Potentials and constraints of the spatial and regional development perspective using regional genetic methods

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Abstract. Regional development is a strategy of utilizing and combining internal factors (strengths and weaknesses) and external (opportunities and challenges) that exist as potentials and opportunities that can be utilized to increase the region's production of goods and services that are a function of the needs both internally and externally. These internal factors are in the form of natural resources, human resources and technological resources, while external factors can be opportunities and threats that arise along with their interactions with other regions. The comprehensive spatial planning and development of the region certainly needs the support of information on the potential and constraints of the region with its own genetic background as a whole, meaning that all complete information about all aspects relevant to the spatial needs are met. Information for spatial planning includes potential including physical-mechanical properties of various types of rock masses. Leles is one of the sub-districts in Garut regency which has an area of 6.5 million hectares with a large potential of mining excavation. Regional Spatial Planning Arrangement based on the potential of mineral excavation ensures mining plans in the area do not kill other potentials and shows conformity to the plan long-term. Mountain sand eruption excavated as an industrial commodity is the biggest potential in the Leles region. The existing constraints are related to earthquakes and volcanic eruptions.

1. Introduction
The technology prior to the regional Genetic Unit's invention on Spatial Planning experiences many difficulties, obstacles, or shortcomings in making the best decisions for regional development policies, because it is not supported by the presentation of holistic information about these areas as a system, which precisely determines the right policies for the quality and benefits of the plan were achieved, but they were not met. This result is due to the process of understanding the prospective area of development planning that is not supported by a comprehensive (comprehensive) approach that includes the characteristics, potential, and constraints of the region, as a result or product of the process of formation or event of the region concerned (regional genetics).

After the implementation of spatial planning, it turned out that there were many regional behaviors that did not support the original development plan, but instead showed a mismatch of the characteristics that were known to be very unexpected. Land behavior actually makes a variety of infrastructure buildings damaged, even dangerous, for example highways that have collapsed, shifted, or landslides, cities hit by earthquakes and tsunamis, cities that are sometimes hit by floods, water unavailability, etc., which often escapes from previous calculations, because information about supporting (potential) and
inhibiting factors (constraints) in the region was not explored beforehand through integrated comprehensive studies.

Garut Regency in accordance with the Regional Spatial Plan there are many discrepancies and background conditions, the regional genetic approach as a paradigm of a comprehensive understanding of the characteristics, potential, and constraints of the region, with a variety of response behaviors for development both on the surface, in the earth (subsurface) and on the surface is the beginning of this invention, which is very fundamental in a holistic study. This invention strongly supports the implementation of Law No. 26 of 2007 concerning Spatial Planning, and Regional Regulation No. 29 Year 2011 Garut Regency RTRW 2011-2031 [1].

2. Method

2.1. Regional genetic unit

The genetic typology (classification) of this region is also supported by the fact that shows that morphology (M) is a function of rock (R), process (P), and time (t), or M = f (R, P, t). Morphology, rock, and deformation as a process, and denudation as well as the process of forming morphology in a period of time, all of which point to the three genetic elements of the region mentioned earlier.

More clearly it can be stated, that the product of the process of sedimentation (deposition), freezing of magma, and changes due to pressure and temperature of the rock mass before are various sedimentary rocks, frozen, and metamorphic, then the product of the tectonic process is deformation, and the product of the denudation process is morphology. Three elements of the product of the geological process, namely rocks, deformation, and morphology, are very basic as determinants of regional formation.

Table 2 shows the various possibilities for the formation of Regional Genetic Unit (RGU) from the combination of the three genetic elements of the region in Indonesia. Each digit number makes it easier to recognize the genetic origins of each RGU (as a system with three elements or its constituent components), which are homogeneous, characteristic, potential, and its own constraints, which are different from other RGU. This systemic approach is the basis for giving value (valuation) to the relevant system itself, which is different or explicitly separated from other systems. This method has the advantage of a biased previous approach, because the regional unit classes without clear typology, but the results of overlapping techniques (superimposed) of thematic maps that are not appropriate.

2.2. RGW systemic-holistic matrix for regional development

Valuation and Meaning of Value RGU has 7 (seven) factors with the weight of each contribution to valuation in percent (%). In addition, factors relevant to the development of integrated mineral and territorial resources, namely, The economics of minerals (20% contribution), Economic spatial area (20%), Physical stability of the region, Threats of risk / natural disasters, The level of environmental pollution, Reclamation, and, Social, economic, cultural, and legal (20%).

Factors 3 through 6 are environmental factors. The contribution of these seven factors in supporting the ability to develop the smallest regional unit or RGU is intended as a concern for environmentally friendly development, namely as follows: The 1st factor is 20%, Second factor is 20%, Factors 3, 4, 5, and 6 of 10% each, so that these environmental factors contribute 40% to the developing ability of the SGW concerned, and The 7th factor contributes 20%.

