job that fits me.	2	0.0766	3.3	4.7	-0.107
I get a job that pays well.	5	0.0712	3.5	4.6	-0.078
I have a job that I enjoy.	3	0.0766	3.3	4.6	-0.100
I get job offers.	1	0.0776	3.3	4.7	-0.109

system in which the requirements are tangible and thus can be clearly identified by customers, the AHP method may be a better choice. For service development, SERVQUAL is a better choice, and the Kano model may be used where service design is highly configurable and the service provider can influence the cost of the service. This implies that even though any of these models can be used to prioritize customer requirements, it is important to consider other factors such as product-service mix, service design flexibility, and cost to the service provider in order to achieve higher customer satisfaction.

Overall, for the application of the findings of the study to the COC, the most important need that customers want as a benefit from using this service is getting a job. All three models used determined this to be the highest customer need. The next two highest priority items that customers want to see as a benefit from using the COC, as determined by all three models, are getting a job that fits them and getting a job they enjoy. The COC should focus on ensuring that its customers are getting jobs, customers get jobs that fit them well, and customers are finding these jobs enjoyable. If this is not taking place, the COC should take action to correct this situation. The other benefits outlined are important but agree less rigorously among the three models as to importance. This, again, highlights the significance of the first three benefits aforementioned.

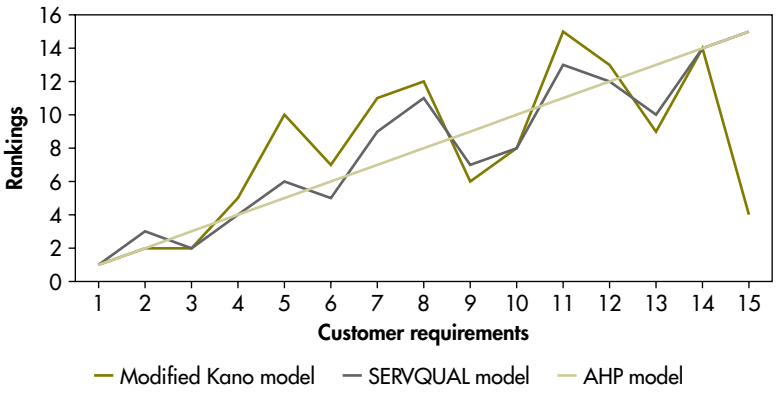
After the completion of the initial study, the results were provided to the COC for its review. Based on the recommendations of the study, the COC chose to take action on several items in order to improve its level of services and ensure it was providing the correct types of services and level of customer satisfaction to its customers. The COC has begun implementing several new initiatives. The first action was the creation of a new workshop focused on international students and their job search process, and the purchase of a new online database that is provided free to COC customers. This database also includes an international component. The COC has also arranged speaking engagements with industries that hire COC customers to discuss job search skills and international awareness. The COC is now a standard agenda

Table 13 Results for Kano, SERVQUAL, and AHP rankings.

Benefit	Modified Kano ranking	SERVQUAL ranking	AHP ranking
I get job offers.	1	1	1
I get a job that fits me.	2	3	2
I have a job that I enjoy.	2	2	3
I stand out to a potential employer.	5	4	4
I get a job that pays well.	10	6	5
I get opportunities with potential employers.	7	5	6
I am comfortable during an interview.	11	9	7
I know what different jobs are available.	12	11	8
I am prepared for an interview.	6	7	9
I have a professional résumé.	8	8	10
I get a résumé evaluation.	15	13	11
I have interviewing experience.	13	12	12
I have my résumé easily accessible to companies.	9	10	13
I have a professional appearance for an interview.	14	14	14
I can work overseas.	4	15	15

item for the University's Council of Graduate Student committee meeting, which has a large base of international students. This allows for all graduate students to have a voice in the COC regarding needs, wants, and concerns regarding the hiring and career service process.

Figure 3 Variation in ranking for three models.



CONCLUSION

This study has considered a service industry case study using the same dataset for three different models. The results from three models were compared, and it was observed that the variation in the rankings among these models increases with an increase in the number of customer requirements. The selection criteria for the use of these models will depend not only on the number of identified customer requirements but also on service design flexibility, product-service mix, and cost to the service provider. Future research can be focused on identifying a weight scale for the modified Kano

model for three different types of consequences. That will make the modified Kano model more robust and quantitative, and the variation can be further analyzed. Similarly, for a particular type of service design, another weight scale can be used for five different dimensions of service quality (RATER). For example, in services where the degree of customer contact is high, the tangibles will have considerably more weight as compared to services where customer contact is low, such as a call center. The identification of such weights can be used as a sales point and can help in providing an accurate representation of customer requirement rankings.

