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E-QUAL: A QUANTITATIVE MODEL OF USER CO-CREATION EXPERIENCE QUALITY

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ABSTRACT

This paper sets forth a quantitative model, indicating how a set of measures to assess co-creation experience quality of service providers and customers (E-QUAL) in a service process. Inspired by ecological mutualistic evolution and evolutionary fitness, both partnership and adaptability for service participants in service exchange resemble the relationship of mutualism for species in symbiotic ecosystem. However, the three criteria (PR, ED, and UR) and interactive fitness (IF) are used to test the partnership and estimate the adaptability for assessing user co-creation experience quality within the collaborative service with value co-production. In this article we demonstrate a service system that uses the E-QUAL to evaluate value co-creation experience quality. From the perspective of practice, the measurable model, on the other hand, facilitates an interaction-based self-service system to meet (semi-)automated value co-production.

Keywords: experience quality, value co-production, interactive fitness, service performance, adaptability, mutualism,

INTRODUCTION

In recent years considerable concern has arisen over the collaborative e-services on Internet, for example, Ask Yahoo!, Google groups, Wikipedia. Given experience economy, interest in service quality has shifted to reflect current developments in user experience quality which emphasize the experience with value co-production. E-QUAL is to assess the user co-creation experience quality during a service process for service providers and customers using service performance assessment. Particularly, this model is applicable to the interaction-based self-service systems that are able to conduct service exchange with benefits (i.e., value co-production). For E-QUAL, the service system is able to examine if the service participants can afford to build the relationship that meet the condition of mutualism. In other words, the model can assess and track the partnership and adaptability for evaluating user co-creation experience quality.

Mutualism is the mutually beneficial interaction between the individuals of two species [4]. Lifetime Reproductive Success (LRS) is to estimate of fitness of an individual in ecology. A service system involves a set of elements such as service encounter, operation, process, delivery, and recovery et al., which are deemed an ecosystem. As a result of the similarity between the species ecosystem and service systems, the three criteria have been tested mutualism using proximate response (PR), ultimate response (UR), and evolve dependence(ED). In service system E-QUAL proposes a quantitative model to examine both partnership and adaptability for evaluating value co-creation experience quality according to service performance assessment.

The remainder of this paper is organized as follows. Section 2 describes the related works including customers' experience quality and interaction-based self-service systems with value co-production, and Section 3 presents the E-QUAL model. Concluding remarks are presented in Section 4.

RELATED WORKS

Unlike a product with physical features that can be objectively measured, service quality contains many intangible factors such as psychological features [17]. Measures of service quality can be examined based on the quality difference (gap) between the customer expectations and the customer-perceived quality (e.g., the PZB model) [1].Furthermore, a means-end framework conceptualizes, constructs, refines, and tests a multiple-item scale (i.e., E-S-Qual, E-RecS-QUAL) for measuring service quality delivered by web sites that allow customers to shop online [1,2,3]. Measuring service quality is a challenge because customer satisfaction is determined by many intangible factors [17]. In addition, on the basis of the conceptual problems associated with SERVQUAL P-E model and using the EP model as a theoretical foundation (i.e., NQ model) [14]. A mixed-model specification that assumes some features to be vector attributes and other to be classic ideal point attributes would be conceptually more appropriate. The mixed-model specification considers service-attribute type and interpretation of the comparison standard [3]. Service performance is a bottom-line issue, that is, services should be developed and delivered to achieve maximum customer satisfaction at minimum cost [10]. Gronrros proposed that the two most important service attributes were intangibility and interaction with clients. Intangibility and interactivity are elements common to countless service products [9]. For experience quality in service research, the related works include (1) customer experience quality, and (2) interaction-based self-service systems with value co-production.

Service Experience Quality

User experience is the internal and subjective response customers have to any direct or indirect contact with a company [5]. Customer experience encompasses every aspect of a provider offering so that customer satisfaction is the culmination of a series of customer experiences. Service inherits time-perishable, intangible experience performed for a customer acting in the role of co-producer [17]. A customer experiences encounters with a variety of service providers, and each moment of truth is an opportunity to influence the customer perceptions [17]. To measure service experience, customer satisfaction is the culmination

of a series of customer experiences or, say, the net result of good experiences minus bad experiences [5].

