Research on the Effectiveness of Service Design Based on the Quantitative Method of Kansei Engineering—Taking the LANNA Coffee Service Process as an Example

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Abstract. The increasing enrichment of industrial products has made it difficult to meet the growing consumer demand for the material functions of products. This has caused the non-material or mental function of the product to be strengthened, promoted product design to gradually expand from the material dimension to the non-material service design, and accelerated the transformation of the manufacturing industry into a service-oriented product manufacturing. Service design has gradually become a new hot academic research field in product design. As a traditional industry, how to promote the transformation of coffee shop from "product" to "service" has become the research direction of this study. After investigation, we find some problems in coffee shop service, such as single focus, unbalanced proportion distribution of internal structure of service design, as well as vague and uncertain user demand. This paper attempts to use the forward quantitative inference method of Kansei Engineering to analyze consumers' perceptual demands for coffee shop services through questionnaires, the overall process of service and the weight of service elements. We also try to set up the service elements and multivariate linear regression equation between the service effectiveness, put forward the service design effectiveness evaluation method, and on this basis, provide the analysis of the service system to serve the interests of the parties with complimentary method to make the adjustment and evaluation of service design more intuitive.

Key words: service process; Kansei engineering; effectiveness

1. Introduction

With the development of economy, the progress of science and technology and the improvement of social production efficiency, the consumer's consumption concept also add other dimensions to the product change. With the enhancement of consumers' overall perception of products, product functionality which meets users' basic needs is no longer a decisive purchase reference for consumers. Instead, consumers' perceptual demand for products has increased. Therefore, the dimension of product design presents the characteristics of complexity and multi-coupling, and gradually develops to non-materialization. Product design changes from single function satisfaction to product service satisfaction. The involvement of Kansei Engineering provides research tools, methods of collecting Kansei information [1] and data processing support for service design. For example, In 1999, Rostlinger and Goldkuhl [2] tested the service of washing machines using kansei engineering. In the same year, Nishino [3] applied kansei engineering to explore Internet services and found wider
applicability. In 2011, Zhang ST [4] put forward the research and application of Kansei Engineering and Genetic Algorithms to the intelligent design system of product shape, 2012, Hartono [5] proposes a comprehensive framework including the kano model and QFD is applied in a luxury hotel services, thus, experts and scholars at home and abroad for the combination of perceptual engineering and design services have conducted extensive research. But this type of research has a smaller proportion than other types of research. Most of them focus on the design of physical products, such as automotive interior [6], camera [7], mobile phone [8], etc. However, its value to the correctness of the service hypothesis, the “dynamic virtuous circle” of each “contact” in the service process, the evaluation of the service structure, and the combing of user needs are not taken seriously.

In previous studies, kansei engineering pays more attention to physical products and focuses more on research methods and tools. This study attempts to use the kansei engineering theory to discuss the “effectiveness” of service design. Through sorting out the whole process of service design and analyzing the structure of service contacts, the quantitative method of Kansei Engineering is introduced to study the validity relationship between service contacts and users' feelings. We aim to find and identify the key contacts that affect the service quality, optimize the original service contact structure, and establish the evaluation criteria of service system effectiveness through quantitative research, and use the quantitative engineering inference method for service design effectiveness research. The linear regression equations of service design effectiveness are fitted to construct an evaluation system based on the design effectiveness of perceptual engineering services.

2. Effectiveness of service design

Service design is a kind of interdisciplinary knowledge, and its definition is constantly changing with its own development. Most discussions on service design involve the five principles of service design proposed, namely user-centered, co-creation, order, object and integrity [9]. These five principles explain the effectiveness of service design in different dimensions.

1) User-centered. In the process of service design, the user is the object of service design concern. Therefore, the effectiveness of service design is reflected in users' experience of service process and evaluation of service results.

2) Co-creation. The needs of different stakeholders are included in the design considerations, so it is reflected in the effectiveness of the service process.

3) Order. The procedural characteristics of service design lead designers to take “time” as an important consideration when designing services. Therefore, in the discussion on the effectiveness of services, the consideration of order becomes relatively important.

4) Objects. In order to improve the quality of service, some service processes are designed to appear in a form of “invisible”, which will change users' expectations in a positive or negative way. Therefore, the effectiveness of service design is also reflected in the enhancement of users' sense of gain through materialization.

