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Integrating Quality Aspect in Service Performance Evaluation for Ease of Service

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Abstract. Since service has evolved as a third factor that customers consider besides quality and price when making buying decisions, design for ease of service has been proposed in pursuing service excellence and gaining customer loyalty. Its approach includes a service performance assessment in which service time and complexity of service delivery have been considered to form a service index to reflect the service supportability of a design. To make service operations easier, not only should the complexity and time be taken into account, but the quality of timely service delivery is also critical. This paper presents the integration of the quality aspect of service into the index to ensure service supportability. This integration is built around the idea that poor service performance almost always results in customer dissatisfaction; therefore, a design should ensure customers will not be dissatisfied with service delivery. For each service activity, potential causes of poor service performance and their effects on customer dissatisfaction are identified and assessed. A Reverse Kano model is applied to determine how customers perceive the potential causes. The information gathered is incorporated into the index in the form of a no dissatisfaction factor. The proposed index was applied to assess window frame installation for illustration.

Keywords. Design for ease of service, service index, customer dissatisfaction, Reverse Kano

Introduction

Service has become another important factor that customers consider when making a buying decision and influences revisiting intentions [1,2]. It assists in differentiating winners from the rest because customers may perceive comparable values of the offering products in terms of features, qualities, and prices. Dell, for example, has used E-Customer Service to allow their customers direct online access to account information and payment option, and this direct online service strategy has increased customer satisfaction and made them successful in the market [3]. It is a shift from traditional product selling toward service-oriented product selling [4].

Service is a company's ability to fulfill customer requirements before, during, and after purchase. It is intangible, heterogeneous, and inseparable [5] and is an action or performance that offers from one to another [6]. In theory, service is distinguished separately from products. However, most of the products and services today have mixed characteristics, and their combinations can better fulfill customer needs and add value to the product [7]. Some products may involve activities, such as installation, operation,

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maintenance, repair, or modification. Therefore, if these activities are considered in the design, ease of services such as easy maintenance or easy repair can become a highlight for the products yielding to customers' satisfaction and thus bringing success to the business.

Consequently, a methodology for incorporating service information into the product design and development process to ease service activities to enhance service excellence has been proposed [8]. It aims at assisting a business in offering products that meet customer needs in terms of physical appearance and functionalities and that support service when needed. A service index has been introduced to assess a current service performance of a design, and according to the evaluation, service improvement is then considered.

However, the aforementioned assessment emphasizes only easing services by eliminating the complexity of service activities which may not be sufficient in practice. The quality of service delivery is another factor that should not be overlooked as customers perceive it directly and react to it immediately. Poor service delivery can cost more than benefit the businesses. Therefore, not only should businesses concentrate on integrating and simplifying service activities, but they should also consider the quality of service delivery.

This paper presents the integration of the quality aspect of service delivery into the index to ensure service supportability. Potential causes of poor service performance and their effects on customer dissatisfaction are considered in the assessment.

1. Design for Ease of Service

Successful product design and development requires a transdisciplinary approach to blend knowledge, skills, attitude, and abilities to exploit available internal and external resources to realize the business opportunity and deliver it to target markets reasonably. Incorporating service into the process further strengthens the value creation of transdisciplinary in this critical business activity.

Understanding what customers value and proper responses in a timely manner is essential for achieving high-quality service as a standard does not exist for describing their expectations. The individuals' needs, prior experience, pricing, and word of mouth affect theirs [9]. The qualities of assurance, responsiveness, and empathy are crucial factors in surpassing customer expectations on service, while reliability must be there to meet their expectations [10]. In terms of price, the more money the customers pay, the better the service they expect. Parasuraman et al. [5] presented a generic model of service quality aiming to assist companies in understanding the factors that determine perceived service quality. Mismatches between offering and expectation can occur at several stages leading to customer dissatisfaction. The companies should attempt to close these gaps and offer service beyond their expectation, when possible, to bring delight to their customers. This level of performance is called service excellence [11].

