Development of Population Data Cluster Application based on Real-time Expertise

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Abstract: Population data is one of the information needed for sustainable development planning. Sustainable development is a planned development in all fields to create an ideal comparison between population development and the carrying capacity and capacity of the environment and to meet the needs of the current generation, without having to reduce the capabilities and needs of future generations, to support the life of the nation from generation to generation throughout time. Population data as essential regional data is relatively static, such as data on changes in migration between regions. Changes in the general structure of the population, socio-economic structure, vertical and horizontal population mobility are an essential part of population data collection and planning at the regional and national levels. Invalid population data is one of the weak points in implementing sustainable development in the regions. For example, in human resource planning, data is needed on the number of school-age population and workers. By incorporating population into the national economic and development strategy, sustainable development will accelerate by growing the workforce. As a result, development goals will be achieved more quickly. Information on population data in the city of Bitung is not efficient in its management. The data input process should be carried out at the unit closest to the community, such as the village. This application will be developed using PHP and MySQL. By using the mixing method, the application will be developed to the trial stage in real conditions. This application was created to classify the population's expertise in real-time to support sustainable development in the city of Bitung in particular.

1 INTRODUCTION

A population is an object as well as a subject in national development. The policy in the field of the population is not only about the number and density of the population, immigration flows, births, and deaths, but also policies in terms of controlling high population growth and directing mobility and a more even distribution of the population, especially in sparsely populated areas. Regulate the desired population will cause social and economic problems. The very large population growth will affect the facilities and infrastructure in the fields of education, health, and so on.

Referring to data from the BPS (Central Statistics Agency) of Bitung City through a publication entitled "Bitung City in Figures 2021", it was noted that the number of the labor force in Bitung city in 2020 was 91,622 people with the percentage of the population working towards the workforce in Bitung city was 89.77%, where the working-age population is the population aged 15 years and over while the labor force is the population working age (15 years and over)who are working, have a job but temporarily not working, and are unemployed. The number of skilled and skilled workforce at BLKI Bitung City in 2020 is 859people. The problems caused by the large number and growth of the labor force, on the one hand, demand greater job opportunities. On the other hand, demand the development of the workforce itself so that it is able to produce higher outputs. This increase must be anticipated by the government and the business world as employers or job openings.

Employment comes from economic growth. However, high growth does not always provide large jobs. This relates to the economic development strategy carried out by the government and the business world. Another thing that must also be considered in analyzing the relationship between the labor force and employment opportunities is that if

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job opportunities are above the labor force, it does not mean that employment problems, ormore specifically unemployment, are resolved. The existence of new job opportunities is a "potential," and this "potential" may not be utilized if the available workforce does not have adequate quality.

A large population and workforce will be able to become development potential if properly fostered. Good coaching will produce a good quality workforce. The quality of the workforce is reflected, among others, in the level of education and skills/expertise. A large population with low population quality causes the population to become a burden for economic growth and not a driver. Employment problems are also caused by the lack of competence and expertise needed by labor users. Therefore, this application is made for grouping population skills in real-time to support sustainable development in the city of Bitung in particular.

2 SYSTEM ANALYSIS METHOD

Data analysis is one of the important steps in obtaining research findings. This is because the data will lead us to scientific findings when analyzed with the proper techniques. The analysis of this system is carried out using the Simple Additive Weighting (SAW) method, which is often also known as the weighted addition method. The basic concept of the SAW method is to find the weighted sum of the performance ratings on each alternative on all attributes (Fishburn, 1967) (MacCrimmon, 1968). The SAW method requires the process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings. The SAW method recognizes 2 (two) attributes, namely the benefit criteria and the cost criteria.

The steps for completing the Simple Additive Weighting (SAW) method are as follows

a. Determine the criteria that will be used as a reference in decision making, namely Cj
b. Determine the suitability rating of each alternative on each criterion.
c. Make a decision matrix (X) which is formed from the suitability rating table for each alternative on each criterion. The value of X for each alternative (Ai) on each criteria (Cj) that has been determined, where, i=1,2,…m and j=1,2,…n.