5) Integrity. The integrity of service design means that cooperation and support between different disciplines can be achieved through service design to improve customer experience and employee satisfaction. This should be considered in the initial phase of service design.

3. Factors influencing the effectiveness of service design

The empirical research method of service design involved in this study is an improved method based on the “iterative process” method [9]. "Iteration" research methods, can be summarized as four key steps, explore, create, rethink, implementation), the four steps are repeated, is building the basic introduction to design complex design process [9], but its research for service only provides a rough framework, and did not set a specific research specification. So in this paper, combined with the study of specific effectiveness problems, the original iterative method is improved into a new research method, namely: discovery, demonstration, design and implementation. The following will give a brief overview of the research tools used in this paper to study the effectiveness of service design, and take LANNA coffee as an example to describe the four key steps of the “iterative process”.

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Step one, discovery. The research tools in this part mainly focus on information collection and problem discovery. Understand and clarify the real motivation of user behavior to ensure the effectiveness of the problem itself. The main research tools of this study at this stage are: Stakeholders map, Journey map and shadowing practice.

(1) Stakeholders map
The function of the stakeholders map is to clearly represent all participants in the service and list their importance and influence on the service, as well as to present visually or physically by means of the design diagram. It is beneficial for participants and designers of service design to reach interest consensus quickly and help them allocate resources more effectively. The stakeholders map will help the study to complete the basic information about the effectiveness of the service design process.

![Stakeholders map](image)

**Figure 1.** Stakeholders map.

According to the stakeholders map of LANNA coffee (figure 1), based on the weight that affects the user experience (the closer to the user, the greater the weight that may affect the user), internally, the main stakeholders that affect users are baristas and stores, while externally, the main stakeholders are third-party supported software.

From the perspective of controlling variables, external third-party software, due to its stable and controllable nature, can almost be regarded as a constant in the dimension of effectiveness discussion, and will not be discussed here.

It is not difficult to see from the map that the main factors affecting the user experience are stores and baristas. The main interest concerns of stores are profit and supply chain adjustment, with profit prioritized, and the second is to ensure the normal operation of coffee shops. However, the interests and concerns of baristas are different from those of the stores. The main interests and concerns of baristas are to establish a good relationship with users and create a comfortable dining environment. The second is to ensure the quality of coffee and deliver the core demands of stores.

(2) Journey map
The purpose of service journey is to list the whole process of service in a linear manner, and to clearly present the related actions of stakeholders in the whole service through the design drawing. Its main purpose is to find the “broken points” in service design which make users feel bad and improve the effectiveness of the overall service.

Taking LANNA’s service process as an example (figure 2), the elements related to service are vertically listed: elements (materials), contacts, foreground behaviours, consumer behaviours, background behaviours and users’ mood. Horizontal listing of the different stages of the service process, vertical and horizontal intersection grid shows that in the process, the service behaviour occurs, and this is called a focus moment. As in the previous interview, it has been found that the user
experience of three service processes in the focus of bad moments, which are the broken points in the figure. The research and presentation of the effectiveness involved in this study will also be carried out based on this.

(3) Shadowing practice

The shadowing practice method is similar to the participatory observation method in kansei engineering, which is to observe users without their knowledge. Shadow exercises will play a key role in the research on the effectiveness of user experience in this topic.

The evaluation of the effectiveness of the first phase depends on various “satisfactory” feedbacks. By listing the degree of influence of different stakeholders on the service, the priority of different degrees of satisfaction will be sorted out, and the source of the problem and relevant demonstration methods will be fully assumed as far as possible, so as to provide corresponding mature hypotheses and relevant feasibility demonstration methods for the demonstration in the second stage.

The second stage is argumentation. The stage of argumentation is the stage of concept formation in the whole process. The main purpose of this stage is to identify the problems in the service process, list the feasible Suggestions, put forward the relevant demonstration process according to these Suggestions, and complete the design briefing. In this stage, the three main research tools used to discuss effectiveness are business model canvas, 4PS and SWOT.