Customer Experience Management (CEM) captures the immediate response of the customer to its encounters with the company [5]. In terms of psychological underpinnings, the service encounter is viewed as a core task surrounded by the customer's psychological experience during the transaction [15]. User experience is cumulative service productivity and customer satisfaction [20]. Tracking user experience quality can be captured from the course of interactions and coordination, especially, their cognition from interaction for collaborative intelligent [19]. It should be noted, however, that there have been few attempts to measure the service experience quality. Some service attributes need advance methodologies to attack such tough problems.

Interaction-based Self-Service Systems with Value Co-Production

In most cases, an interaction-based self-service system comprises service providers and clients working together to co-produce value in value chains or networks [10]. A service system with value co-production is composed of people, technology, other internal and external service systems, and shared information [9]. The characteristics of service systems, such as measures, and other shared information types, evolve over time as service systems attempt to improve productivity, quality, compliance, and innovation [9]. In general, an e-service involves a negotiated exchange between a provider and a customer for the service provision of intangible assets [6]. For example, the knowledge workers depend on their knowledge, tools and social-organizational networks to solve problems, be productive, and continually develop, generate and capture value (e.g., IT outsourcing, call centers, patents, and educational service systems) [12]. Considering service activities, service systems are complex adaptive systems comprising people who are complex and adaptive [9]. That is, an interaction-based self-service system is likely to be closely related to a collaborative service system. Our main goal is to understand the interaction of service activities to determine how the user experience quality would be inferences from service performance.

User co-creation experience quality is determined by many intangible factors such as the cognition and impression user perceived, for this reason, the evaluation of service performance and service quality taking for the user co-creation experience quality is critical. In order to address the critical issue, this study addresses a set of quantitative measures to track the critical questions. This study intends to tackle the issue of developing a quantitative method for user co-creation experience quality within a service process. The purpose of this research also gives rise to a slew of new opportunities and challenges for systematic service innovation. Thus, it is crucial that service systems exert to control good customer experience quality at all times and it's worthy of further investigation.

USER CO-CREATION EXPERIENCE QUALITY

By cross-domain mapping, the model derives mainly from both ecological mutualistic evolution and evolutionary fitness. This study explores how a set of measures estimate user co-creation experience quality according to testing the relationship (mutualism), and estimating the fitness (adaptation).

Antecedent of Ecosystem—Species Mutualism versus User Value Co-Creation

The origin of this study derived from ecosystem on account of the similarity between the phenomenon of ecological species' mutualism and the users' value co-creation. Mutualism can afford to be mutually beneficial exchange to empower the species to live in nature. Value co-creation is also benefit exchange to empower the co-production between providers and customers. In the service process, evolution shows how customers and providers build the partnership as mutualism over time; adaptation shows how customers and providers delivery the service ideally.

Evaluating Species Mutualism

Mutualism is mutually beneficial interaction between individuals of two species, and the degree of benefit (i.e., performance) resulting from the interaction depends on adaptation is considered. Mutualistic evolution examines the performance of species using the three criteria—proximate response (PR), ultimate response (UR), and evolved dependence (ED)—in order to test mutualism. That is, the performance deviation between partner absence and partner presence can test the relationship of mutualism. Lifetime Reproductive Success (LRS) is to compute the number of recruits of the subsequent generation that an individual produces over its entire lifespan, which is generally assumed as a relatively good estimate of fitness [4]. LRS is to assess the absolute fitness of an individual [7], and can be regard as an indicator for the adaptability.

For evaluating mutualism, PR is associated with the performance deviation observed between partner absence and partner presence. ED is responsible for decreased performance resulted from partner removal in the certain partnership. UR is influenced by PR and ED when the species has been evolved into mutualism through the two stages of evolution and adaptation. Moreover, LRS of PR (LRSP) represents a new LRS after a partner addition. LRSP-LRS represents the individual performance change owning to partner appearance. LRS of UR (LRSU) also represents a new LRS when they have been evolved into mutualism, namely, the holistic performance on account of evolution and adaptation. In the meantime, LRS of ED (LRSE) represents a new LRS when they form the loss of performance owning to change/quit partnership. ED is then LRSE-LRS (Fig.1)

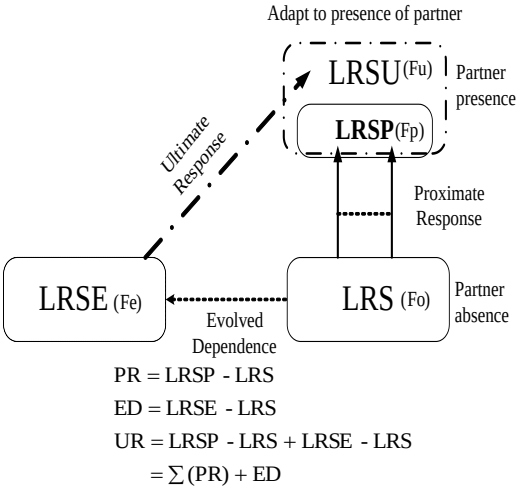

Figure 1 LRS with PR, ED, and UR

The performance deviation between Fo and Fp shows that the increments of performance from partner absence to partner presence. However, the loss of performance Fe-Fo occurs when the species exchange/drop their existing partnership. Fu is the holistic performance Fp-Fo+Fe-Fo