Thus, in fact the development scenario with this method is really very environmentally friendly, because of the proportion or comparison between the attention of developing mineral resources: Territorial: Environment: Socio-Cultural and Community = 1: 1: 2: 1. This is a community-friendly approach many, with a policy basis namely the development of Mineral Resources: Territorial: Communities = 1: 1: 1. Therefore this new paradigm in the development of integrated territorial mineral resources is clearly regional-based and environment-oriented and the welfare of the community at large.
3. Results
Valuation and Meaning of Value RGU has 7 (seven) factors with the weight of each contribution to valuation in percent (%). In addition, factors relevant to the development of integrated mineral and territorial resources, namely:

3.1. The economics of minerals (20% contribution)
The economics of excavated materials are divided into 6 basic assessments, namely reserve, quality, accessibility, market, top soil storage, and level of difficulty of top soil. Based on the map of the distribution of minerals, Figure 1 shows that there are 6 mining quarry locations located in the study area which include sand, limestone and river stones. The excavation of the excavated material comes from the base thunder and lava mountain rocks composed of basalt andesite originating from old volcanoes so that the quality of the excavated material at the study site is very good and based on geological maps scale 1: 100,000 pieces of Arjawinangun, Bandung and Garut compiled by Ratman & Gafor being a geological map of 1: 500,000 scale, the arrangement and sequence of the constituent rocks in the northern Garut Regency are dominated by volcanic material associated with volcanic eruptions, including the eruption of G. Cikuray, G. Papandayan and G. Guntur. The eruption took place sporadically several times during the Quaternary period (2 million years ago), resulting in volcanic material in the form of breccia, lava, lava and tuff containing quartz and stacks piled on the inter-mountain plains in Garut. The amount of volume and area of each reserve in research locations with the backup calculation method using the contour method in the table 1 below,

| Type of Minerals        | Volume          | Areas   |
|------------------------|-----------------|---------|
| River Sand (South Side) | 847.442.033,763 m³ | 1235,753 Ha |
| Sandstone (North Side) | 791.492.810,109 m³ | 1803,978 Ha |
| Sandstone (South Side) | 100.640.170,078 m³ | 272,1 Ha     |

From the map of the distribution of excavated materials, it can be seen that the accessibility of research sites can be said to be quite supportive due to the large number of access roads. Mining quarrying materials are generally available so that access is easy to exploit. On the other hand, based on market demand, the excavation material in the research location has a favorable prospect, mainly intended as construction material. The quarry material market in the study area is in great demand from outside the region, generally big cities in West Java, the mineral composition of the erupted mineral material is very strong to be used as building material.

Research location related to overburden storage for shoot top soil storage is relatively easy, an area that has varied topography is very advantageous to use for temporary storage. The type of quarry material located in the research location is eroded rock so the difficulty of processing can be fairly easy because the type of rock is not too hard so it can use simple technology.
3.2. Economic spatial area (20%)

The economics of the spatial area is divided into seven basic assessments, namely the slope, the elevation of the highway, the foundation, the availability of water, the availability of building materials, and the area of waste disposal. Geomorphological and geological conditions are the parameters of the triggers for ground motion. Geomorphological aspects such as slope play an active role in controlling the occurrence of soil movement. The greater the slope, the greater the driving force of the land mass or the rock making up the slope. However, it should be noted that not all sloping land is always vulnerable to movement. It really depends on the geological conditions, such as the type of structure, and the composition of the soil or rocks making up the slope. Van Zuidam classifies the slope into 7 (table 2) [2].

Table 2. Classifies the slope.

| Percent     | Degree  | Category               |
|-------------|---------|------------------------|
| 0% - 2%     | 0°-2°   | flat slope             |
| 2% - 7%     | 2°-4°   | slope slope            |
| 7% - 15%    | 4°-8°   | slope slope            |
| 15% - 30%   | 8°-16°  | the slope is rather steep |
| 30% - 70%   | 16°-35° | steep slope            |
| 70% - 140%  | 35°-55° | The slope is very steep |
| > 140%      | > 55°   | steep slope            |

Areas with slope between 0% to 15% will be stable against the possibility of landslides, whereas above 15% the potential for landslides in earthquake prone areas will be even greater. Based on the slope map and van dzuidam classification in Figure 2, it can be seen that the study site has a slope from flat to steep according, which is where in the northwest, north and northeast are relatively flat which has a slope value of 0% - 2%, for the eastern part is steep 30% - 70%, the southern part is steep 30% - 70%, southwest is quite steep 15% - 30% and steep 30% - 70% and the western part is steep 30% - 70%. The area around the study area in the southeast to northwest is a mountainous area with a slope of steep to steep slopes, the north to the east is the sloping terrain to the lowlands [2].