Companies must be aware of customer interaction with their services, covering from purchasing stage to the usage and disposal stages. Front-line staff plays an important role in the majority of pure service operations conducted during the first stage. The service activities involve a product more and more during the usage and disposal stages. Whether service activities are performed by end-users or require company assistance, product design continues to be essential in supporting service activities.

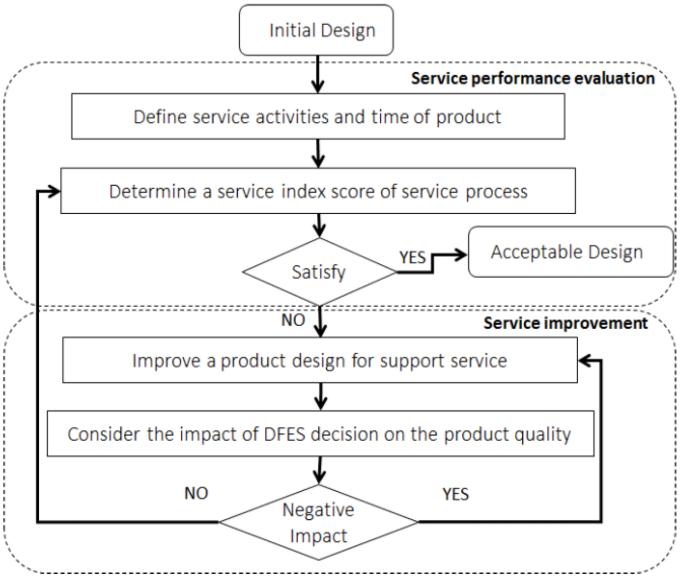

Figure 1. Product design for ease of service methodology [8].

Therefore, the incorporation of service was proposed to be considered during concept development phases right after the selection of the design concept because a change can be made easily at a low cost and dictates the overall performance and cost of a selected design [8]. As illustrated in Figure 1, service performance evaluation and service improvement are two main stages in product design for ease of service. A service index (SI) is applied in the first stage to assess an initial design for its serviceability. Service improvement is necessary in case the design lacks serviceability. The product is redesigned accordingly to improve serviceability. The revision is checked for the impact of changes on product quality and is returned for service performance evaluation unless it raises a concern. These activities are repeated until the design can satisfy both product function and product service support.

A ratio of a total service time for an ideal design with no complexity to a total service time for the evaluating design has been introduced for a service index (SI) to reflect the service supportability as illustrated in Eq. 1. Each activity has its own service score (SC_i) that is a product of its service time (T_i) and its service complexity (C_i), as illustrated in Eq. 2. A service complexity score represents service difficulty in three levels: 1-no complexity at all, 2-low complexity, and 3-high complexity. A higher complexity score means more time is required to complete that activity.

$$SI = \frac{\sum T_i}{\sum SC_i} \times 100\% \quad (1)$$

$$SC_i = T_i \times C_i \quad (2)$$

The service index near 100% means the product design has the capability to support the service activity, and service providers feel the service activities are not complicated. In contrast, the service index score level of less than 50% means the product is still

complex. However, easy maintenance or repair is not going to help customers receive rapid service if the service is delivered tardily. Achieving actual service times closer to expected service times can be expected but will be insufficient. Thus, the quality of service delivery, also critical, should be incorporated to achieve service quality.

2. Improvement of Design for Ease of Service

2.1. Integrating Quality Aspect into Design for Ease of Service

The previous design for ease of service concept has focused on reducing service complexity. Besides achieving actual service times closer to expected service times, quality of service should also be considered as it has an influence on customer satisfaction as well. Thus, this research proposes to integrate the quality aspect, in addition to expected service time, into product design for ease of service to increase customer satisfaction and enhance service excellence. Therefore, a new index is proposed here, as illustrated in Eq. 3.

$$SI = \frac{\sum(ST_i \times CS_i)}{\sum(T_i \times C_i)} \times 100\% \quad (3)$$

where ST_i is expected service time for service i,
CS_i is degree of customer not dissatisfaction for service i,
T_i is actual service time for service i,
Ci is service complexity for service i.

