Determining the regional potential sector using the Analytical Hierarchy Process (AHP)

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Abstract. The main problem faced by local governments in establishing regional development policies lies in determining the focus of development based on the uniqueness or potential of the region. Different potentials in terms of local human, institutional or physical resources cause different regional characteristics. Development policies in the regions must consider all the potential they have. Therefore, local governments must have the ability to identify which sectors are the strengths or weaknesses of their regions. Sectors that are considered regional superiority have prospects to be developed and encourage the development of other sectors. Meanwhile, a weak sector is not expected to be an obstacle to the development process. This research was conducted to create a model that can be used to determine the leading sectors of sub-districts in Bandung Regency. The identification of leading sectors is done using the Analytical Hierarchy Process (AHP) method. Three criteria with a total of 12 sub-criteria and six alternative sectors become the basis for determining the leading sector. Data collection was carried out by distributing questionnaires with competent district or district government staff respondents in each sector. The results of the study in four sub-districts found that each sub-district studied had a different leading sector.

1. Introduction
Economic development is an ongoing effort to improve the welfare of the community. The main problem in regional development lies in the focus of development policies based on the uniqueness of the region by using the potential of human resources, institutions, and regional physical resources [1]. The potential of a region is different from the potential of other regions according to their respective characteristics. Therefore, local governments must be able to see sectors which are strengths and weaknesses for their regions. To achieve regional economic development goals, the main policy that needs to be done is to make regional development priorities according to their potential. This orientation leads to the development process to create new employment opportunities and stimulate increased economic activity [2].

The determination of regional superior sectors can be done by considering various criteria with different analysis methods. The analytical methods that are widely used to determine the dominant sector are the Location Quotient method [3-6], the shift-share method [4,5,7,8], and the Growth Ratio Model [6]. Location Quotient Analysis (LQ) is an analysis tool to show the economic base of a region, especially from the contribution criteria. This analysis tool is also used to measure the concentration of activities (industry) in an area with the role of similar activities (industry) in the regional or national economy. The shift-share analysis is a technique for analyzing the growth of an area by looking at
changes or increases in economic growth indicators in the area within a certain time period [8-10]. Meanwhile, the Growth Ratio Model is an analytical tool used to see potential economic sectors based on growth criteria for regional economic structures both external and internal [6]. This analysis model is derived from the initial equation of the main components in the shift-share analysis. Klassen's typological analysis is used to see a general picture of the growth patterns and structures of each economic sector. The description of regional growth patterns and structures can be used to estimate the prospects for future regional economic growth.

The difficulty faced by local governments in determining potential sectors is that each sector has its own advantages and disadvantages and many criteria must be considered. For this reason, the Analytical Hierarchy Process (AHP) method [11,12] is a method that can be used to determine the potential sector of a region. The AHP method is known as the analytical method commonly used to make decisions with many considerations or assessment criteria. However, the use of AHP to determine the leading sector of an area is still rarely found. Therefore, this paper will describe the results of research on the determination of regional leading sectors using the AHP method. This paper provides a different perspective in determining the leading sectors of the region which are usually used as the basis for formulating regional development policies.

2. Literature review
Analytical Hierarchy Process (AHP) is a method of decision making where the factors of logic, intuition, experience, knowledge (data), emotions and feelings are optimized through a systematic process [10, 11]. This method is used to find the ranking or order of priorities of various alternatives in solving a problem. AHP shows how to connect the elements of one part of the problem with the elements of another part to get the combined results. The process is identifying, understanding, and evaluating the interactions of a system as a whole. This analysis can be used to solve measurable problems (quantitative) and problems that require an opinion (judgment). With a hierarchical approach, a problem is seen as a system that has sub-systems or system elements. Sub-systems can be seen as smaller systems that can be broken down again into subsystems so that the level of the hierarchy of a system is obtained. The decomposition of the problem into this level makes it easy to do a thorough analysis by taking into account the influence of each sub-system to the system above it, to the system as a whole.

