Evaluation of service quality and user experience on credit card application using e-SERVQUAL model and usability testing

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Abstract. One of the emerging fields of a startup business is financial technology, also known as fintech. Fintech is divided into several sectors, namely payment, aggregator, lending, crowdfunding, and other online financial transactions. The study was conducted at an Indonesia fintech aggregator that became the first e-commerce marketplace for financial products such as credit cards, insurance, and loans. The data showed that 53.6% of the number of application submissions came from the credit card category but there was a decrease of 22.8% in 2019. The purpose of this study is to evaluate the service quality and user experiences from credit card submissions in a mobile application to improve the platform to fit the customer's needs. Service quality evaluation is done using the e-SERVQUAL model with efficiency, system availability, fulfillment, privacy, responsiveness, compensation, contact as its dimensions. The results found that 13 variables need to be improved by the company. Evaluation of user experience done by usability testing method by considering the dimensions of learnability, effectiveness, efficiency, and satisfaction. Based on the Pareto diagram, there were 21 failures that need to be prioritized. User satisfaction obtained using the System Usability Scale (SUS) is 44.5 which is categorized in the OK category. Design of improvement is done using the House of Quality method and 10 technical requirements need to be developed. After giving a proposal using a prototype, the re-test was done, and user satisfaction increased to 70.4.

Keywords: e-SERVQUAL, fintech, house of quality, usability testing

1. Introduction

Today's rapid technological developments have a major impact on economic growth. The digital economy persists to develop in Indonesia and is considered to have great potential due to the increasing penetration of the internet [1]. One of the developing business fields in Indonesia is financial technology, known as fintech, which 50% of fintech in Indonesia has entered the final stage of funding that indicates the ecosystem is developing maturely[2]. Unfortunately, due to the high threat of substitute products, it caused increasing competitive rivalry, hence a continuous innovation is needed for companies to have higher performance.

This is supported by the research conducted at a fintech aggregator in Indonesia which provides several financial products such as credit cards, insurance, and loans. Currently, the highest number of product submissions is a credit card application at 53.6%. However, according to the number of submissions between 2018 and 2019, the number of applications submitted in 2018 was higher and
decreased by 22.6% in 2019. An interview was conducted to determine the cause of the decline in submissions and found that the decrease of credit card applications was caused by the presence of substitute products, marketing factors, unsatisfactory services that decreased user satisfaction, and a complex user experience that makes user difficult to apply for a credit card on the mobile application. If the dissatisfaction continues as shown from the decreased of application rating and user comments at Google Play Store, the company will lose its potential customers in the future.

Based on the problems that occur, this study will use an e-SERVQUAL model approach to determine the quality of current credit card application services [3]. Furthermore, researchers will also evaluate the mobile application user experiences for credit card submission using usability testing to find out the difficulties experienced by users when operating the application and overall user satisfaction after operating the application [4]. After getting the results, the House of Quality approach will be used to improve the platform by analyzing customer needs and define technical requirements to achieve the needs [5].

2. Literature Study

2.1. e-SERVQUAL

Electronic service quality is a way to find out how a website can facilitate user activities which include purchasing transactions and product delivery efficiently and effectively [3]. E-service quality is also identified as the user's perception of services that will be used as a foundation for assessing the services provided [6]. There are several dimensions to E-Service quality [7]:

- Efficiency: the ease and speed of access. In this case, there are three main elements, such as ease of use, function or convenience, speed of use, or and accessibility.
- Fulfillment: reliable and correct information about service and product availability. This element can affect the intention and trust of customers going forward.
- System availability: technical functionality because a service is only useful when it is available when needed, so it is necessary to evaluate system readiness in evaluating customer quality.
- Privacy/security: keeping customers' personal information and not leaking personal information without their consent, and also protecting users from fraud especially from using their financial information.
- Responsiveness: punctuality when customers experience problems and have questions. This can create an excellent customer experience. There are main elements in this dimension such as providing correct contact information, fast response to requests, and fast troubleshooting.
- Compensation: how the company can compensate customers for online service failures or other forms of problems they encounter.
- Contact: the availability of phone or online assistance. When a customer experiences a problem with the website, the company should provide someone who they can contact to report on their trouble.

The service quality concept is also used to determine the gap between current perceptions of services and the expectations of services from the customers. The gap analysis formula [8]:

\[
Q = \text{Perceived Service} - \text{Expected Service}
\]  

where Q is service quality.

Additionally, Importance Performance Analysis (IPA) is formed to measure the relationship between consumer perceptions and customer expectations. The result will show the priority to improve service quality. The quadrant of the IPA is as follow [9]:

- Quadrant A is the main priority where this quadrant shows that service indicators are very important but the current level of service still does not meet customer expectations.