$$X = \begin{bmatrix} x_{11} & x_{12} \dots & x_{1j} \\ \vdots & \vdots & \vdots \\ x_{i1} & x_{i2} \dots & x_{ij} \end{bmatrix} \quad (1)$$

d. Normalize the decision matrix by calculating the value of the normalized performance rating (rij) from the alternative Ai on the Cj criteria. If j is a benefit attribute, then

$$r_{ij} = \frac{X_{ij}}{Max(i)\, X_{ij}} \quad (2a)$$

If j is a cost attribute, then

$$r_{ij} = \frac{Min(i)\, X_{ij}}{X_{ij}} \quad (2b)$$

Where:
r_{ij} = normalized performance rating value of alternative A_i on attribute Cj
Xi = attribute value owned by each criterion Max(i)
Xij= the largest value of each criterion i Min(i)
Xij= the smallest value of each criterion i
Benefits= if the largest value is the best
Cost= if the smallest value is the best value

e. The results of the normalized performance rating value (r_{ij}) form a normalized matrix (R)

$$R = \begin{bmatrix} 11 & 12 \cdots & 1j \\ \vdots & \vdots & \vdots \\ i1 & i2 \cdots & ij \end{bmatrix} \quad (3)$$

f. The final result obtained from the ranking process is normalized matrix multiplication R with the weight vector. The largest value is chosen as the best alternative (Ai) as the solution.

$$V = \sum_{j=1}^{n} w\, r_j \quad (4)$$

Where:
Vi = ranking for each alternative

3 SYSTEM DESIGN METHOD

In developing the system, we have conducted surveys and interviews both in person and through online questionnaires to prospective system users. We use the results as the basis of the design system to develop an expertise-based population data system.

System design is the process of developing new system specifications based on the results of system analysis recommendations. The objectives of system design are:

a. Meeting the needs of users of the system (users), such as designing a decision support system to help find population data based on expertise mapped based on the address of the residence in question.

b. Provide an overview through flowcharts to build Applications Population Data Cluster based on Expertise in Real-time in Bitung city.

After the population data collection is completed, we must determine the criteria that will be used as a reference in decision making. The following is a table that contains 6 criteria used to make decisions through the SAW method.

Table 1: Table of Criteria Terms.

No	Criteria Code	Criteria	Weight	Information
1 2 3 4 5 6	C1 C2 C3 C4 C5 C6	Wages Work experience Distance Education Age Skill	10 25 15 15 10 25	Cost Benefits Cost Benefits Cost Benefits

The value of each criterion is as follows, referring to the residents' answers in the Application evaluation section Population Data Cluster based on Expertise in Real-time in Bitung city.

1. Salary Criteria

Table 2: Value of Salary Criteria.

No	Wages	Criteria Value
1 2 3 4 5	< 1M >1 M & <= 2 M >2 M & <= 3 M > 3 M & <= 4 M > 4 M	1 2 3 4 5

2. Work Experience Criteria

Table 3: Value of Work Experience Criteria.

No	Work experience	Criteria Value
1 2 3 4 5	There is not any yet <= 1 year > 1 Year & <= 3 Years > 3 Years & <= 5 Years > 5 Years	1 2 3 4 5

3. Distance Criteria

Table 4: Distance Criteria Value.

No	Distance (km)	Criteria Value
1	<=2	1
2 3 4 5	>2 & <=5 >5 & <=8 >8 & <=15 >15	2 3 4 5

4. Education Criteria

Table 5: Value of Education Criteria.

No	Certificate	Criteria Value
1 2 3 4 5	Junior high school Senior High School Diploma I/II/III S1 / Diploma IV S2 / S3	1 2 3 4 5

5. Age Criteria

Table 6: Age Criteria Value.

No	Age (Years)	Criteria Value
1 2 3 4 5	<=17 >17 & <=20 >20 & <=30 >30 & <=40 >40	1 2 3 4 5

6. Expertise Criteria

Table 7: Value of Expertise Criteria.

No	Certificate Type	Criteria Value
1 2 3	There is not any Training Certificate Certificate of expertise	1 2 3

Several analytical tools are needed to assist in conducting the analysis in this study, including:

a. Flowchart used to analyze systems and programs
b. Entity Relationship Diagram (ERD) is used to analyze the relationship between entities in the system to be built

Both of them is shown in Figure 1 and Figure 2.

4 RESULT AND DISCUSSION

After the population data is obtained, the next step in the settlement using the SAW method is to convert the answers from the residents as the value of each alternative (people who have filled out the evaluation form) on each predetermined criterion. Considering a large amount of data, we only took 4 alternative samples to explain the SAW method calculation.