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BIOGRAPHIES

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APPENDIX

COC Survey Questionnaire Part A

Find the benefit of using the Career Opportunities Center in the list below that is most important to you. Assign it 10 points. Then, assign from 0 to 10 points to the other benefits to indicate how important they are to you in comparison to the most important one. You may assign the same number of points to more than one benefit.

_____ I have a professional appearance for an interview.

_____ I am comfortable during an interview.

_____ I stand out to a potential employer.

_____ I am prepared for an interview.

_____ I have interviewing experience.

_____ I get opportunities with potential employers.

_____ I can work overseas.

_____ I know what different jobs are available.

_____ I have a professional résumé.

_____ I get a résumé evaluation.

_____ I have my résumé easily accessible to companies.

_____ I get a job that fits me.

_____ I get a job that pays well.

_____ I have a job that I enjoy.

_____ I get job offers.

COC Survey Questionnaire Part B

Please rate how well the Career Opportunities Center delivers each of these benefits when you use it. Circle the number below that best indicates how well you feel the COC satisfies each of the benefits. For comparison purposes, please rate your ideal career center on the same benefits. Use a scale of:

1= Strongly disagree
2= Disagree
3= Neutral
4= Agree
5= Strongly agree

	MST COC	Ideal Career Center
I have a professional appearance for an interview.	1 2 3 4 5	1 2 3 4 5
I am comfortable during an interview.	1 2 3 4 5	1 2 3 4 5
I stand out to a potential employer.	1 2 3 4 5	1 2 3 4 5
I am prepared for an interview.	1 2 3 4 5	1 2 3 4 5
I have interviewing experience.	1 2 3 4 5	1 2 3 4 5
I get opportunities with potential employers.	1 2 3 4 5	1 2 3 4 5
I can work overseas.	1 2 3 4 5	1 2 3 4 5
I know what different jobs are available.	1 2 3 4 5	1 2 3 4 5
I have a professional résumé.	1 2 3 4 5	1 2 3 4 5
I get a résumé evaluation.	1 2 3 4 5	1 2 3 4 5
I have my résumé easily accessible to companies.	1 2 3 4 5	1 2 3 4 5
I get a job that fits me.	1 2 3 4 5	1 2 3 4 5
I get a job that pays well.	1 2 3 4 5	1 2 3 4 5
I have a job that I enjoy.	1 2 3 4 5	1 2 3 4 5
I get job offers.	1 2 3 4 5	1 2 3 4 5
Would you recommend this service to your peers?	1 2 3 4 5	1 2 3 4 5

Table 10 AHP comparative matrix.

Benefit	Imp. rating	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
I have a professional appearance for an interview.	6.8	1.00	0.93	0.84	0.88	0.99	0.88	2.27	0.94	0.88	1.03	0.91	0.81	0.87	0.81	0.80
I am comfortable during an interview.	7.3	1.07	1.00	0.90	0.95	1.06	0.95	2.43	1.01	0.95	1.11	0.97	0.87	0.94	0.87	0.86
I stand out to a potential employer.	8.1	1.19	1.11	1.00	1.05	1.17	1.05	2.70	1.13	1.05	1.23	1.08	0.96	1.04	0.96	0.95
I am prepared for an interview.	7.7	1.13	1.05	0.95	1.00	1.12	1.00	2.57	1.07	1.00	1.17	1.03	0.92	0.99	0.92	0.91
I have interviewing experience.	6.9	1.01	0.95	0.85	0.90	1.00	0.90	2.30	0.96	0.90	1.05	0.92	0.82	0.88	0.82	0.81
I get opportunities with potential employers.	7.7	1.13	1.05	0.95	1.00	1.12	1.00	2.57	1.07	1.00	1.17	1.03	0.92	0.99	0.92	0.91
I can work overseas.	3	0.44	0.41	0.37	0.39	0.43	0.39	1.00	0.42	0.39	0.45	0.40	0.36	0.38	0.36	0.35
I know what different jobs are available.	7.2	1.06	0.99	0.89	0.94	1.04	0.94	2.40	1.00	0.94	1.09	0.96	0.86	0.92	0.86	0.85
I have a professional résumé.	7.7	1.13	1.05	0.95	1.00	1.12	1.00	2.57	1.07	1.00	1.17	1.03	0.92	0.99	0.92	0.91
I get a résumé evaluation.	6.6	0.97	0.90	0.81	0.86	0.96	0.86	2.20	0.92	0.86	1.00	0.88	0.79	0.85	0.79	0.78
I have my résumé easily accessible to companies.	7.5	1.10	1.03	0.93	0.97	1.09	0.97	2.50	1.04	0.97	1.14	1.00	0.89	0.96	0.89	0.88
I get a job that fits me.	8.4	1.24	1.15	1.04	1.09	1.22	1.09	2.80	1.17	1.09	1.27	1.12	1.00	1.08	1.00	0.99
I get a job that pays well.	7.8	1.15	1.07	0.96	1.01	1.13	1.01	2.60	1.08	1.01	1.18	1.04	0.93	1.00	0.93	0.92
I have a job that I enjoy.	8.4	1.24	1.15	1.04	1.09	1.22	1.09	2.80	1.17	1.09	1.27	1.12	1.00	1.08	1.00	0.99
I get job offers.	8.5	1.25	1.16	1.05	1.10	1.23	1.10	2.83	1.18	1.10	1.29	1.13	1.01	1.09	1.01	1.00
	sum	16.12	15.01	13.53	14.23	15.88	14.23	36.53	15.22	14.23	16.61	14.61	13.05	14.05	13.05	12.89

