Integration of Quality Function Deployment and Analytical Hierarchy Process in Developing Digital Application Features

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Abstract. The development of digital technology is increasingly developing along with the emergence of the industrial concept 4.0. Indirectly, this creates opportunities for the macro and micro industries located in cities and villages. Analysis of visitor needs and application feature priorities were carried out in this study for the development of android applications in the “Ponggok Village” and “Cikoromoy Village”. The purpose of this study is to make it easier for visitors to know the tourism objects in the village. Quality Function Deployment (QFD) and Analytical Hierarchy Process (AHP) are used as a basis for designing digital application designs. Identification of visitor needs is obtained by using QFD methods and ranking of application features is obtained by using methods. Finally, two villages were compared in order to developing an integrated digital application.

1. Introduction

In the opinion of the Minister of Industry and Trade, industry 4.0 makes the production process running with the internet the main support (Glienmourinsie, 2016). All objects are equipped with technological devices that are assisted by sensors and able to communicate alone with information technology systems (Prasetyo and Sutopo, 2017). Digital technology creates opportunities for SMEs, especially those in rural areas to be able to build and develop marketing networks on a wide, large, and efficient scale. This study proposes the design of mobile application features by utilizing the concept of industry 4.0 which is expected to provide new experiences to village visitors to find out the potential of the village that has not been exposed to public. The contribution of this research is to study the comparison of two design of the application model which were evaluated in two villages with different cultures and potentials, namely “Ponggok Village” and “Cikoromoy Village”. From the comparison of two concept models in subsequent studies as data for the basic design and application program for Android.

2. Theory

2.1. The Tourism Industry

According to Undang-Undang Pariwisata No. 10 of 2009, the tourism industry is a group of tourism businesses that are interrelated in order to produce goods and of services for the fulfillment of tourists in the administration of tourism. While, in The International Recommendation for Tourism Statistics 2008, UNWTO (United Nations World Tourism Organization) states, the tourism industry includes...
accommodation for visitors, food and beverage service activities, passenger transportation, travel agents, cultural activities, sports activities, and entertainment activities.

Tourism may have many impacts on certain regions, one of which is social and cultural impact. A social and cultural of the community can be affected by the interaction between tourists and the host community (Zaei & Zaei, 2013). The tourists backgrounds and lifestyle may change the local communities and it can improved cultural and social events, infrastructure and facilities, and entertainment (Zaei & Zaei, 2013). These changes can lead to an improvement in the regional economy. It will provides an opportunity for job creation and generation of revenue at international, national, regional, and local levels (Zaei & Zaei, 2013). Tourism objects for example the cultural events or entertainment and also culinary tours may generate income which is spent by visitors (Holloway & Robinson, 1995). For developing countries, the tourism industry is an option that has high potential in developing the country’s economy.

2.2. Quality Function Deployment (QFD)

Yoji Akao, the original developer, described QFD as a “method to transform qualitative user demands into quantitative parameters, to deploy the functions forming quality, and to deploy methods for achieving the design quality into subsystems and component parts, and ultimately to specific elements of the manufacturing process” (Akao, 1994). The House of Quality (HOQ), a part of QFD, is the basic design tool of quality function deployment. There are sections in HOQ, including (figure 1):

1. Voice of the customer (VoC), the first is to fill in the sub-matrix of consumer desires in the voice of customer column obtained from the questionnaire that has been distributed
2. Technical / Design Requirements, after knowing the needs of consumers, the company must design what will be done to meet the needs of consumers / How’s
3. Relationships, an important part to be done carefully. The relationship between How's and What's it's represented in the matrix. This matrix shows how strong the relationship of each consumer's voice (What’s) with its technical response (How’s) and Technical Response with each customer's wants and needs, based on the value of Impact, Relationship, and Priority
4. Competitors to be compared are competitors who produce similar products
5. It is the level of importance of each How’s element to the n’s What's calculated to determine the priority of the achievement of the How's element
6. This section contains the development of the team's estimate of the relationship between the implementation of the existing elements and the Technical Response
7. This section can be done by marketing or through team discussions
8. Column weights, How's with a high initial technical rating, high technical competitive priorities, and a high improvement ratio that will be the focus set by the company.