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- Quadrant B is part of maintaining performance where this quadrant shows service indicators considered important by customers, but the company has performed well.
- Quadrant C is a low priority part where this quadrant shows that service indicators are considered less important by customers, but the company has performed well and is following customer expectations.
- Quadrant D is an unnecessary part wherein this quadrant the indicators are considered not very important by the customer, but the company provides more or very satisfying service to users.

2.2. Usability Testing

Human-Computer Interaction (HCI) is a discipline that is concerned with the design, evaluation, and implementation of computing systems for human use [9]. The main key to HCI is usability. Usability comes from the word usable which generally means it can be used well. Something can be said to be useful well if the failure can be eliminated or minimized and provide benefits and satisfaction to users[10].

Usability testing is the method to know how a product can be used by certain users to achieve some set of targets with effectiveness, efficiency, and achieve user satisfaction [11]. In other words, usability testing is carried out in a temporarily controlled environment which allows the evaluator to control what users do to know whether the product being developed can be used by the targeted user to achieve the designed task [12].

In usability testing, the number of respondents is determined based on figure 1[13].

![Figure 1. Usability Testing Respondents](image)

Usability testing can be measured using the following dimensions [4]:

- Learnability relates to ease of use from all functionality and feature in an application or website. The success rate equation [14]:

  \[
  \text{Success rate} = \frac{\text{Success} + (\text{Partial Success} \times 0.5)}{\text{Total Task}} \times 100\% \tag{2}
  \]

- Effectiveness relates to mistakes made by users while interacting with certain websites or applications. The error rate equation [14]:

  \[
  \text{Error rate} = \frac{\text{Total Defects}}{\text{Total Opportunities}} \tag{3}
  \]

- Efficiency relates to the speed at which "tasks" are performed on a particular website or software application time-based efficiency is used to analyze the time it takes for the user to complete a task. The time-based efficiency equation [14]:

  \[
  \text{(4)}
  \]
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\[ \text{Time-based efficiency} = \frac{\sum_{j=1}^{N} \sum_{i=1}^{R} n_{ij} t_{ij}}{N R} \]

where N is the number of tasks completed by the user, R is the number of users, \( n_{ij} \) is the result of task \( i \) performed by user \( j \); if the user completes the task successfully then \( n_{ij} = 1 \) otherwise \( n_{ij} = 0 \), and \( t_{ij} \) is the time used by user \( j \) to complete task \( i \).

- Satisfaction is related to user satisfaction after using the website or application. The questionnaire that is generally used to determine satisfaction is the System Usability Scale (SUS) assessment. Table 1 shows the questions of SUS adopted by [15].

| No. | Questions |
|-----|-----------|
| 1   | I think that I would like to use this system frequently |
| 2   | I found the system unnecessarily complex. |
| 3   | I thought the system was easy to use. |
| 4   | I think that I would need the support of a technical person to be able to use this system. |
| 5   | I found the various functions in this system were well integrated. |
| 6   | I thought there was too much inconsistency in this system. |
| 7   | I would imagine that most people would learn to use this system very quickly. |
| 8   | I found the system very cumbersome to use. |
| 9   | I felt very confident using the system. |
| 10  | I needed to learn a lot of things before I could get going with this system. |

Figure 2 is a scale to determine the acceptability ranges, grade scale, and adjective rating adopted by [16].

2.3 House of Quality
HOQ is used to understand customer needs (voice of customer) and translate it into a design so that the customer's voice can be integrated into product or service features. The step of House Quality is [17]:
- Customer Needs is input from customers. This stage is achieved by collecting complaints from customers and prioritizing the importance of those complaints.
Planning Matrix is formed using the results of customer needs. The data collected will be analyzed with the companies or competitors’ products, designing targets for achieving customer satisfaction for future products, calculating improvement factors, and sales points.

Technical Requirement describes how the company intends to respond to each customer's needs. This stage is sometimes referred to as the voice of the company. Technical requirements are not the product or service design specifications. Rather, they are the characteristics and features of a product that are considered to meet customer needs and are measurable.

Interrelationships Matrix is used to examine the relationship between customer needs (what’s) and technical requirements (how’s).

Correlation Matrix is used to know the relationship between each technical requirement. When a product or service is being designed, there will be some technical requirements that tend to benefit or conflict with each other.

Design Target provides information about the goal of the company for each technical requirement to compete in the market.

3. Research Methodology

In this study, a questionnaire was done on 102 respondents to determine the level of customer satisfaction between current service and service expectations. Furthermore, the operationalization variables are tested for validity and reliability to ensure that the data collected covers the area that being investigated and provides stable and consistent results. Observations were also carried out by directly seeing the respondent when operating the mobile application following the instructions given then recorded user comments, tasks that failed to operate by the user, and the time the user spent operating the application. To complete the overall findings, a focus group discussion was held within the company’s internal team to determine design requirements to meet user needs and design targets.