The most important stage in this method is the analysis of opinions, namely the assessment with a pairing comparison technique of the decision elements at a certain decision hierarchy level. The AHP procedure consists of six steps as follows:

- **System identification**, i.e. identifying objectives and factors involved in decision making;
- **Arrange the hierarchy**, i.e. arranging the system into a level decision making with several decision elements at each decision level (objectives, sub-objectives, criteria, sub-criteria, and alternatives);
- **Make a pairwise comparison matrix** between elements at each level of the hierarchy;
- **Determine the priority (weight)** of each criterion and sub-criteria based on a paired matrix;
- **Test the consistency of the comparative matrix** to avoid possible judgments that deviate from logical consistency.
- **Test the consistency of the hierarchy** so that a parameter called the Hierarchy Consistency Ratio (CRH) is obtained.

3. Method
This research was conducted in Bandung Regency and divided into several stages, namely the preliminary stage, data collection and processing, and the final stage (analysis, recommendations, and conclusions).

The preliminary stage consists of observation, literature review, problem formulation, and determination of research objectives. The next stage is the research stage to get the data needed in accordance with the research method used. At this stage, the activities carried out are collecting data,
determining research variables, designing and distributing questionnaires, and making models to determine the potential of sub-districts. The questionnaire used in this study consisted of two parts. The first part contains the identity of the respondent/expert who will be asked to provide an assessment. The second part deals with criteria, sub-criteria, and alternatives for the selection of potential sectors.

This research was not conducted in all sub-districts in Bandung Regency but only in four sub-districts that were considered to represent Bandung regency. Respondents/experts in this study are sub-district heads, government staff, who are considered competent to provide opinions or assessments in this study. Data processing is performed using the AHP method with expert choice software. The final stage of the research consists of analyzing the results of data processing and making recommendations based on the results of data processing, as well as the formulation of conclusions and suggestions for further research.

4. Result and discussion

The determination of the sub-district potential sector in Bandung Regency will refer to 6 (six) sectors, namely: agriculture, plantations, animal husbandry, fisheries, industry, and tourism. Each sub-district may not necessarily have the potential of all sectors depending on the resources owned by each sub-district. Determination of sub-district potentials is carried out in the following stages: 1) setting objectives; 2) determine the criteria and sub-criteria to be used to determine the potential of the sub-district; 3) determine alternatives.

4.1. Setting goals
This study aims to determine the potential sectors in the sub-district based on the results of the priority assessment of each alternative sector considered.

4.2. Determine the criteria and sub-criteria
To determine the potential superiority of a sub-district, assessment criteria are needed as a basis for consideration. The criteria used in determining the Potential Districts in Bandung Regency refer to the Minister of Home Affairs Regulation, Republic of Indonesia, No. 9 of 2014 concerning "Regional Leading Products Development Guidelines". In Appendix H of this regulation, it is explained that the criteria for regional superior products consist of 12 criteria. In this study, the criteria are grouped into 3 groups: contribution to the region, business sustainability, and business development.

- **Contributions to the Region (CI)** describe how much the contribution made by the sector to the region. The first group criterion consists of 4 sub-criteria, namely employment (C.Ia), contribution to the economy (C.Ib), regional economic base (C.Ic), and socio-cultural (C.Id).
- **Business Sustainability (CII)**, describing the ease and certainty of sustainability of the sector concerned. This group consists of 4 sub-criteria, namely: market availability (C.IIa), raw materials (C.IIb), capital (C.IIc), and price (C.IId).
- **Business Development (CIII)** means that the superior sector must be easy to develop in terms of the use of raw materials, technology, ease of supporting infrastructure, and ease of professional management by the community. This criterion consists of 4 sub-criteria, namely renewable (C.IIIa), infrastructure facilities (C.IIIb), technology (C.IIIc), and business management (C.IIIId).

4.3. Determine alternatives
At this stage, it is proposed several alternative potential sectors which will be determined as priority sectors based on the assessment of several experts. Potential sub-district potential alternatives will be seen from 6 sectors, namely: Agriculture, Plantation, Livestock, Fisheries, Industrial, and Tourism.