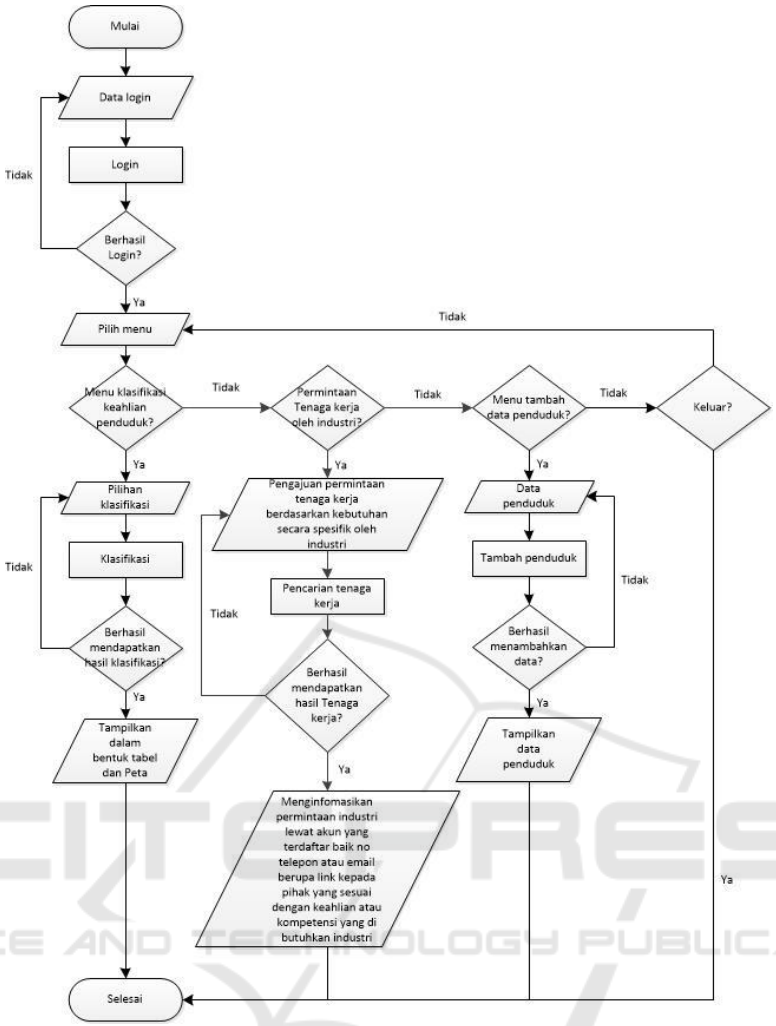

Figure 1: System design.

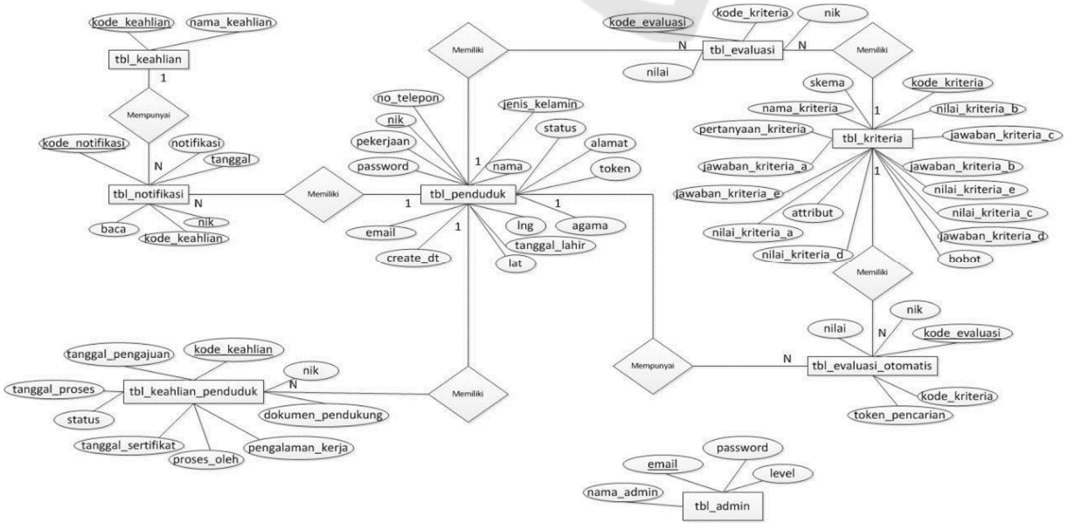

Figure 2: Entity relationship diagram.