Figure 1. HOQ (Cohen, 1995)
2.3. Analytical Hierarchy Process (AHP)

The Analytical Hierarchy Process (AHP) is a method that can be used to establish measures in both physical and social domains (Saaty, R. W., 1987). In using the AHP to model a problem one needs a hierarchic or a network structure to represent that problem and pairwise comparisons to establish relations within the structure (Saaty, R. W., 1987).

Sometimes in a study with a scale of 1 – 9 there is a CR > 0.1, one way to minimize the possibility of this happening is to use a scale 1 – 5 (Aupetit and Ganest, 1993 in Hossain et al., 2014).

Table 1. Comparison between two scale

| Scale 1-9 | Scale Description | Scale 1-5 |
|-----------|-------------------|-----------|
| 1         | Same important    | 1         |
| 3         | Quite important   | 2         |
| 5         | Important         | 3         |
| 7         | More important    | 4         |
| 9         | Absolutely important | 5       |

Source: Hossain et al., 2014 and Zaman, et al., 2017

3. Result and Discussion

In this research, the application needs of users (visitors, community, and village stakeholders) will be needed to determine what is needed in the process of developing the application model concept design and evaluating user acceptance. Case studies were carried out in two villages with different potentials and cultures that would adopt applications for developing the potential they had in each village. Respondents are visitors to the village, the community and the two urban villages. This is important because it requires active involvement from the user in the process of determining these needs which will affect the successful development and application of the design concept of the application model.

The research steps to analyze the needs of application users are as follows:
1. Preliminary study, observing and explaining the application of ideas in the application to the village, the results of the preliminary study are used as a questionnaire design
2. Distribution of questionnaires, carried out on application users (visitors, community, and village stakeholders)
3. The QFD process is carried out to obtain a voice of customer (VOC) on the application design and input on developing village potential. In the AHP process, to get application design priority because several features are displayed dominantly to attract more users can enjoy using the application
4. Comparative study, is the final step for implementation in terms of preliminary studies, application features, and strategies for the two villages

Table 2. Village name and its potential

| No | Village | Potensial |
|----|---------|-----------|
| 1  | “Desa Ponggok, Klaten-Jawa Tengah” (Village A) | a. Agriculture, fisheries, trade and tourism include water sources b. Village potential is managed by two active BUMDes: “Tirta Mandiri” and “PokDarWis Umbulsari” |
“Desa Cikoromoy Kadubungbang, Pandeglang-Jawa Barat” (Village B)

Agriculture, fisheries (paddy goldfish), trade and tourism include bathing water sources, religious tourism and culinary.

Source: Preliminary study, 2019

Table 2 shows a general description of the object of observation for research. Whereas, table 3 is the VOC for the questionnaire design in QFD.

### Table 3. Voice of Customer Variable

| Scale 1-9 | Scale Description                                                                 | Code |
|-----------|-----------------------------------------------------------------------------------|------|
| 1         | Information regarding directions to tourist attractions                           | ADOB |
| 2         | General information regarding the village profile of the tourist site             | AIW  |
| 3         | Information regarding tourist attraction                                          | AIT  |
| 4         | Information regarding cultural event and the history of the village               | AIE  |
| 5         | Information regarding agriculture and livestock                                   | AIEE |
| 6         | Information regarding souvenir shop                                               | AIK  |
| 7         | Ease of use and attractive appearance of the application                          | AIM  |
| 8         | Adverts in the application                                                        | AIA  |

Source: Preliminary study, 2019

Table 4 shows the variables as well as the types of features that exist in the application, which then enter into the technical response and are processed with AHP to get priority application features as the initial display.