Evaluation criteria and sub-criteria, as well as alternative potential sectors, are then explained in the decision hierarchy model (figure 1).
Potential alternative sectors for each sub-district in Bandung regency may vary and there may be only a few sectors. This depends on the potential of each sub-district. Based on the results of processing using the AHP method obtained priority from alternative sectors for each district. Potential leading sectors from the four sub-districts are explained in table 1. From the results of the study described in table 1, it can be seen that the livestock sector is ranked last in all sub-districts. This illustrates that the livestock sector is a sector that is less attractive to be developed in the four sub-districts observed. In addition, the industrial sector was considered quite important to be developed even though it did not become a leading sector. The sector that has the potential to excel in sub-district A is the industrial sector, then the agriculture sector in the second rank. In sub-district B, the plantation sector became the leading sector, then the industrial sector was ranked second. For sub-district C, the agriculture sector is the first priority and the industrial sector is second. In sub-district D, the tourism sector is in the first place and the agricultural sector in the second place. The diversity of leading sectors in each sub-district requires the Bandung regency government to adjust the development plan of Bandung Regency in accordance with the sub-districts superior sector.

The determination of the superior potential is based on the evaluation of three criteria. The results show that business sustainability criteria are considered the most important criteria to determine whether a sector is important or not for a region (table 2). The next criterion is business development and the last is the contribution of the sector to the region. The top 5 of the 12 sub-criteria are capital (C.IIc), technology (C.IIIc), business management (C.IIId), market availability (C.Iia), and prices (C.IId).

**Figure 1.** Hierarchy model.

**Table 1.** Sector ranking in each sub-district.

| Sub-district | Sector rank |
|--------------|-------------|
|              | Plantation  | Agriculture | Animal husbandry | Industry | Tourism |
| A            | 4 (0.149)   | 2 (0.254)   | 5 (0.107)    | 1 (0.326) | 3 (0.163)|
| B            | 1 (0.294)   | 4 (0.165)   | 5 (0.128)    | 2 (0.207) | 3 (0.205)|
| C            | 3 (0.208)   | 1 (0.278)   | 5 (0.093)    | 2 (0.222) | 4 (0.199)|
| D            | 4 (0.129)   | 2 (0.223)   | 5 (0.081)    | 3 (0.195) | 1 (0.373)|
Table 2. The priority of sub-criteria (global weights sub-criteria).

| No | Sub-district A | Sub-district B | Sub-district C | Sub-district D |
|----|----------------|----------------|----------------|----------------|
|    | Sub-criteria   | Global weight  | Sub-criteria   | Global weight  |
| 1  | C.Iic          | 0.164          | C.IIIC         | 0.200          |
| 2  | C.IIia         | 0.157          | C.IIIc         | 0.126          |
| 3  | C.IIIc         | 0.113          | C.IIId         | 0.109          |
| 4  | C.IId          | 0.107          | C.IId          | 0.099          |
| 5  | C.IIIId        | 0.092          | C.IIb          | 0.074          |
| 6  | C.Iib          | 0.089          | C.Ic           | 0.078          |
| 7  | C.Id           | 0.059          | C.Iib          | 0.041          |
| 8  | C.Ic           | 0.057          | C.Ib           | 0.063          |
| 9  | C.Ia           | 0.051          | C.IIIId        | 0.055          |
| 10 | C.IIIb         | 0.045          | C.IIIa         | 0.041          |
| 11 | C.Ib           | 0.041          | C.Ia           | 0.040          |
| 12 | C.IIIa         | 0.026          | C.IIa          | 0.029          |

5. Conclusion

From the research that has been done to determine the superior potential of sub-districts in Bandung Regency, some conclusions can be drawn, namely:

- The variables considered in determining the superior potential of sub-districts consist of 3 criteria, namely business sustainability, business development and contributions to the region. Viewed from the 12 sub-criteria in the assessment of the existing sectors for the four sub-districts, the top five sub-criteria are capital, technology, business management, market availability, and prices.
- Based on the results of determining the potential in the four sub-districts selected as research objects, the sectors considered to be the superior potential of each sub-district are the plantation sector for sub-district B, the industrial sector in sub-district A, the agricultural sector for sub-district C and the tourism sector for sub-district D.

This research was conducted in four districts representing the Bandung regency. Six alternative sectors are used as consideration for determining the potential of sub-districts. Further research should be directed to carry out an assessment in all districts in Bandung Regency with alternative choices of all sectors according to the economic sector grouping in the calculation of Gross Regional Domestic Product. Thus, the determination of superior sector will be more detailed by considering various existing sectors. While for the assessment criteria and sub-criteria, this research has considered all the criteria that must be met in determining the superior sector or product based on existing regulations.

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