Table 8: Conversion of population values.

Alternative	C1	C2	C3	C4	C5	C6
Resident 1	2	1	4	5	2	1
Resident 2	3	3	3	5	3	3
Resident 3	4	2	1	4	5	2
Resident 4	5	5	2	3	4	1

After the value of the suitability rating of each alternative on each criterion is determined in Table 8, it is obtained decision matrix X with the following data:

$$X = \begin{bmatrix} 2 & 1 & 4 & 5 & 2 & 1 \\ 3 & 3 & 3 & 5 & 3 & 3 \\ 4 & 2 & 1 & 4 & 5 & 2 \\ 5 & 5 & 2 & 3 & 4 & 1 \end{bmatrix}$$

Next, normalizing the X matrix is obtained by calculating the rij normalized performance rating value from the Ai attribute on the Cj attribute based on an equation that is adjusted to the type of attribute (benefit/cost). Because each weight n. The value given to each criterion is a matching value (the most significant value is the best), then all the criteria given are assumed to be profit criteria with equations. The results of the normalized matrix R can be seen as follows:

$$R\begin{bmatrix} 1 & 0{,}2 & 0{,}25 & 1 & 1 & 0{,}33 \\ 0{,}67 & 0{,}6 & 0{,}33 & 1 & 0{,}67 & 1 \\ 0{,}5 & 0{,}4 & 1 & 0{,}8 & 0{,}4 & 0{,}67 \\ 0{,}4 & 1 & 0{,}5 & 0{,}6 & 0{,}5 & 0{,}33 \end{bmatrix}$$

After normalization, the next step is to determine the ranking value of the alternatives using the SAW method. By using the formula, the preference value for each alternative (Vi) can be seen in Table 9.

Table 9: Calculation Value of Ranking Process.

Alternative	Results	Rank
Resident 1	0.52	4
Resident 2	0.73	1
Resident 3	0.63	2
Resident 4	0.59	3

The most significant value is in Resident 2, the alternative chosen as the best alternative with a result of 0.73. This ranking will be used in the Application Search feature to display population expertise data based on a specified location. The data is presented in tabular form with resident data ranking based on the calculation of the SAW method. The initial view of the Cluster Application Population Based on Expertise in Real-Time in Bitung City can be seen in Figure 3, while the display of the population data search feature based on expertise according to the specified location can be seen in Figure 4.

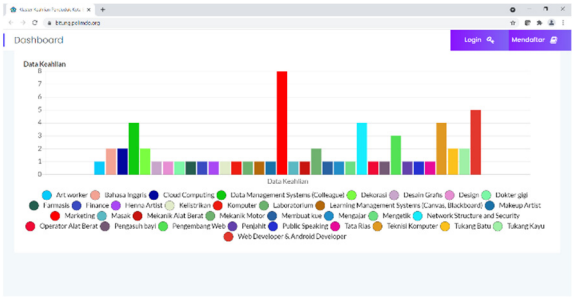

Figure 3: The initial view of the Population Data Cluster Application Based on Expertise.

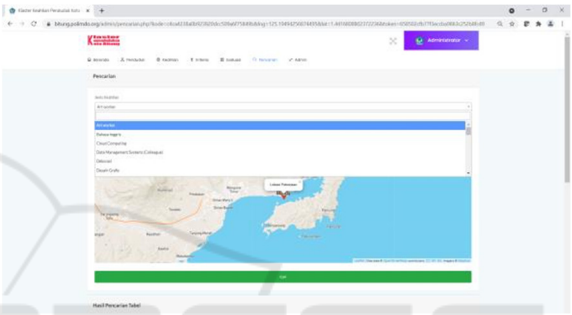

Figure 4: Display of the population data search page based on expertise and location of residence.

5 CONCLUSIONS

The Population Cluster Application Based on Real-Time Expertise in Bitung City was built to provide integrated and valid population data to support sustainable development in the city of Bitung in particular. This application uses the Simple Additive Weighting (SAW) method to rank population data according to predetermined criteria, including salary criteria, work experience, distance, education, age, and expertise. The Search feature in the application can display population expertise data based on a specified location. The data is presented in tabular form with population data ranking based on the calculation of the SAW method.

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