Customer not dissatisfaction with service quality can take values within the range 0.0-1.0, and that is if the product has high customer satisfaction in service quality, wherein its value is close to 1, the value of the service index will be unchanged. However, when customer satisfaction drops, the overall service index will decrease also. The way to identify the customer not dissatisfaction with the service quality aspect is presented in the next section.

2.2. Customer Not Dissatisfaction

Customers can be satisfied, neither satisfied nor dissatisfied, or dissatisfied, depending on their attitude to the service they received. Their satisfaction may be improved or maintained at the same level when quality service is provided. Poor service quality may irritate and cause customer dissatisfaction. The first two reactions are the customer not dissatisfaction with the service quality, and they can also be seen as a complement to the customer dissatisfaction.

Poor performance of any service can cause customer dissatisfaction. When customers experience it, they may decide to defect and turn to other similar ones. The decision to defect relates to how severe the damage is and how often it occurs. Therefore, severity and occurrence both play vital roles [12] but not at the same level. Figure 2 presents a contour graph representing several customer dissatisfaction levels as the functions of the two factors. Customers are not dissatisfied when experiencing quality service. Their dissatisfaction is stimulated after the first occurrence. Their levels of dissatisfaction depend upon the severity level. For high severe cases (point A), the

customers may decide to leave immediately after the first occurrence. They are unhappy for moderate (point B) and low severe cases (point C) but can tolerate it. Occurrence becomes important in intermediate zones (i.e., upset and dissatisfied zones) and can cause defection later as customer dissatisfaction is pushed into the defection zone. However, repeated occurrences alone will not drive customer dissatisfaction to the defection zone if customer dissatisfaction is in an indifferent zone.

Customer dissatisfaction can be mathematically described to be proportional to the occurrence and to be a power function of severity where the exponent is the adjustment for one of the customer dissatisfaction Kano attributes [13]. Reverse Kano, a negative meaning compared with the traditional Kano model, can be applied to evaluate the dissatisfaction of the customers on the impact of potential failures in the product or service. The exponent k values of 2, 1, 0, and -1 are suggested for reverse must-be, reverse one-dimension, indifferent, and reverse attractive, respectively.

$$U = W_O O S^k \tag{4}$$

where W_O is a ratio between a weight given to occurrence (w_O) and a weight given to severity (w_S).

For a numeric scale of 1 to 10 for both severity and occurrence and the four Kano attributes, the maximum value of dissatisfaction is 1,000. Thus, the customer not dissatisfaction for service activity i can be described, as shown in Eq. 5. As a result, the service index (Eq. 3) can be rewritten as shown in Eq. 6.

$$CS_i = 1 - \frac{W_O O_i S_i^{k_i}}{1000} \tag{5}$$

$$SI = \frac{\sum\left[ST_i \times \left[1 - \frac{W_O O_i S_i^{k_i}}{1000}\right]\right]}{\sum(T_i \times C_i)} \times 100\% \tag{6}$$

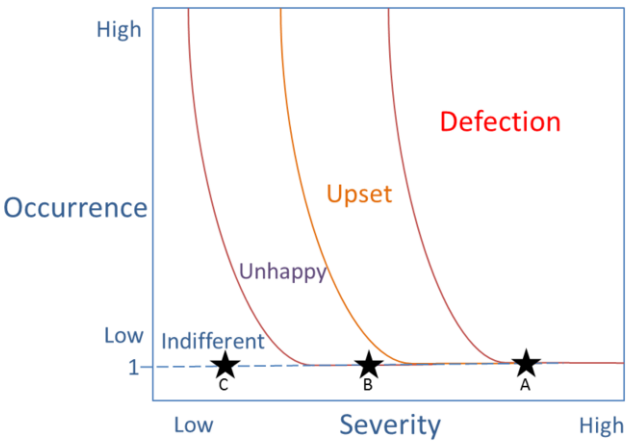

Figure 2. Customer Dissatisfaction.

According to Eq. 6, the service index is 100% when the total actual service time is equal to the total expected service time of service and the customer no dissatisfaction scores stay at the highest level for all activities. However, the service index will reduce to 50% despite rapid service if the customer no dissatisfaction scores are decreased on average by half, which directly links to the quality of service delivery.

