Application To Measuring Food Business Opportunities For The Development Of Smart Cities

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Abstract. In the development of technology, more people are using products from technology development to facilitate their daily activities especially in food industry. However, to measuring and determine opportunities when opening a food business covering food material and type of culinary. People usually choose what food ingredients are of public interest and estimates materials and cost to determine a business opportunity. In this situation a Decision Support System (DSS) can be developed, namely apus-kul is a decision makers by using certain data and models to solve some unstructured problems using Simple Additive Weighting (SAW) algorithm. This system is expected to be a means to assist the community when making decisions to choose materials and food businesses for the development of smart city governance systems.

1. Introduction
Citizen have a variety of jobs, one of which is a culinary business. To determine the opportunity when opening a culinary business, people usually choose with their respective estimates without using a system that is able to help the community to determine a business opportunity. This is also happened in Purwantoro District, Wonogiri Regency, Central Java Province. There is no Decision Support System yet that is able to help communities in Purwantoro to choose and determine culinary business opportunities and culinary business locations. By utilizing the advanced of technology can be one way to create a system that can help the community to determine culinary businesses that are in accordance with conditions and criteria. With this system, it is hoped that the community will be easier to choose the right culinary business in micro businesses. This research is an idea for developing smart cities, namely Smart Living. Smart City as an effective integration between physical infrastructure, digital systems and HR skills to build an environment that provides hope for a sustainable, prosperous and inclusive future [1][2].

In previous research, about Smart Governance Planning said that smart government is the spearhead of Smart planning City [3][4]. This provides inspiration for how to build smart government related to the management of culinary businesses in the region. So, in this research are developed the application based a web. This is a Decision Support System using the CodeIgniter (CI) framework. The system can be managed by an administrator. The system will be created using the Simple Additive Weighting (SAW) method in its calculations. The existence of DSS in companies or organizations is not to replace the tasks taken, but is a facility that helps them in making a good decisions about materials of food business and location [5]. The criteria used for business ranking are business funds, profits, number of competitors, and number of buyers. The criteria used for business
place ranking recommendations are the distance between the village and the market, the distance between the village and the main road, and the population of the village.

2. Experimental

The research methodology that be used in this study is the Waterfall model. Waterfall method can be seen in Figure 1. Below the phase of waterfall method:

a. Analysis
b. Design
c. Coding
d. Testing
e. Support and Maintenance

![Waterfall Model Diagram]

Figure 1. Business Proses In Apus-kul

3. Result and Discussion

Functional requirements are used to determine the functions performed by actors who have access to the system. Functional Needs in the Application of Determining Culinary Business Opportunities can be seen in Table 1.

| Code  | Description                                                                 | Actor    | Dependency |
|-------|-----------------------------------------------------------------------------|----------|------------|
| FR01  | Login                                                                       | Admin    |            |
| FR02  | Admin can change alternative culinary business data                         | Admin    | FR03       |
| FR03  | The system can display a list of alternative culinary business data         | System   |            |
| FR04  | Admin can change the alternative data for culinary business locations       | Admin    | FR05       |
| FR05  | The system can display a list of alternative culinary business location data | System   |            |
| FR06  | The system can display a list of culinary business criteria data             | System   |            |
| FR07  | Admin can change the criteria of culinary business criteria                 | Admin    | FR06       |
| FR08  | The system can display a list of culinary business location criteria data   | System   |            |
| FR09  | Admin can change the criteria for                                           | Admin    | FR08       |
| FR | Description                                                                                                                                   |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------|
| FR10 | The system can display a list of business fund attribute data                                                                            |
| FR11 | Admin can change the business fund attribute data                                                                                         |
| FR12 | The system can display a list of business profit attribute data                                                                             |
| FR13 | Admin can change the business profit attribute data                                                                                         |
| FR14 | The system can display a list of attribute data for the number of buyer                                                                    |
| FR15 | Admin can change the attribute data of the number of buyer                                                                               |
| FR16 | The system can display a list of attribute data for the number of business competitors                                                      |
| FR17 | Admin can change the attribute data of the number of business competitors                                                                  |
| FR18 | The system can display a list of attribute data for the number of business distance to the market                                           |
| FR19 | Admin can change the data attribute of the distance of the business location to the market                                                  |
| FR20 | The system can display a list of attribute data of the distance of the business location to the highway                                      |
| FR21 | Admin can change the data attribute distance of business location to the highway                                                             |
| FR22 | The system can display a list of attribute data for the number of residents in the business location                                        |
| FR23 | Admin can change the attribute data on the number of residents in the business location                                                   |
| FR24 | The system can process calculations using the SAW method                                                                                   |
| FR25 | Admin can see the results of the calculation of the culinary business data SAW method                                                         |
| FR26 | Admin can see the results of the calculation of the culinary business location data method                                                   |
| FR27 | User accesses the user dashboard page                                                                                                       |
| FR28 | User can accesses the list of alternative business sequences according to the results of calculations and filters used                      |
| FR29 | User can accesses the list of alternative business locations according to the results of calculations and filters used                       |
The Code field content is unique for each system's functional requirements. The Description field contains a description of the functional requirements of the system. In the Actor field contains actors in the form of people or systems that perform or relate to a function. Then the Dependency field contains the Code from other functions, where a function has a dependency on the function whose unique code is listed in the Dependency field.