(1) LANNA coffee business model canvas

![Figure 3. LANNA Coffee Business Model Canvas.](image)

The Business Model Canvas (BMC) is designed to help researchers identify which key activities,
resources and partners are used to communicate the core proposition of an enterprise to users. It includes the cost structure of the enterprise, the way of profit, the relationship between the expectation and users, and the specific delivery channels. In this study, BMC can help researchers improve the accuracy of questions and reduce speculation, so as to ensure the effectiveness of demonstration.

In the business model canvas of LANNA coffee (figure 3), orange represents the cost block of the business model, green represents the profit block, and the value proposition in the middle is the core of the whole business model. The value proposition is realized through the consumption module, and the profit is realized through the output module. Through the business model canvas, can be clear: first, the overall business model of the core value proposition. Second, it can tease out the relationship between cost (orange) and profit (green).

(2) 4PS

4PS refers to Product, Price, Place, Promotion [10]. This tool follows the canvas of business model and subdivides the services provided by the enterprise to users for discussion in these four dimensions. The figure below is the 4PS diagram of LANNA coffee (figure 4).

![Figure 4. 4PS diagram of LANNA coffee.](image)

(3) SWOT analysis of LANNA coffee

SWOT analysis is mainly used to present the internal and external advantages and disadvantages of the service. Help researchers adjust the proportion of resource allocation to make their service strategies clearer.

![Figure 5. SWOT analysis of LANNA coffee.](image)

Take LANNA as an example. In SWOT analysis, LANNA coffee does not describe its opportunity (mark in figure 5).
Stage three, design. The design phase consists of two phases: design justification and design testing. In the first stage, relevant assumptions should be put forward and demonstrated for the problems found in the previous stage. In the case that it is as real as possible, the “prototype” that can be demonstrated for the overall service research design should be put forward. The effectiveness of this stage is reflected in that it follows the principle of “integrity” in the service design. The main research tools in this stage are: portrait, “If...” hypothesis, storyboard, desktop walkthrough, etc.

(1) Portrait
The portrait mainly helps researchers to comprehensively consider the needs of different dimensions by using the research results of the first two stages in the design stage. The shaping of the portrait is conducive to accelerating the process of service research and ensuring the effectiveness of the design.

(2) “If” hypothesis
“If...” hypothesis belongs to “re-proof” phase of the design phase, in which participants are encouraged to describe what they consider to be an ideal state of service or a more desirable service experience. Explore future service scenarios, which in service design are often a valid way to analyze the whole (or fragment) of a service individually.

(3) Storyboard
The purpose of storyboard is to “materialize” the concept of service and the imagination of service. By describing the context of the service in as much detail as possible, the researcher can help the researcher deeply understand the user experience described by the participants and provide some insights for the service or the prototype of the service. It helps designers to incorporate research findings into the specific design of the service architecture, thus ensuring the effectiveness of the practice.

(4) Desktop walkthrough (service prototype)
Desktop walkthroughs can help researchers reproduce service scenarios, and can also help participants discuss and co-develop “service prototypes” or analyze and tweak existing services.

The effectiveness evaluation in the third stage is similar to that in the second stage, but the effectiveness evaluation in the third stage focuses more on the effectiveness evaluation with user experience as a higher priority.

The fourth stage is implementation. The main purpose of this stage is service implementation and information feedback. In this stage, the effectiveness of the results in service design can be guaranteed by collecting the satisfaction data of users on the service results. The research tool in this stage is the concept interpretation and service blueprint.

(1) Concept interpretation.
Concept interpretation helps service providers to provide more accurate services for users. However, researchers need to further clarify the relevant responsibilities of service participants and the common “interest consensus” through “concept interpretation”, so as to ensure the effectiveness of service results.

(2) Blueprint.
Blueprints are a way to elaborate on each service touchpoint. Service blueprints help researchers identify the most important parts of a service, help them understand how the service performs, and allocate resources efficiently.

4. Research and tools for service design and kansei engineering
From the current service design research and practice, the problems existing in the service design mainly concentrate on the question of “validity” and “availability”. Because the “availability” of service design research focuses on service execution level and specific tool level, is based on the specific service environment, which is not the focus of this study, we do not get into details in this paper.