Evaluating User Value Co-Creation

In order to examine the experience with value co-creation, this model is to explore both partnership and adaptability between the provider and customer who occur in service systems. Using the synthetic methodology [19], the measures are centered on the experiences that derive from two parts of evolution and adaptation during a service process. Whereas both mutualistic evaluation and evolutionary fitness (LRS) resemble the notions of service with value co-production, this study utilizes the synthetic methodology to emerge the way of evaluating user experience quality. This study address a set of measures to assess the user co-creation experience quality using analytic and synthetic methodology based on the service performance assessment. Our research methodology in this study is addressed from the 'science of the artificial' (i.e., science (analytical) of engineering (synthetic)). Once synthesized, the artifact can be characterized in terms of its functions, goals, and adaptability. Artifacts are frequently discussed in terms of imperative and descriptive methodologies (i.e., design science). By design for emergence, the model can be used to test the partnership (mutualism) during the service process. For the service with value co-production, the both incremental and holistic service performance are assessed by IF_{PR} and IF_{UR}. The species mutualism in ecosystem is characterized by (1) assessing performance for species, (2) testing mutualism using PR, ED, and UR, and (3) estimating virtually absolute fitness by LRS. By contrast, the proposed E-QUAL is characterized by (1) assessing the performance for providers and customers, (2) testing value co-creation using criteria, and (3) estimating virtually interactive fitness using IF in the interaction-based self-service systems (Table1).

Table1 the analogy between species mutualism and user value co-creation

Species Mutualism in Ecosystem	User Value Co-Creation in Service Systems
● Assessing performance for species ● Testing mutualism using criteria—PR,ED,UR ● Estimating absolute fitness—LRSP, LRSE,LRSU	● Assessing performance for providers and customers ● Testing value co-creation using criteria— PR, ED, UR ● Estimating interactive fitness — IF_{PR}, IF_{ED}, IF_{UR}

As fitness essentially matters to understand microevolutionay process in a metapopulation, the fitness is accordingly defined to explore whether achieving proformance due to evolution. Notably, much of the discussions regarding the performance deviation derived from co-production between provider and customer has centered on how service participants behave from without to with partners to meet value co-production. Thus, a service system uses interactive fitness (IF) to assess the realistic adaptability to observe and to control the experience during a service delivery process.

Testing Partnership Using the Criteria

The mutualism in ecology can be regarded as the partnership between the service provider and customer for human being. For testing partnership, we borrow from the criteria which test mutualism between two species into the criteria which test partnership between service provider and customer in a service circumstance. Building the partnership needs exchange benefits to develop the advantage of relationship as mutualism. In this article the three criteria (i.e., PR, UR, and ED) indicated that the incremental performance, the possible loss of performance, and holistic performance during a service process when the service participants conduct service exchange. A study examine if the relationship between providers and customers evolve into superior partnership to observe the part of value co-creation experience quality.

- PR : Assessing the service performance that resulted from the service interactions with customer input in a service process.
- ED: Assessing the loss of performance once provider or customer exchange/drop partner (as switching cost).

- UR: Assessing the holistic service performance resulted form PR and ED.

PR refers to the short-term response without adaptation, namely, customer may increasingly adapted to service provider. ED refers to a loss of performance in service process resulted from change/quit partnership. Yet all the cases among service participants occur the event that resulted in ED. UR shows that two species have been evolved into mutualism via long-term response and adaptation.

Estimating Interactive Fitness

In order to further assess the user co-creation experience quality, the measurable methodology is necessary. Thus, we proposed a qualitative indicator—Interactive Fitness (IF), integrating the measures of service performance into three criteria. Figure 2 depicts E-QUAL characterizing the realistic service performance instead of IF. IF_{UR} is to present an estimate of adaptability between the service provider and customer through PR and ED. Tracking the increasingly increased fitness allows the service systems to ensure the superior adaptability. In other words, UR embraces the difference from LRS to LRSP (during the evolution) and the difference from LRS to LRSE. An adaptive LRS (LRSU) is formed with a number of interactions of customer input and possible loss of performance. $LRSU = \sum(LRSP_{t+n}) + LRSE$ can be viewed as a holistic service performance when service delivery.