3. Implementation of Design for Ease of Service in Practice

The current installation service for aluminum glass window frames is a practical example to verify the concept's applicability and demonstrate its merit. The analysis of the service index for the window frame installation service began with identifying service activities. According to steps of service that start with contact from a customer to completing the installation, twenty-three activities were identified. The natures of work in each activity were described next, followed by specifying service times of all activities. Last but not least, potential causes of customer dissatisfaction were identified for all activities. A summary of the twenty-three activities and their potential causes of customer dissatisfaction is available in Table 1.

Table 1. Activities and Potential Causes of Dissatisfaction During Window Installation.

No.	Activity	Potential Cause of Dissatisfaction
1	Customer contacts	The human relations of employees are not good
2	Make appointment (through phone) with customer for site visit.	Customers need to wait for making an appointment with company to visit the site.
3	Organize a technician's team to do measurements in the site	Customers need to wait for technician of company for measurements at the site on the appointed date.
4	To measure the working site (decide a design with customer + spec of product)	Company cannot make the customers requirement
5	Draw a sample of window style on the paper	Customers need to wait for the drawing of window style.
6	Calculations of drawing/design to evaluate the price	Customers must wait to bid.
7	Offers drawing and prices	The sample drawing of the proposed window style is incomprehensible to customer
8	Setting appointment for the work	Customers need to wait for making an appointment with company to start working.
9	Organize an Installation Team	Customers must wait for the Installation Team of company to start working at the work site on the appointment date.
10	Company calculates availability of materials by size and volume	Customers need to wait for the purchasing materials of company such as aluminum, glass.
11	The Installation Team cut aluminum and glass following the size and assembly requirement.	Customers need to wait for assembly the window frame for installation.

No.	Activity	Potential Cause of Dissatisfaction
12	Transportation of materials to work site; preparation to start installation.	Installation Team carrying materials or devices bump against appliance in customer's house causing damage.
13	Installation Team prepares for the installation of aluminum frame by measuring the rectangular cement frame	Installation Team wears shoes when climbing on the table or chair of customer and resulting to dirtied or damaged furniture.
14	Drill on cement wall for aluminum frame to latch on	Installation Team cracks the cement wall or tiles being drilled
15	Insert plastic plug and bolts to attach aluminum frames with the cement wall	A bolt protruding from the aluminum frame. (Does not affect the use but does not look good).
16	Install aluminium window in aluminum frame.	Wall of customers house is dirtied by technicians.
17	Install the aluminum caster	Caster cannot easily slide along the aluminium window (non-smooth).
18	Take DAP (Acrylic Latex Caulk) along the edge of the aluminum frame	DAP messes the aluminum frame (Stained cement walls / floor) or DAP lumps resulting to not flat surface
19	Cleaning of aluminum	Aluminum is dirty or scratched
20	Cleaning of glass	Glass is not clean or scratched by the ring or the staff's shirt buttons.
21	Cleaning the working area	The working area is not clean such as having fag ends/cigarette filters at the floor.
22	Checking the installed aluminium window and other work	Inspection Team makes the customer's home dirty such as wearing the shoes into the house.
23	Delivered to customers	The human relations of employees are not good

According to the information obtained, two sets of questionnaires were prepared. The survey on service complexity, expected service times, and occurrence was conducted with three technicians who had a deep understanding of work and had direct experience installing aluminum window frames in this company for more than ten years. The survey on severity and Kano attributes was conducted with seventeen customers. The survey results and the calculations are presented in Table 2 and Table 3.

Table 2. Survey Results and Calculated Customer Not Dissatisfaction.