Previous literature exploring “validity” related issues has several findings. First of all, the excessive pursuit of service design user experience has resulted in misleading conclusions, blind designs,
reduced operability and the lowered efficiency from the implementation of “iteration” issues. Secondly, the rational analysis of positivism in service design tend to be mostly qualitative. The fuzziness of the qualitative reasoning itself has brought problems, such as in accurate details, and hard-t-define perceptual intentions. Kansei engineering is a translated method that can transform the user's fuzzy visual perception into the details of the product design process[6]. Its intervention provides tools such as reliability analysis and quantitative inference for service design, reveals problems and rules in the process of service design from a more intuitive and datamatic perspective. It also makes up for limitations in qualitative inference, helps designers to accurately grasp perceptual design details, and assists designers in making design decisions.

4.1. Quantitative inference research tool for Kansei Engineering

(1) The quantitative inference of reliability analysis in kansei engineering

The reliability analysis method adopted in this study is the “Cronbach's alpha” coefficient. The calculation formula is as follows:

\[ a = \frac{k}{k-1} \times (1 - \frac{\sum Si^2}{ST^2}) \]  

Where K is the total number of items in the scale, Si^2 is the intra-item variance of the score of item i and ST^2 is the variance of the total score of all items. It can be seen from the formula that the coefficient a evaluates the consistency among the scores of each item in the scale, which belongs to the internal consistency coefficient.

Likert scale was used in the questionnaire in this study, which is composed of a group of statements. A likert scale of five or seven points is established for each group of statements, and the subjects are asked to score the items in the scale according to their attitudes. Finally, the attitude scores of the subjects can be obtained by adding them together.

(2) Multiple linear regression quantitative inference in kansei engineering

The regression analysis used in this study is multiple linear regression analysis, and the formula of multiple linear in this study is:

\[ y = b_0 + b_1x_1 + b_2x_2 + \ldots \ldots + b_kx_k + e \]

Where b0 is the constant term, b0 is the regression coefficient, and b1 is x2, x3, x4... When xk is fixed, the effect of x1 on y is increased by one unit, that is, the partial regression coefficient of x1 on y; Similarly, b2 is x1, and when xk is fixed, the effect of x2 on y for each unit added, that is, the partial regression coefficient of x2 on y, and so on.

In this study, multiple regression is mainly used to solve three problems: first, to determine whether there is a correlation between variables; If they exist, find a mathematical expression that expresses their relationship. Second, predict or control the value of one or more variables based on the value of one or more variables. Third, carry out weight analysis, that is, to find the main and secondary weights and their mutual relations among multiple variables whose functions affect a variable.

5. The case study

At present, in the process of accelerating the transformation from industry to service priority, the coffee industry is the first to complete the transformation from “product” to “service”. Therefore, as a coffee service provider, it is necessary to pay more attention to the continuous improvement and differentiation of services to maintain competitive advantages. In the normal coffee service, customers always want new services and new experiences. Therefore, the service design of coffee should be open, so as to continuously adjust the service to meet the new needs of customers. Designers need to have an insight into customers’ real emotional needs in order to design new services that meet customers' expectations.

Take localized cafes in Shanghai as an example, on the one hand, influenced by European and American countries, local cafe its service form presents the state of coexistence of Europe and the United States has very good out of the cup, has established good customer relations with customers, but on the other hand, due to the different consumption patterns and lifestyles, make Europe and the United States and the Shanghai local cafe cafe in service mode difference, so service design problems
that should be reviewing local cafe.

To sum up, the cafe in Shanghai provides a relatively ideal model for this study, both in terms of the effectiveness of the service design process and the service design results.

5.1. Experiment and data processing

In this section, researchers, practitioners in the coffee industry, users and service designers jointly participated in the experimental design, and selected perceptual words related to service experience from the original kansei engineering lexicon. They also constructed original research materials based on perceptual words, and constructed questionnaires for data collection. The focus group interview method was used to screen perceptual vocabulary, and the results are shown in table 1. In order to ensure the efficiency of the questionnaire, 5-order Likert scale was adopted.