Table 11 AHP weights matrix.

$A_{weights}$ =

0.0620	0.0621	0.0620	0.0621	0.0621	0.0621	0.0620	0.0621	0.0621	0.0620	0.0621	0.0620	0.0620	0.0620	0.0621
0.0666	0.0666	0.0666	0.0666	0.0666	0.0666	0.0666	0.0666	0.0666	0.0666	0.0666	0.0666	0.0666	0.0666	0.0666
0.0739	0.0739	0.0739	0.0739	0.0739	0.0739	0.0739	0.0739	0.0739	0.0739	0.0739	0.0739	0.0739	0.0739	0.0739
0.0702	0.0703	0.0703	0.0703	0.0703	0.0703	0.0703	0.0703	0.0703	0.0702	0.0703	0.0702	0.0703	0.0702	0.0703
0.0629	0.0630	0.0630	0.0630	0.0630	0.0630	0.0630	0.0630	0.0630	0.0629	0.0630	0.0629	0.0630	0.0629	0.0630
0.0702	0.0703	0.0703	0.0703	0.0703	0.0703	0.0703	0.0703	0.0703	0.0702	0.0703	0.0702	0.0703	0.0702	0.0703
0.0274	0.0274	0.0274	0.0274	0.0274	0.0274	0.0274	0.0274	0.0274	0.0274	0.0274	0.0274	0.0274	0.0274	0.0274
0.0657	0.0657	0.0657	0.0657	0.0657	0.0657	0.0657	0.0657	0.0657	0.0657	0.0657	0.0657	0.0657	0.0657	0.0657
0.0702	0.0703	0.0703	0.0703	0.0703	0.0703	0.0703	0.0703	0.0703	0.0702	0.0703	0.0702	0.0703	0.0702	0.0703
0.0602	0.0602	0.0602	0.0602	0.0602	0.0602	0.0602	0.0602	0.0602	0.0602	0.0602	0.0602	0.0602	0.0602	0.0602
0.0684	0.0684	0.0684	0.0684	0.0684	0.0684	0.0684	0.0684	0.0684	0.0684	0.0684	0.0684	0.0684	0.0684	0.0685
0.0766	0.0767	0.0766	0.0767	0.0767	0.0767	0.0766	0.0767	0.0767	0.0766	0.0767	0.0766	0.0766	0.0766	0.0767
0.0712	0.0712	0.0712	0.0712	0.0712	0.0712	0.0712	0.0712	0.0712	0.0712	0.0712	0.0712	0.0712	0.0712	0.0712
0.0766	0.0767	0.0766	0.0767	0.0767	0.0767	0.0766	0.0767	0.0767	0.0766	0.0767	0.0766	0.0766	0.0766	0.0767
0.0775	0.0776	0.0776	0.0776	0.0776	0.0776	0.0776	0.0776	0.0776	0.0775	0.0776	0.0775	0.0776	0.0775	0.0776