Geological based on area development: Terrain genetic unit method

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Abstract. This study aims to analyze the supporting factors, especially natural resources of mining materials for the development of the Pangalengan area, using the Terrain Genetic Unit (SGW) method. Pangalengan is one of the regions that has a wealth of natural resource potential, including mineral and rock resources, energy and geothermal resources and other natural resources that can be a support for regional development. The results of the study of holistic matrices and the direction of the development area for Pangalengan have the highest value of 291.5 and 360 compared to 4 other districts namely Kertasari, Ciwidey, Rancabali and Pasir Jambu. The presence of geothermal resources in Pangalengan is another multiplayer effect factor, which has a positive impact on the development in Pangalengan. The results of a holistic matrix analysis and regional development direction with elaboration of economic data obtained the results of 295 and 390.

1. Introduction

In the process of development, it will require considerable natural resources, both of which can be renewed such as wood, but not a few also require development of large non-renewable natural resources, one of the natural resources that plays a role in development, namely water, both groundwater and spring water. Springs are ecosystems in which groundwater reaches the Earth’s surface either at or near the land-atmosphere interface or the land-water interface [1]. but in the course of the development process constraints arise from nature itself, including due to activities irresponsible humans. The springs originate from water wholly derived from rainfall and are controlled by deep-seated and superficial fracture systems. Water movement is turbulent in high-permeability fractures. Percolation of free water takes place along the intersections of fracture systems and the water table; and as confined movement downward in deep fractures below the water table, rising to the spring discharge point along joints and fissures [2]. Natural conditions both directly and indirectly will have an impact on the development process and not a few natural disasters devastate an area which at the time of the construction process requires a lot of cost, energy and time [3]. So it is necessary to develop concepts even if the concept cannot be directly interpreted as a reference. Basic principles for sustainable development are stressed and a brief review of two case studies is provided to illustrate how a systems approach and its computational framework of mathematical models can be used in addressing the main issue of water allocation satisfying some of the technical and environmental constraints [4]. Despite these terms’ disagreeing concepts, their search for balance between human being’s needs and the environment is...
generally accepted, as well as their effort to understand both sides’ complex interaction dynamics in order to deepen and broaden their meaning [5].

Pangalengan District is located at 107° 29’-107° 39’ East Longitude and 7° 19’-7° 6’ South Latitude. The area is divided into several categories including the area of agricultural rice fields (technical irrigation, non-technical irrigation and irrigation), the area of agricultural land not rice fields and the extent of non-agricultural land. The village with the widest rice field area is Lamajag Village with 836.57 Ha and the Smallest Rice Field Area is in Pulosari Village with an Area of 3.78 Ha. In general, Pangalengan is located at an altitude of 1,000-1,400 meters above sea level [6].

Pangalengan viewed from the geo-tourism aspect, has a million beautiful natural charms, especially from a geological perspective. As a result of these geological activities, here are found many tourist attractions such as Situ Cileunca, Malabar, Cibolang hot springs, tea plantations, and many other tourist attractions. Behind the beautiful charm, besides that it is more special than geological charm, so many phenomena are formed and are good. The enchantment is the presence of active volcanoes in the region including Mount Malabar, Mount Wayang, Mount Windu and others. Mount Wayang and Mount Windu, which are currently being used for the heat potential of their earth. Some places prone to erosion and earthquake.

The condition and wealth of the geological aspects, one of which will be the basis in regional development based on the Genetic Area of Pangalengan Geology Region. The purpose of this study is to prioritize aspects of water resources based on springs as a driving factor for regional development, so that a region that develops both physically and economically is realized.

1.1. Location
The location of the activity is related to the Regional Genetic Unit in Pangalengan District, Bandung Regency, West Java Province.

Figure 1. Pangalengan area which is limited by 4 other sub-districts namely Kertasari, Talegong, Cimaung and Pasir Jambu [6].
Figure 2. Land use activities location.

Based on figure 2, where the location of the activity enters the volcano area, a volcanic disaster will occur at any time.

2. Method
The methodology that will be used is a study of the location and characteristics of disaster-prone areas so that the determinants of disaster-prone zoning are obtained which will be related to future regional development. In principle, this activity refers to scientific methods, namely a method of procedure that has been characterized as natural science since the 17th century, consisting of systematic observation, measurement, and experimentation, and the formulation, testing, and modification of hypotheses [7-9].

Terrain Genetic Unit is a regional entity that has the same background of genesis. A region, whether it is plain, hills, and / or mountains are formed or arranged by the mass of rocks and / or soil with their own characteristics. The characteristics of the rock constituent of the region are determined by the type of rock and its deformation pattern due to the role of tectonics [10].

Hirnawan divides the SGW type based on 9 parameters, namely constituent material (rock 3), deformation pattern (tectonic 3), and morphological construct (also 3) [10]. The results are obtained not less than 72 types.