Table 1. Kansei adjectives filtering table.

| Traditional kansei adjectives | Quick, familiar, professional, timely, high-quality, convenient, friendly, valued, reliable, creative, save, save time, customized, expensive, cheap, complete, direct, in general, real, excellent, trusted, unified, elastic, a new, simple, exquisite, efficient and safe. |
|-------------------------------|--------------------------------------------------------------------------------------------------|
| Service design effectiveness vocabulary | Quick, familiar, professional, timely, high-quality, convenient, friendly, economical, valued, time-saving, customized, expensive, cheap, general, true, excellent, trustworthy, novel, efficient. |
| Service design process effectiveness vocabulary | Convenient, friendly, economical, time-saving, customized, expensive, cheap, trustworthy, valued, novel, efficient. |
| Service design results validation vocabulary | Convenient, friendly, economical, time-saving, customized, expensive, cheap, trustworthy, novel, efficient. |

In this study, ten cafés with similar price and location with LANNA coffee were selected as the research samples for the overall effectiveness of coffee service. The coffee brands are: View, Blueking, Manner, Wagas, Roast, Rumas, Carving time, cat's sky city, Seesaw and Huzhazha coffee. After confirming the research sample, the consumers were randomly selected to fill out the questionnaire. A total of 300 copies were handed out, and 253 copies were recollected. Considering the total number of questionnaires actually collected and the number of questionnaires in each cafe, and the comprehensive assessment of the questionnaires by the expert group, each store selected 20 questionnaires to participate in the final analyses. The average scores of 20 questionnaires in each store are shown in Table 2.

Table 2. Questionnaire average score table.

| QN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|----|---|---|---|---|---|---|---|---|---|----|----|
| Q | 3.9613 | 3.7431 | 3.8477 | 3.8659 | 3.5568 | 3.6023 | 3.4545 | 3.5273 | 3.6 | 3.4977 | 3.7477 |
| Cat | 4.0952 | 3.9285 | 3.9524 | 4.0408 | 3.5952 | 3.6667 | 3.3095 | 3.4523 | 3.6905 | 3.4286 | 3.8333 |
| Wagas | 3.976 | 3.8333 | 3.9523 | 4.0952 | 3.5476 | 3.5 | 3.3809 | 3.524 | 3.7619 | 3.6667 | 3.9762 |
| Roast time | 4.0952 | 3.8095 | 4.0476 | 4.2381 | 3.5476 | 3.5 | 3.2143 | 3.5952 | 3.7857 | 3.9048 | 4.3571 |
| Rumas | 4.0952 | 3.9285 | 4.0952 | 4.0952 | 3.5238 | 3.4761 | 3.2143 | 3.8809 | 3.8809 | 3.8571 | 4.0238 |
| Manner | 3.976 | 3.3333 | 3.4524 | 3.1905 | 3.7619 | 4.3809 | 4.5476 | 4.0952 | 4.0952 | 3.881 | 4.0714 |
| Roast | 3.4047 | 3.1190 | 3.3333 | 3.2143 | 3.524 | 3.3095 | 3.5714 | 3.5476 | 3.7619 | 3.6905 | 4.0238 |
| Huzhazha | 3.5952 | 3.4285 | 3.619 | 3.5714 | 3.69 | 3.7143 | 3.8333 | 3.5952 | 3.8571 | 3.881 | 4.1905 |
| View | 3.9285 | 3.8333 | 4.024 | 4.0952 | 3.8809 | 4.1905 | 4.0714 | 4.1191 | 3.9048 | 4.024 | 4.381 |
| Blueking | 3.6190 | 3.6904 | 3.7857 | 4.0714 | 3.476 | 3.619 | 3.6428 | 3.7619 | 3.7857 | 3.8095 | 4.0952 |
| Seesaw | 3.8095 | 3.9761 | 4.024 | 3.9762 | 3.4285 | 3.9048 | 3.4286 | 3.9762 | 4.1191 | 3.9285 | 4.0476 |

a Question number.
b All questionnaire samples.

The reliability analysis of the statistical results is mainly carried out with the “Cronbach's alpha” analysis tool, and the reliability results are shown in table 3.
Table 3. Reliability Diagram for Survey Data.

| Sample          | Cronbach's Alpha | Number of terms |
|-----------------|------------------|-----------------|
| All the samples | 0.969            | 220             |
| Cat             | 0.963            | 20              |
| Wagas           | 0.947            | 20              |
| Carving time    | 0.96             | 20              |
| Rumas           | 0.95             | 20              |
| Manner          | 0.951            | 20              |
| Roast           | 0.726            | 20              |
| Huzhazha coffee | 0.662            | 20              |
| View            | 0.642            | 20              |
| Blueking        | 0.837            | 20              |
| Seesaw          | 0.917            | 20              |

It can be concluded from the above table that the overall data credibility is higher than the basic confidence of 0.6, so the results of data feedback are credible.