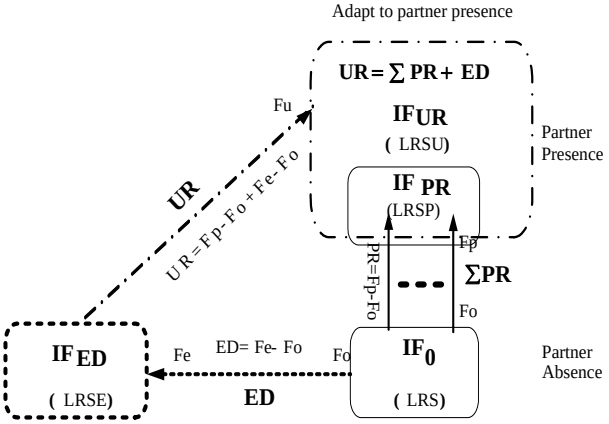

Figure 2 Assessing user co-creation experience quality using IF

The study uses the performance-based on fitness to estimate of adaptability. Assessing LRSP attempts to address the stage of concern by shedding light on the effects of interaction. IF_O represents the original service performance as adaptability at that time. IF_{ED} is a new adaptability when service participants encounter partnership change or terminate. IF_{PR} includes the individual effect of interaction with customer input. Finally, IF_{UR} accumulates the all IF_{PR} and IF_{ED}, namely, the holistic service performance LRSU is cumulated by all the increments of fitness LRSP and LRSE. Examining the all effects of PR and ED, the service performance can be examined in the interaction-based self-service process. The user feedback in service systems can be used to assess IF, which also can be regarded as the experience quality perceived by the service participants.

E-QUAL centers on both partnership and adaptability development as user co-creation experience quality in a service process with value co-production. As the service participants engage in value co-production through PR and ED, Figure 3 shows that the fitness occurs to estimate in the whole service process. In Figure 3 the starting point IF_O increasingly accumulates each increment of fitness $\Delta IF_{PR1} + \Delta IF_{PR2} \cdots$ till IF_{PR}. IF_{UR} is $\Delta IF_{PR1} + \Delta IF_{PR2} \cdots + \Delta IF_{ED}$ with all IF_{PR} and IF_{ED}.

$$IF_0 = F_o, IF_{PR} = F_P, IF_{ED} = F_e$$
$$\sum(PR) = \Delta IF_{PR1} + \Delta IF_{PR2} + \cdots \Delta IF_{PRn}$$
$$ED = \Delta IF_{ED}$$
$$UR = \sum(PR) + ED$$
$$= \Delta IF_{PR1} + \Delta IF_{PR2} + \cdots \Delta IF_{PRn} + \Delta IF_{ED} = IF_{UR}$$
$$n = 1,2,\cdots n$$