The elevation of the highway in Figure 2 can be seen that the research location has a highway elevation from flat to steep. This is in accordance with the classification of van dzuidam [2]. In addition, from the map of water availability, Figure 5.4, it can be seen that the research location has the availability of water coming from springs in the main catchment area inside and outside the study site, one of which is the cicapar springs in the research location which has never been receded during the dry season and irrigated the rice fields down to the Cangkuang village. However, at the research location there is a Qy
rock formation which is a young volcanic rock formation with basalt andesite rocks having a low porosity so that the area has sufficient water availability. At the research site, it was found that the availability of mining materials which are relatively large in number and easily found because there are surfaces such as sand, limestone and river stone which are the main ingredients of building material needs for building construction. The waste disposal area is seen based on the type of rock that has poor permeability so that it will not pollute the surrounding environment due to mining activities that produce hazardous waste if something unexpected happens, if viewed from the regional geological map and water availability, the research area is a water catchment area in generally so that it is not a suitable area for waste disposal.

3.3. Regional stability
The stability of the area is divided into 3 basic assessments namely natural slopes, land surface, and earthquake shocks. Based on the slope map, Figure 2 shows that the study location has a slope from stable to unstable. This is in accordance with the classification of van dzuidam [2], namely in the northwest, north and northeast are relatively stable with a slope value of 0% - 2%, for the eastern part is classified as unstable 30% - 70%, the southern part is classified as not stable 30% - 70%, southwest classified as less stable 15% - 30% and unstable 30% - 70% and the western part is classified as unstable 30% - 70%. Land subsidence at the ground surface is strongly influenced by tectonic activity and the constituent rocks on the surface, there is a normal fault in the study area that extends to the outside of the study area, allowing land subsidence to occur slowly, in addition to that earthquake shocks in the study area in the area around the fault will form rocks the fragmented is getting more and more solid (figure 3).

Figure 2. Slope and topographic map.
3.4. Risk / natural disaster threats

Based on the geological map compiled by Alzwar et al. the geological structure found in the study area was a fault. Faults that are found are normal faults and sliding faults, generally directed southwest-northeast direction. This fault involved Tertiary and Quaternary rocks, so it was mentioned that the fault was a young fault. From the direction pattern it is estimated that the tectonic force originates from the south-north distribution and is thought to occur at least Late Oligocene-Early Miocene. Then it can be presumed that maybe some of these faults were the activation of the old faults occurring before. Tectonics that occurred in the mapping area in the Tertiary Age were greatly influenced by the subduction of the Indian Ocean Plate under the Southeast Asian Plate. The subduction that occurs in the Late / Early / Middle Oligocene produces andesite volcanic activity, accompanied by carbonate sedimentation in shallow seas. Sedimentation occurs on slopes under the sea, magmatic activity ends with the breakthrough of quartz diorite at the end of the Middle Miocene resulting in propagation of the Jampang Formation. After folding, lifting and erosion occurs, magmatic activities result in volcanic eruptions. At Plio Plistocene volcanic activity resumed and was followed by a series of Early Quaternary volcanic activities which are now widespread in the central and western parts of the study area (Figure 3). Research locations based on the above geological information are very vulnerable to the threat of natural disasters caused by volcanic eruptions originating from thunder volcanoes, earthquakes and tectonic slides caused by active faults formed millions of years ago and up to now there is still movement until outside the research area. Expansion soils occur in clay material while the study area is the area of volcanic eruption so that no material is found. In the eastern part of the research area, there are many clay material deposits. Flooding occurs in the study area every rainy season with high intensity on the main route that connects Bandung - Garut. The alleged flooding was caused by sand mining activities not far from the location of the road and the mine opening area which is relatively large and the construction of industrial factories in the area which is considered to be a conservation area worsened the catchment of rainwater in the study area. Floods that occur always carry loose material in the form of sand so that the risk of landslides due to erosion by water becomes greater.

Figure 3. Natural disaster map.
3.5. Environmental pollution is divided
Environmental pollution is divided into 4 basic assessments which are related to water, soil, air, and land use in the study area. Groundwater and air pollution in research areas is relatively low, mining that has been carried out in research areas generally uses conventional mechanical devices without the use of chemicals and industrial minerals which do not need further processing. B3 waste generated by mechanical devices is handled directly by third parties for reprocessing.

Land use in Figure 4 is generally non-agricultural dry land and lading agriculture, a centralized settlement in the eastern part close to the provincial main road access. The impact of mining on land use is insignificant and is classified as safe.

![Figure 4. Land use map.](image)

3.6. Reclamation
Reclamation of the study area is divided into three basic assessments, namely pile, cover vegetation, and aesthetics. Reclamation of mining areas to be replanted requires shoot soils as plant nutrients to grow back, research areas are easily found in shoots and are easily re-planted.