4. Result and Analysis

4.1. Validity and Reliability

This research starts by collecting e-SERVQUAL data using an online questionnaire. This study involved users who had submitted credit card applications on the mobile application. The result of validity data processing using the SPSS software found that all the indicator E1 – E8 in dimension Efficiency (E), indicator SA1 – SA4 in dimension System Availability (SA), indicator F1 – F5 in dimension Fulfillment (F), indicator P1 – P5 in dimension Privacy (P), indicator R1 – R6 in dimension Responsiveness (R), indicator C1 – C4 in dimension Compensation and the indicator CO1 – CO3 in dimension Contact (CO) were valid.

All indicators in the questionnaire are valid because the significant value is greater than the r-table = 0.195. The r-table value is obtained based on the r table with a significance level of 5% where df (degree of freedom) = n - 2, where the n value is obtained based on the total number of respondents who participated in filling out the questionnaire [18]. Additionally, all valid indicators will continue for reliability testing. Table 2 is the result of reliability data processing using the SPSS application.

| Reliability Statistics          | Perceived | Expectation | N of Items |
|--------------------------------|-----------|-------------|------------|
| Cronbach's Alpha               | 0.968026  | 0.948163    | 35         |

The basis for making decisions on this reliability test is: if the Cronbach's alpha ≥ 0.7, then the statement item is declared reliable, vice versa [19]. As a result, all statements are reliable because there is no Cronbach's alpha value below 0.7.
4.2. Gap Analysis

After all indicators are valid and reliable, a gap analysis is created between the current service perspective and expectations service from consumers. Table 3 shown the gaps in credit card application.

| No | Indicator | Mean | Gap |
|----|-----------|------|-----|
|    |           | Perceived Services | Expectation Services |
| 1  | E1        | 3.676 | 4.765 | -1.088 |
| 2  | E2        | 3.402 | 4.725 | -1.324 |
| 3  | E3        | 4.127 | 4.735 | -0.608 |
| 4  | E4        | 3.882 | 4.716 | -0.833 |
| 5  | E5        | 3.725 | 4.745 | -1.020 |
| 6  | E6        | 3.480 | 4.735 | -1.255 |
| 7  | E7        | 3.804 | 4.745 | -0.941 |
| 8  | E8        | 3.804 | 4.735 | -0.931 |
| 9  | SA1       | 3.245 | 4.765 | -1.520 |
| 10 | SA2       | 3.157 | 4.706 | -1.549 |
| 11 | SA3       | 3.353 | 4.725 | -1.373 |
| 12 | SA4       | 3.353 | 4.735 | -1.382 |
| 13 | F1        | 3.775 | 4.716 | -0.941 |
| 14 | F2        | 3.647 | 4.755 | -1.108 |
| 15 | F3        | 3.706 | 4.735 | -1.029 |
| 16 | F4        | 3.833 | 4.706 | -0.873 |
| 17 | F5        | 3.912 | 4.706 | -0.794 |
| 18 | P1        | 3.863 | 4.784 | -0.922 |
| 19 | P2        | 3.657 | 4.716 | -1.059 |
| 20 | P3        | 3.922 | 4.686 | -0.765 |
| 21 | P4        | 3.647 | 4.725 | -1.078 |
| 22 | P5        | 4.069 | 4.716 | -0.647 |
| 23 | R1        | 3.618 | 4.775 | -1.157 |
| 24 | R2        | 3.716 | 4.716 | -1 |
| 25 | R3        | 3.814 | 4.706 | -0.892 |
| 26 | R4        | 4.108 | 4.735 | -0.627 |
| 27 | R5        | 3.784 | 4.706 | -0.922 |
| 28 | R6        | 3.99  | 4.784 | -0.794 |
| 29 | C1        | 3.431 | 4.716 | -1.284 |
| 30 | C2        | 3.167 | 4.735 | -1.569 |
| 31 | C3        | 3.333 | 4.647 | -1.314 |
| 32 | C4        | 3.441 | 4.657 | -1.216 |
| 33 | CO1       | 4.049 | 4.647 | -0.598 |
| 34 | CO2       | 3.912 | 4.559 | -0.647 |
| 35 | CO3       | 4.078 | 4.294 | -0.216 |

4.3. Importance Performance Analysis

Based on the results of the gap analysis, an importance-performance analysis is done to create service improvement priorities in the form of quadrants. Figure 3 is the result of the quadrant.
4.4. **House of Quality**

Figure 4 is the overall result of the House of Quality from the credit card application service.