### Table 4. Decision Criteria

| No. | Scale Description                | Code |
|-----|----------------------------------|------|
| 1   | “Profil Desa” feature           | FPRD |
| 2   | “Desa Berbudaya” feature        | FDB  |
| 3   | “Keliling Desa” feature         | FKD  |
| 4   | “Belanja Kuy” feature           | FBK  |
| 5   | “Tani -Ternak Desa” feature     | FTD  |
| 6   | “Peta Desa” feature             | FPD  |
| 7   | Simple UI Design                | DUS  |
| 8   | Pop-Up Advertising               | IPM  |

4. Result And Discussion

4.1. Result

The initial variables of each user’s needs are obtained from literature studies and field studies. Then there is discussion with the village stakeholders to get priority application features in accordance with the conditions of each village.
Based on the results using QFD method in “Ponggok Village” and “Cikoromoy Village”, there is a slight difference in the priority value of the technical response and the value of VOC. According to the HOQ, both villages have the highest weight in the same technical response, that is in the “Peta Desa” feature (FPD) with each weight is 119.86 in “Ponggok Village” and 116.19 in “Cikoromoy Village”. The second highest was found in the “Profil Desa” feature (FPRD) with each weight is 73.24 in “Ponggok Village” and 70.88 in “Cikoromoy Village”. Moreover, the third highest weight is found in the Simple UI Design (DUS) with each weight is 71.19 in “Ponggok Village” and 67.41 in “Cikoromoy Village”.

By using the same method, we noted that “Information regarding directions to tourist attractions” (ADOB) and “Ease of use and attractive appearance of the application” (AIM) have the same weight and are the highest weight in “Ponggok Village” at 4.21. Besides that, this highest attribute also appears in “Cikoromoy Village” which is “Infomation regarding directions to tourist attractions” (ADOB) at 4.35, followed by “Ease of use and attractive appearance of the application” (AIM) at 4.08.

| Table 5. “Ponggok Village” and “Cikoromoy Village” AHP Result |
|---------------------------------------------------------------|
| No | Feature | “Ponggok Village” Weight | Rank | “Cikromo Village” Weight | Rank |
|----|---------|--------------------------|------|--------------------------|------|
| 1  | FPRD    | 0.23                     | 1    | 0.15                     | 4    |
| 2  | FDB     | 0.19                     | 2    | 0.20                     | 1    |
| 3  | FKD     | 0.13                     | 3    | 0.19                     | 2    |
| 4  | FBK     | 0.11                     | 4    | 0.11                     | 5    |
The ranking of alternatives feature to the AHP method is presented in Table 5. We noted that the first rank in “Ponggok Village” is “Profil Desa” feature (FPRD) at 0.23, whereas the first rank in “Cikoromoy Village” is “Desa Berbudaya” feature (FDB) at 0.20. The second highest weight in “Ponggok Village” is “Desa Berbudaya” feature (FDB) at 0.19 whereas in “Cikoromoy Village” is “Keliling Desa” feature (FKD) . Finally, the third highest weight in “Ponggok Village” is “Keliling Desa” feature (FKD) at 0.13 whereas in “Cikoromoy Village” is “Peta Desa” feature (FDP) at 0.18.

4.2. Comparative Discussion of “Ponggok Village” and “Cikoromoy Village”

In order to create android application for both village, we have proposed a method where QFD is integrated with AHP to weight decision criteria, which is the application feature. The proposed method provides a systematic analysis of the interdependencies among voice of customer and technical response. The technical response became alternatives feature on AHP to weight the decision criteria based on the importance given to CRs.

Based on processing using the QFD method, there are similarities in visitor priorities on both villages. We noted that the existence of clear information about the direction to the tourist attractions is important because visitors can expose and know the potential of the Village which can provide a pleasant experience and can be published globally.

However, based on AHP method, we noted that both villages have difference priority. “Ponggok Village” prioritizes the village profile, whereas “Cikoromoy Village” prioritizes village culture. These results relate to the facilities provided by each village. “Ponggok Village” has good management system where tourism are managed by Village Owned Business Entity (BUMDES) while “Cikoromoy Village” has a strong local culture.

5. Conclusion

This research concludes that QFD and AHP methods can be used to determine the priority needs of visitors and priority features of the application. Although this research provide preliminary information about important application features that will be designed on the Android platform, further research is needed in order to develop business models and determine the other application features to provide a complete information for village visitors.

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Source: Data Processing, 2019
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