The aesthetics produced due to the mining of sand mining materials, especially those located near the main roads of the province, ruined the mountain scenery in the area in the form of trees and shrubs. Everyone who wants to visit the arrowroot area through Leles will definitely see mining activities directly on the mountain slopes. Some excavated materials which have been carried out also indirectly mining does not have too much impact on the panorama and scenery (Figure 5).
3.7. Social, economic, cultural and law
Social, economic, cultural, and legal aspects are divided into five basic assessments, namely community perception, community empowerment, human resource development, transportation, and tourism.

The public perception of mining activities in Leles sub-district has different perceptions. In general, people who are close to the mining area complain about access to transportation using their public roads during operational activities. Some mines do use public road access to bring their minerals to consumers. Floods that often occur when the intensity of rain is high in the research area, the community considers that the impact of mining activities will reduce the area of previous water catchment. Some communities that have businesses related to mining activities strongly support the existence of these activities.

Community empowerment in the Leles area is generally carried out by the central government with a village funding program to develop tourism potential of the Cangkuang temple. Cicapar spring is projected as a potential that can be utilized as bottled drinking water which can increase employment opportunities. At present the community works as laborers, farmers, and entrepreneurs. Human Resources Improvement continues to be carried out by the regional government and supported by the provincial government through counseling through UKM and increasing the skills to support and support industrial activities. One of the village funds obtained by the local government is reused by improving the access road to the existing tourism sites. Several access roads to the mining industry and other industries are the responsibility of every company as part of the responsibilities and contributions to the government and surrounding communities.

The results of the holistic systematic matrix, Leles District area is feasible to be developed with several unavoidable obstacles related to geological conditions. The initial condition has a value of 146 in the research area and 146.5 outside the area if it is developed to 174.5 in the area and 162 outside the research area. The potential in terms of economic aspects of minerals and spatial planning is very helpful in creating business and employment opportunities for the surrounding community and increasing income the regional aspects of reclamation and environmental pollution are considered to have minimal impact. Existing mining materials do not need to be processed by chemical processes or that produce hazardous waste, the process is done by simply reducing the size and washing simply. Land use is more productive and can be made more useful for the community after mining is completed for their land to plant or expand residential areas.

Obstacles in the Leles sub-district are related to geological conditions, the presence of faults in the region cannot be denied will eventually lead to earthquakes, volcanic activity generated by Mount Guntur at any time will emit magma from within the earth, and morphological conditions in the form of
hills are very vulnerable to the presence of erosion and landslides even though the rocks from which the slope is formed will be very influential depending on the level of weathering in the area.

4. Conclusion
Research activities carried out through analysis of geological factors with scoring methods based on Regional Genetic Unit (RGU), holistic valuation analysis of RGU through scoring and weighting methods which include fundamental factors in regional development namely morphology, rocks and geological structures as well as determination of the priority scale of integrated mining area development in the Leles District Garut Regency as follows Regional genetic units based on geological phenomena that occur in the study area based on geological maps of scale 1: 100,000 pieces of Arjawinangun, Bandung and Garut compiled by Ratman & Gafor (1998) into geological maps of 1: 500,000 scale, arrangement and sequence of rocks in the region the study was dominated by volcanic material associated with volcanic eruptions, including the eruption of G. Cikuray, G. Papandayan and G. Guntur. The eruption took place sporadically several times during the Quaternary period (2 million years ago), resulting in volcanic material in the form of breccia, lava, lava and tuff containing quartz and stacks piled on the inter-mountain plains in Garut. Characteristics of the study area is an area dominated by volcanic material associated with volcanic eruptions / eruptions. There are normal faults and sliding faults, generally directed southwest-northeast direction. This fault involved Tertiary and Quaternary rocks, so it was mentioned that the fault was a young fault. The potential of mining excavated materials in the form of volcanic eruption material has been exposed in many areas of research and some of them have been carried out mining. The volcanic density in the southern part causes the carrying capacity of the soil and the availability of groundwater is very good and very supportive. Cangkuang temple tourism object in the eastern part is very much influenced by the existence and conservation of nature which must be maintained so as not to change the initial hue from in accordance with the spatial plan of the Leles District area. The fault that was formed in the research area besides bringing benefits to the surrounding community by utilizing excavated materials as the main material of infrastructure also brought negative impacts in the form of earthquakes. The result of the eruption of Mount Guntur in addition to making the soil around fertile slopes also has the potential to reactivate at any time to issue magma again. Distribution of quarrying materials There are 6 mining quarry locations located in the study area which include sand, limestone and river stone material which have the potential to develop the Leles sub-district area to be more developed. The result of the Holistic Matrix shows that the Leles District area is feasible to be developed as an area that has greater potential compared to the existing constraints.

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