4.5. Usability Testing

Usability testing results are shown in Table 4 by calculating the success rate and error rate using Equation 2 and 3.

| Task   | Success Task | Error Task | Total Task | Success Rate | Error Rate |
|--------|--------------|------------|------------|--------------|------------|
| Task 1 | 119          | 31         | 150        | 89.7%        | 0.207      |
| Task 2 | 435          | 150        | 585        | 87.2%        | 0.256      |
| Task 3 | 21           | 24         | 45         | 73.3%        | 0.533      |

Average | 83.39% | 0.329 |

Table 5 is a table of the results of time-based efficiency using Equation 4. In this case, the whole user must complete the task so the value of $n_{ij} = 1$.

| Task                                             | Error | Cum Percentage |
|--------------------------------------------------|-------|----------------|
| User can see credit card information clearly      | 15    | 7%             |
| User can cancel credit card comparisons easily   | 13    | 14%            |
| User can compare credit cards easily             | 10    | 19%            |
| User can fill out the submission form on the first page easily | 9    | 23%            |
| User successfully canceled the submission made   | 9     | 28%            |
| User confirm passwords easily                    | 8     | 32%            |
| User can distinguish between the information that needs to be filled or not | 8    | 35%            |
| User has successfully seen the details of the submission | 8    | 39%            |
| User find the hyperlink “Email Us”               | 8     | 43%            |
| User find information about reporting complaints easily | 8    | 47%            |
| User can submit complaints easily                | 8     | 51%            |
| User create passwords easily                     | 7     | 55%            |
| User choose the province of residence easily     | 7     | 58%            |
| User choose the provision of residence easily    | 7     | 62%            |
| User can fill out the submission form on the third page easily | 7    | 65%            |
| User view credit card results easily             | 6     | 68%            |
| User get SMS OTP quickly                         | 5     | 70%            |
| User find credit card categories                 | 5     | 73%            |
| User choose what bank to use to receive salaries easily | 5    | 75%            |
| User can see the detailed information they want easily | 5    | 78%            |
| User select districts / cities easily            | 4     | 80%            |
| Others                                           | 15    | 100%           |

The success value is obtained from the success of the task from the given scenario. Meanwhile, the partial success value is taken from the user’s error when doing certain tasks, since in this study the user must complete the task until the end.

After knowing the number of failures, a Pareto diagram was made to determine the most frequent failures during usability testing following the 80/20 principle. Areas that will be prioritized are those that have a cumulative percentage of error reaching 80%. Table 5 shows the number of failures in usability testing.
Table 6. Time-Based Efficiency

| Tasks | Time based efficiency (goals/sec) |
|-------|----------------------------------|
| Task 1 | 0.0174                           |
| Task 2 | 0.0007                           |
| Task 3 | 0.0257                           |

SUS is used as a post-test after the user completes all scenarios on usability testing. The questions on the SUS odd questions in the questionnaire have a positive behavior so the scale will be minus by 1 but for even questions have a negative behavior so the equation will be 5 – scales. After calculating, the average of the System Usability Scale is 44.6. Figure 5 is the position of customer satisfaction with the current mobile application according to the SUS scale.

4.6. Design Proposals
Based on the technical requirements from the house of quality and the failures that were found during usability testing, the researcher redesigned the user interface. The design features are a ticketing system, credit card recommendations, a help center, additional document retrieval, and credit card delivery status on the order detail page, a timer on OTP authentication, red outline when there is an error in creating password and password confirmation, search features for the province, city of administration, and the bank used, minimized the size of a banner on the landing page, provides credit card recommendations by category on credit card listings, credit card comparisons, provides a summary of detailed credit card information, infographics before users fill out the card submissions form credit, and simplified credit card submission form pages.

![Figure 5. Current System Usability Scale](image)

4.7. The New Usability Testing
Table 7 is a comparison of usability testing between the current system and the proposed interactive prototype.

Table 7 Usability Testing Comparison

| Dimension | Task 1  | Task 2  | Task 3  | Task 1  | Task 2  | Task 3  |
|-----------|---------|---------|---------|---------|---------|---------|
| Learnability | 89.70%  | 87.20%  | 73.30%  | 97.90%  | 98%      | 96%      |
| Effectiveness | 0.207   | 0.256   | 0.533   | 0.043   | 0.041    | 0.079    |
| Efficiency  | 0.0174  | 0.0007  | 0.0257  | 0.0193  | 0.0016   | 0.0098   |
| Satisfaction | 44.5    |         |         | 70,357  |          |         |

On average, the learnability dimension increased by 13.90%, and the effectiveness increased by 0.277. Time based efficiency increased to 0.004367 goals / second, and satisfaction increased by 25.87%.
5. Conclusion and Outlook
Current services are still experiencing dissatisfaction and not in accordance with user expectations. It caused by 12 main indicators and 2 additional indicators which can be seen in the results of the Importance Performance Analysis. Users also found hardly to operate the application so to make it easier, company need to improve 21 indicators which can be seen in the failure results found in usability testing. Additionally, mobile application design to meet customer needs is to add a ticketing feature, help center, delivery status and notifications, as well as a timer in the OTP authentication process.

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