Non-functional requirements are used to analyze application interactions outside of functional requirements. Non-functional needs of the Culinary Business Opportunity Determination Application can be seen in Table 2.

| Code  | Description                                                   |
|-------|--------------------------------------------------------------|
| NFR01 | The system can be run by web browser software                |
| NFR02 | The system can provide information when input data does not comply with the rules |

The non-FR Code column contains unique codes for each non-functional system requirement. The FR Description column contains a description of the non-functional requirements of the system.

In this study there are 2 actors involved in the system, namely admin and user. Admin and user have different access rights and features in the system. One of the differences between admin and user access is that the admin must log in if he wants to access the admin page and the user does not need to log in to access the login page. Admin and user can see the results of the order of culinary business recommendations and culinary business location based on calculations using the Simple Additive Weighting method.

Entity Relationship Diagram (ERD) or E-R Model or is a model used to describe data in the form of entities, attributes, and relationships between entities[6]. ERD in this study can be seen in Figure 2.
Implementation of the design for the admin page can be seen in Figure 3 and Figure 4. And the result of Simple Additive Weighting (SAW) is a weighted sum method. The Saw method is used in supply chain vendor evaluation [7] and also for the selection of personnel within an organization [8]. The basic concept of Simple Additive Weighting (SAW) is to find the weighted sum of the performance ratings for each alternative on a criterion. The Simple Additive Weighting (SAW) method requires the process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative branches. The calculation step for the SAW method is [9]:

1. Determine the alternative (Ai)
2. Determine the criteria (Ci) that will be used as a reference in decision making
3. Determine the weight of preference or level of importance (W) for each criterion. \( W = [W_1, W_2, W_3, ..., W_4] \)
4. Make a match rating table for each alternative on each criterion
5. Making the decision X matrix formed from the match rating table of each alternative (Ai) for each predetermined criterion (Cj) where, \( I = 1,2,...,m \) and \( j = 1,2,...,n \).
6. Normalize the decision X matrix by calculating the normalized performance rating (rij) value of alternative (Ai) on performance (Cj)
7. The results of the normalized performance rating (Rij) form a normalized matrix (R).

Implementation of the design for the admin page can be seen in Figure 5. Application development uses codeigniter(CI). CI source code that is equipped with comments in it so that it clarifies the function of a program code and the resulting CI is very clean and search engine friendly (SEF)[10][11].

![Figure 3. Dashboard admin page](image)

![Figure 4. Alternative data menu page](image)
The test results of the Culinary Business Opportunity Determination Application based on the opinion of respondents during the system public test can be seen in Figure 6.

**Figure 5.** Culinary business recommendation page on the user page

**Figure 6.** Result public test about apus-kul

**4. Conclusion**

The research that was carried out produced conclusions that had been made developing a system for a development smart cities with the title Application of Culinary Business Opportunities Determination apus-kul) to measuring and determining food material and type of business.

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