There are 4 (four) stages used in this study, namely;

- Preparation Phase, This preparation stage is the initial stage to inventory the supporting data in the research;
- Field Stage, where this stage consists of 5 (five) aspects, namely; environmental aspects, technical aspects, economic aspects and policies, aspects of land use and supporting aspects;
- Stage studio, is an activity in inventoring, calculating, processing and interpreting data, both primary data want secondary data and analyze data;
• Reporting stages.

Identification of potential and constraints in each Terrain Genetic Units (SGW) can be done, it can even be continued by interpreting the level of potential and constraints of the region. The methods that have been done include conducting a scoring system or scoring method, by giving scores on all potential parameters and regional constraints from the regional aspects (space or space) and material aspects of mining materials (mineral resources), as well as disaster [10].

For obstacle parameters, the more constrained the value is greater, for example in the plain area there is no landslide, for the landslides parameter the score is 5, whereas in the mountains there is no flooding, then the score score is 5. To be more clearly discussed in the reference book / writing. The greater the value of all parameters, the SGW the more potential it is, the more constrained it is[10].

3. Results and discussion

3.1. Geomorphology and geology

3.1.1. Geomorphology. The Pangalengan District landform has a diversity ranging from ramps to very steep. By using van Zuidam's classification in Noor (2006) obtained the distribution of slopes found in Pangalengan District. 14% of land or around 3821.26 ha in Pangalengan Sub district are in the slope of 0% -2% or in the flat category. Regions with a flat category will avoid the danger of landslides. Land that is in the sloping category or with a slope of 2% - 7% dominates Pangalengan Sub district which is 33% of the total area or around 9007.27 ha [3].

The land height in Pangalengan District varies from 900 meters above sea level to 2100 masl. The elevation map of Pangalengan District can be seen in Figure 16. In accordance with West Java Regional Regulation No.2 of 2006 the Pangalengan District area can be divided into 3 (three) protected area classes, namely Protected Areas, Protected Areas Outside Protected Forests, and Water Infiltration Areas [3].

3.1.2. Geology. Overall, the southern part of Bandung is composed of volcanic rock [11]. The oldest rocks in the South Bandung area are known based on Pertamina drilling data [12] which reported that K-Ar analysis of alkaline lime andesite lava gave Miocene age (12.0 ± 0.1 million years).

Tertiary volcanic rocks are seen as the bedrock of the Quaternary Volcano [11]. Pangalengan and its surrounding geological conditions refer to the Garut Geology Map and Pameungpeuk [13] and the Southern Bandung Special Geology Map [14], that constituent rocks originated from the eruption / pyroclastic deposits of ancient Pangalengan which erupted large ( cataclysmic). Produces a Pangalengan plain with Situ Cileunca as its former Calder [11], then covered by pyroclastic volcanic / sediment products originating from parasite volcanoes namely Mount Windu, Mount Wayang and Mount Malabar which are younger in Upper Quaternary (Pleistocene) The general nature of the aid is still loose with the evolving geological structure, namely the alignment of faults that traverse Southeast-Northwest.

The sequence from young to old Pangalengan rock units as follows (Qd) Lake sediments are in the northern part of the location, (Qyw) Gunung Wayang Young Volcanic rocks are spread in the South, (Qmt) Malabar - Tili Volcanic Rocks which spread very widely in Pangalengan region North, South, West and East parts ± 50% of the area of Pangalengan. (Qgpk) Old volcanic rocks scattered in the east extending to the south, (Qopu) Spice deposits released from the Old Irreducible Volcano occupying the southern part of the location bordering Qwb and Qyw. (Qwb) is Andesite Waringin - Bedil, Old Malabar which occupies the Northern part of the Qyw unit.
3.2. Structure and tectonics of the Pangalengan region

Pangalengan is located in the southern part of West Java which has a weak fault condition or is susceptible to earthquake propagation. In the Bandung Basin Geology explains [15], the seismotonic issue of West Java and the Zoning of the Acceleration of the Bandung Earthquake.

Analysis of Landsat imagery shows that straightness is generally trending southeast - northwest and southeast - west northwest. The line that is believed to be a fault cut the Malabar Caldera resulting in the shape of the hills being cut up and forming swells around Pasir Panjang (locations 7° 14’ 25.9” LS - 107° 38’ 51.7” BT and 7° 14’ 48.4” LS - 107° 37’ 51.0” BT) [11]. There is a fault system in the northwest-southeast direction which is suspected to be a horizontal fissure. These faults included the Malabar Fault, Mount Geulis Fault, Cikuray Fault, Tilu Fault, Patuha Fault, Galunggung Fault and Jatiluhur Fault.