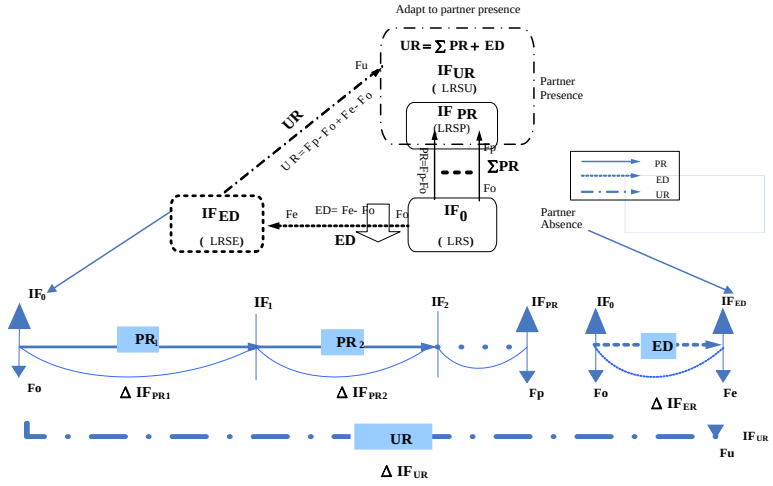

Figure 3 the estimates of IFPR, IFED, and IF_{UR} in a service process

E-QUAL can be examined by the absolute fitness of any individual in each interaction of customer inputs, using the parameters of L and $\overline{R}g, i$. Based on the analogy for the measures, the interactive fitness will be applicable for evaluating the user co-creation experience using the fitness derived from service performance through service exchange with value co-production. LRS-based measures provide a good theoretical framework for attacking the problem of estimating fitness of value-co-production between providers and receivers. The primary measures to be addressed in E-QUAL are how the effects of the fitness can compute $\overline{R}$ and L. The log of expected service delivery is modeled as a linear function of the parameters of interest. In this model, L is defined as the part of cost relative to service. The expected average of service performance is estimated by analogy with the equations for expected average reproductive success $E(\overline{R})$. A model for the total effect of customer input through evolution and adaptation according to the 'proximate factors' x on $E(\overline{R}) = e^{[\beta^T x]}$ is then shown in Table 2.

Table 2. the equations of IF

The components of IF
(L) : service cost (i.e., input) $\frac{1}{L} : \frac{1}{\text{service cost}}$ $E(L) = e^{[\alpha^T x]}$ (1) $\overline{R}$: average outcome performance (i.e, output) $E(\overline{R}) = e^{[\beta^T x]}$ (2) where β is a vector of coefficients, x are specific factors $E(IF_g) = E(\frac{\overline{R}}{L}) = e^{[(\alpha-\beta)^T x]}$ (3)

For the measures of service performance, Eqs (1), (2), and (3) refer to the estimates of adaptability using IF for observing user co-creation experienced quality within a service system.

The Proximate Factors for PR

The proximate factors studied here may be of importance in assessing the fitness (Table 3). In ecology the variation in LRS of individual to morphological characteristics (i.e., factors) that probably can influence service performance [7]. Using a synthetic methodology, the proximate factors are associated with the effects of PR in a service exchange process. Based on the empirical study of service quality, for example, the service quality model (SERQUAL) provides the criteria fall into 10 key categories [1]. It should be noted, however, the service systems take into account the factors which relate to service performance. The determinants also require serving as the basis of measuring value co-creation experience quality.

In order to estimate IF, the service systems takes into account the various factors (Xn , n=1…n,) that influence the service performance when they conduct service exchange. Most particularly, the user feedback can afford to assess service performance through the factors whose service system defined. Thus, a service system that automated value co-production using adaptive methodologies requires defining the important factors. For example, an interaction-based self-service system for collaborative

music content creation, the three defined factors —PF1: content originality, PF2: integration flexibility, PF3: content diversity can be the X in equation to compute $E(\overline{R}) = e^{[\beta^T x]}$ as the outcome of service performance (Table 3). β is the corresponding weight depending on the level of importance among these factors which selected by service system designer. The service performance derived from PR are $e^{[\beta^T x]}$ (e.g., 2.61).UR will be estimate by $\overline{R} = \sum e^{[\beta^T x]}$ and L (e.g., 1.73).

Table 3 an example of E-QUAL

I.	PF1	PF2	PF3	$e^{[\beta^T x]}$
1	0.36	0.32	0.28	e0.96= 2.61
2	0.21	0.16	0.16	e0.53= 1.70
3	0.03	0.02	0.02	e0.07= 1.07
4	0.16	0.10	0.12	e0.38= 1.46
5	0.24	0.18	0.18	e0.60= 1.82
$\frac{\overline{R}}{L} = \frac{\sum e^{[\beta^T x]}}{L}$ = 8.66 / 5 = 1.73				

CONCLUSION

According to a cross-domain mapping [18], the study borrowed the mutualistic evolution and evolutionary fitness to develop analytic and synthetic methodology for evaluating value co-creation experience quality. In a interaction-based self-service system with value co-production, the service participants exchange service as similar as an ecological mutualism, E-QUAL is then introduced to assess user co-creation experience quality through the testing partnership and estimating adaptability. For testing partnership, PR, ED, and UR are used to measure the service performance deviation before and after being partnership within a service system. The interactive fitness serves as the assessments of adaptability provided by service process. The service systems track fitness to ensure user value co-creation experience quality underlying service performance assessment.

This study proposes a set of measures to facilitate the interaction-based self-service system enabling value co-creation experience quality. Although the quantitative model contributes to achieve the fundamental proposition of value co-production, this model uses the theory of ecological mutualism and evolutionary fitness for examining the experience quality among service participants. The experience quality might be associated with the internal and subjective response, so the model needs to assess user experience quality service participants perceived using the important proximate factors in service exchange process. However, how a service system defines and selects the proximate factors to evaluate can be further validated. The theory borrowed from the other social or natural science can further investigate.

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