No.	Occurrence (O)	Severity (S)	Kano Attribute (k)	Customer Dissatisfaction (U)	Customer Not Dissatisfaction (CS)
1	3	10	2	300	0.7
2	9	5	-1	1.8	0.9982
3	9	5	-1	1.8	0.9982
4	4	10	0	4	0.9960
5	8	5	0	8	0.9920
6	10	5	0	10	0.9900

No.	Occurrence (O)	Severity (S)	Kano Attribute (k)	Customer Dissatisfaction (U)	Customer Not Dissatisfaction (CS)
7	2	5	0	2	0.9980
8	8	8	0	8	0.9920
9	7	2	0	7	0.9930
10	8	5	0	8	0.9920
11	9	5	0	9	0.9910
12	5	10	2	500	0.5
13	1	10	1	10	0.99
14	6	10	2	600	0.4
15	3	9	0	3	0.9970
16	6	10	0	6	0.9940
17	2	10	1	20	0.98
18	2	10	2	200	0.8
19	4	10	1	40	0.96
20	4	10	-1	0.4	0.9996
21	4	10	0	4	0.9960
22	1	10	1	10	0.99
23	3	10	2	300	0.7

Table 3. Survey Results and Asscociated Values for Calculating Service Index.

No.	Service Time (hrs.)	Service Complexity	Service Score	Expected Service Time (hrs.)	Customer Not Dissatisfaction (CS)	ST_iCS_i
1	1	2	2	1	0.7	0.7
2	48	1	48	24	0.9982	23.9568
3	48	1	48	24	0.9982	23.9568
4	1.5	3	4.5	1	0.9960	0.9960
5	2	2	4	2	0.9920	1.9840
6	1.5	2	3	1	0.9900	0.9900
7	0.75	1	0.75	0.5	0.9980	0.4990
8	48	1	48	24	0.9920	23.8080
9	48	1	48	48	0.9930	47.664
10	48	1	48	24	0.9920	23.8080
11	48	2	96	36	0.9910	35.6760
12	1	3	3	0.5	0.5	0.2500

No.	Service Time (hrs.)	Service Complexity	Service Score	Expected Service Time (hrs.)	Customer Not Dissatisfaction (CS)	ST_iCS_i
13	0.75	2	1.5	0.5	0.99	0.4950
14	0.4	1	0.4	0.25	0.4	0.1000
15	0.4	1	0.4	0.33	0.9970	0.3290
16	0.17	1	0.17	0.17	0.9940	0.1690
17	0.17	1	0.17	0.17	0.98	0.1666
18	0.5	2	1	0.33	0.8	0.2640
19	0.17	1	0.17	0.17	0.96	0.1632
20	0.17	1	0.17	0.17	0.9996	0.1699
21	0.25	1	0.25	0.25	0.9960	0.2490
22	0.25	1	0.25	0.17	0.99	0.1683
23	0.5	1	0.5	0.5	0.7	0.3500
Total	299.48	33	358.2	189.01		186.9126

Table 4 presents the analysis under three different scenarios. The design of the service is considered to be good, with a service index of 83.60%. The issue seems to be on service delivery. According to the calculations, the service index score drops drastically from 83.60% to 52.76% when the actual service time is considered relative to the expected service time. This indicates that the staff takes much longer time than they should do to serve their customers. According to Reverse Kano Attributes, Customers are sensitive to the potential causes of dissatisfaction with activities 1, 12, 14, 18, and 23. Among them, potentially cracking the cement wall or tiles being drilled of activity 14 has the highest chance of occurring and needs attention. The slight decrease of the service index to 52.18% (when the service quality was considered) indicates the overall quality of the service is not an issue at the moment. Therefore, being more active with a service mind of the staff will allow the company to achieve its service design leading to sustainable customer satisfaction.

Table 4. Service Indexes for Installation service for Aluminium Glass Window Frames .

No.	Scenario	Service Index
1	When considered only service complexity (Eq. 1)	83.60%
2	When considered service complexity and expected service time (Eq. 3 with all CS_i=1)	52.76%
3	When considered service complexity, expected service time, and service quality (Eq. 3)	52.18%

4. Conclusions

Quality aspect has been incorporated along with expected service time into the service index for better reflection of design for ease of service to ensure quality in service for enhancing service excellence. Customer perception of the potential causes of dissatisfaction has been illustrated via Reverse Kano Model and taken into account for identifying customer not dissatisfaction score, an additional factor introduced into the calculation of service index. The successful illustration in a case study on window frame installation service has demonstrated the usage of the service index for analysis of ease of service. When it is applied along with the old index, a holistic picture of design for ease of service can be achieved.

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