3.3. Regional development based on terrain genetic units

In the last 20 years the development of Earth Sciences has grown so fast, with these developments it is deemed necessary for a concept to create wealth and a better standard of living [16]. In urban development, from land use it is necessary to consider planning from a block scale with a plot scale, geological environmental factors must be analyzed, the effects must be evaluated and the necessary steps must be taken in good time. Urban planning is a formal and functional arrangement of the physical environment of people living. This is defined as the organization of the design, resources, complements, infrastructure and production of work created for this purpose. In the planning conception; Spatial development is designed to meet the social and economic needs of society. Another point of view that encourages the need for regional development is the regional autonomy policy in UU No. 32/2004 concerning Regional Government, explicitly giving broad autonomy to regional governments to manage and manage the various interests and welfare of the local community.

The Regional Government must optimize regional development oriented to the interests of the community. Through UU No. 32/2004, regional governments and communities in the regions are more empowered as well as given greater responsibility to accelerate the pace of regional development. Other basic considerations in carrying out regional development are the potential of the region itself as well as changes and developments in Regional Spatial Planning.

The Regional Genetic Unit or Terrain Genetic Unit is a regional unit that has the same background of genesis. Divided the type of Regional Genetic Unit (SGW) based on 9 parameters, namely constituent material (rock 3), deformation pattern (tectonic 3), and morphological construct (3 parameters) [10]. The results are obtained not less than 72 types. Identification of potential and constraints in each SGW can be done, it can even be continued by interpreting the level of potential and regional constraints. In relation to the development of the Pangalengan region the results of identification based on these three factors were obtained 11 SGW Pangalengan.

![Figure 3. Morphology of Mount Pangalengan [11].](image-url)
3.4. Pangalengan terrain genetic unit

The previous paragraph has been submitted, SGW Pangalengan based on consideration of the factors of geological, morphological and tectonic conditions and the geological structure obtained 9 SGW Pangalengan which consists of [3]:

- Strongly Reformed Lava Mountains Unit (1123), SGW with morphological conditions in the form of mountains arranged by strongly deformed lava rocks
- Breccia, Strongly Deformed (2231) High Plane Unit, SGW with morphology in the form of a high plain, composed of strong deformed breccia
- Strong Deformed Breccia Hills Unit (2232), SGW with hilly morphology, composed of strong deformed breccia rocks
- Strongly Reformed Breccia Mountains Unit (2233), SGW with mountainous morphology, composed of strong deformed breccia rocks
- Weak Unformable Tufted Hills (2312), SGW hills units compiled by Irreducible Tuff rocks with weak deformation
- Weak Unformable Unaffected Tuff Mountains Unit (2313), SGW in mountainous regions composed of weakly deformed Tuff Unreached rocks
- Unit of Medium-Modified Lava Hills (3422), SGW hills arranged by lava rock with moderate deformation
- Medium Deformed Lava Mountains Unit (3423), SGW in mountainous regions composed by medium deformed lava rocks
- Unit of Lava Interference Mountains, Strongly Reformed Breccia (3533), SGW with mountainous morphology, composed by strongly deformed lava

The above groupings are not all considered to be developed, there are only 2 SGWs considered to be developed, namely SGW 2231 and SGW 2232. Basic Considerations namely breccia (Qwt) rock units spread the most widely in the region and are relatively indirectly related to the Pangalengan deformation zone namely in around Mount Malabar, Mount Wayang and Mount Windu. Calculation results are holistically SGW Pangalengan specifically for SGW 2231 and SGW 2232, taking into account many aspects, there are 7 assessment factors (Economy of Excavation Materials, Economic Spatial Region, Regional Stability, Natural Disasters, Pollution, Reclamation and Socio-Economic -Culture-Law) with 34 sub-factors of assessment obtained the results of the assessment with the highest weighting.

The weighting value for SGW 2231 if geological and disaster based regional development is carried out is 290 (41.64%) of the total value of 700, while SGW 2232 is 360 (51.45%) of the total value of 700. The understanding is that development will be better than with current conditions and developments, which must be considered namely the state of the region and the surrounding environment, especially those with negative potential that must be sought to be a positive potential in order to be able to support geological and disaster-based regional development plans. In addition, a matrix of holistic regional development is recalculated by adding geothermal potential parameters that are not only natural resources but also become tourist destinations so as to increase the economic added value of Pangalengan. The results of the holistic matrix calculation of the direction of regional development with the elaboration of economic data were obtained 301 and 441.5 or 63%. The presence of geothermal resources in Pangalengan has become another economic driving factor (multiplayer effect), which has had a positive impact on development in Pangalengan.

4. Conclusion

- Based on the results of the activities carried out, the location of potential is principally located in hilly and mountainous areas that can be used as plantations, agriculture, tourist areas, even settlements;
The potential of mineral / rock and geothermal resources in Pangalengan District has considerable potential to be a major factor in regional development in addition to supporting factors;

The weighting value for SGW 2322 if regional development is based on geothermal energy resources and other land carrying capacity is 301 (42.9%) of the total value of 700, while SGW 1322 is 441.5 (63.1%) of the total value of 700.

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