Table 4. The equation of linear fitting chart.

| Model | Unstandardized Coefficients | typical coefficient | t  | Sig. |
|-------|-----------------------------|---------------------|----|------|
|       | B              | Standard error | Trial version |     |      |
| 1     | (constant)     | 15.775          | .000          | .   | .    |
| 2     |                 | -11.459         | .000          | -13.762 | .   | .    |
| 3     |                 | 11.486          | .000          | 12.735  | .   | .    |
| 4     |                 | 1.119           | .000          | 1.933   | .   | .    |
| 5     |                 | -2.717          | .000          | -1.553  | .   | .    |
| 6     |                 | 2.816           | .000          | 3.905   | .   | .    |
| 8     |                 | -.771           | .000          | -.783   | .   | .    |
| 9     |                 | -.510           | .000          | -.299   | .   | .    |
| 10    |                 | .470            | .000          | .328    | .   | .    |
| 11    |                 | -3.812          | .000          | -2.630  | .   | .    |

*dependent variable: 1

Table 5. The Prediction Equation Accuracy.

| Model | R          | R-squared | Adjusted R-Square | standard error of estimate |
|-------|------------|-----------|-------------------|----------------------------|
| 1     | .816*      | .666      | .624              | .14958                     |

*predictive variable: (constant), VAR00003.

5.2. Experimental analysis
The results of linear fitting of data are as follows. From the fitting data, kansei vocabulary 3 is the most concerned valid vocabulary (accessibility), and kansei vocabulary 2 has the least impact on the overall service (looking for convenience). The coincidence degree of the linear whole was 66.6%
(accuracy), exceeding 50% of the low correlation degree, and the experimental results were established. Perceptual vocabulary is moderately correlated with the effectiveness of service experience.

Fitting out multiple linear equations in coffee service design:

\[ y = -11.459x1 + 11.486x2 + 1.119x3 - 2.717x4 + 2.816x5 - 0.771x6 - 0.510x7 + 0.470x8 - 3.812x9 + 15.775 \]

In the overall weight analysis, looking for convenience (-11.459); Accessibility (11.486); Friendly environment (1.119); Waiting for coffee (-2.717); Coffee taste (2.816); Cost performance (0); Professional degree of service (-0.771); Service efficiency (-0.51); Value perception (0.47); Service feedback (-3.812).

According to the weight analysis, the Kansei adjectives “convenient access” takes up the largest proportion in the overall coffee service, showing a relatively large correlation with the effectiveness of the overall service. It reflects users' demand for effective service design results in Shanghai, that is, the priority of “convenience” gradually takes up a larger proportion in the overall service effectiveness perception. Such a weight, on the one hand, explains the rise of cost-effective window stores in Shanghai, and on the other hand, reflects users' demand for efficiency. Simply, the focus of users on the effectiveness of the coffee service is that it is either easily accessible or easily delivered. In other words, the priority of “convenience” is gradually increasing in the recognition of overall service effectiveness.

However, the convenience of finding coffee shops presented in the results shows a weak correlation (-11.459), which reflects the randomness of consumption of coffee services themselves, and confirms the low viscosity of users and coffee shops mentioned above. The low user viscosity is mainly reflected in two aspects. On the one hand, users do not really pursue the taste of coffee and choose to enjoy the service of coffee, but hope to satisfy their own social experience through coffee. Coffee and coffee have gradually separated, and coffee has gradually become a kind of social media. On the other hand, the rise of take-out can meet people's demand for the timeliness of coffee drinks, and at the same time, it is extended through the social places of coffee drinks.

6. Conclusion

This article through to the perceptual technology and service design paper proves that the first, the perceptual design engineering and services can be combined for research, perceptual quantification methods can help services in the engineering design of participants quickly establish service elements of service design priority level, thus effectively control costs, achieve the goal of comprehensive improve service efficiency. Second, this study establishes the design service efficiency and service elements of multivariate linear regression equation, it is concluded that the service effectiveness factors of service design the effect of weight, thus help practitioners in the case of cost must be filtered to the service elements, help them build a service quality effectively, contains effective service process, and the effective service results.

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