Understanding the Characteristics of “Ekistics” Elements in Determining Factors of Urban Settlement Growth

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Abstract. The development of urban settlements causes fast flow of urbanization. These condition leads to the growth of uncontrolled settlements which indicates Urban Sprawl Phenomenon. The phenomenon of urban sprawl begins with the need of the community to obtain better living standard, especially for residential functions. That residential function associated with urban sprawl is driven by settlement growth in certain locations (sporadic growth), and it is difficult to control (the impacts on the decline in environmental quality due to changes in certain land functions). By looking at these conditions, the understanding of the phenomenon of settlement growth must be conducted through the right approach. The approach views from an ecological element by examining a settlement in one large frame, total settlement patterns with a two-way classification scheme [1]. This research was conducted to understand the condition of settlement growth in order to find out the existing growth factors. The research area is located in the urban Situbondo with growth characteristics influenced by coastal and agriculture condition becoming the trigger of growth. Based on the results of the AHP calculation in Situbondo Regency, it is known that the most influential factor on settlement growth is natural factors with an assessment value of 0.243. Based on the morphological approach, the influence of natural factors shaping the pattern of ribbon settlement growth a small observation scale and the octopus pattern in the big range scale observation

Keyword : Ekistic, Urban Sprawl, Urban Settlement

1. Introduction
The growth of urban settlements due to the high flow of urbanization often leads to uncontrolled growth of urban settlements. The uncontrolled growth of urban settlements becomes an indication of the phenomenon of urban sprawl [1]. This phenomenon begins with the need for the community to occupy empty space, especially for residential functions. The occurrence of residential function associated with urban sprawl is driven by the growth of settlements in certain locations (sporadic growth), and it is generally uncontrolled. The growth of settlements with the characteristics of urban sprawl growth is not accompanied by the provision of basic infrastructures; thus, it often creates urban problems (problems of waste, sanitation, drainage, etc.) [2].

As an example of the phenomenon of urban sprawl is development of settlements in the metropolitan area of Indonesia, such as the Jabodetabek and Bandung which tend to lead to suburban areas. On the suburban areas of Jabodetabek, especially in Tangerang Regency, there are many large-
scale housing developers. In total approximately 60 developers who have assets of housing development. Bandung suburbs such as Parongpong, Lembang, Cimenyan, Cilengkrang, Cileunyi, Bojongsoang, Dayeuhkolot, Margahayu and Margasih also needed 51 formal housing developments with 93 locations and 2,382.13 hectares of conversion [1]. As a result of developing suburban areas there have been many city, physical, economic and social problems such as congestion due to inefficient mobility leading to workplaces, transportation, land, air, reduced suburban land for agriculture, land conversion, emergence of slums, etc. [3].

Based on the location of the settlements, the most common location of the settlements there is on the path to human movement and street. However, if viewed based on the characteristics of each sub-district, the location of these settlements has certain characteristics. For example Situbondo, Panji, and Panarukan Sub districts in addition to following the district road lane, settlement growth occurs following the knots of trade and service activities. For Mangaran sub-districts, the location of settlements tends to spread because of the attraction of natural resources in the form of fertile soil potential and potential marine resources related to agricultural activities of the population. Housing tends to develop to the north, which is located in the coastal area of Situbondo Regency. Growth in coastal areas has characteristics which become dense and slum areas. Therefore, if there is no growth control of government regulation, the development of settlements will lead to Urban Sprawl.

By examining these background conditions, an understanding of the phenomenon of settlement growth must be established. The elemental approach to understand the characteristics of residential growth is one of the suitable approaches. Ekistics views a settlement in one large frame, total settlements patterns with a two-way classification scheme [4]. The first classification relates to settlement hierarchies based on scale. The second classification relates to elements of settlements, namely nature, arthropods, society, shells, and networks [5]. This research was conducted to comprehend the condition of settlement growth in order to find out the occurring growth factors. The research area is situated in urban Situbondo with its growth characteristics influenced by coastal presence. This research aims to understand the characteristics of ecological elements by comparing the direction of spatial settlement growth. There are two objectives to be achieved: (1) Understanding settlement growth factors based on the characteristics of the forming element (the approach); and (2) Analyzing the spatial pattern of settlement development. This study employs quantitative exploration method which is supported by qualitative methods. The stages of analysis carried out in this study include: (1) Analyzing the factors influencing the development of settlements; and (2) Analyzing the periodic trend with periodic analysis of regional image. Factors which influence the development of settlements are analyzed using the AHP technique to see the weight of the influence of each variable forming a settlement on the existing development of settlements.

1.1 Characteristics of Settlements
An understanding of the characteristics of settlements in this study broadly refers to several sources, namely Turner related to the characteristics of settlements based on the nature and Doxiadis related to settlement characteristics seen from the forming elements and units.

According to Turner (1976) [6] in his book Housing By People, there are 2 types of settlements based on their nature, namely formal and informal settlements. Formal settlements are settlements built by the formal sector referring to housing development which is built on several development regulations and through legal procedures. On the other hand, informal settlements are built by the informal sector referring to development without regulation and without legal procedures.

Based on its constituent elements, settlements consist of humans, their culture and the place where humans live (the container) which includes natural and artificial elements (home and networks) [7]. All of these forming elements combine to form a residential unit scale that is divided into groups based on the scale from the smallest to the largest unit. Settlement unit groups based on the theory by Doxiadis are:

- Non-Permanent Settlements (Temporary Human Settlement)
- Villages
1.2 Settlement Growth

Growth of settlements can be understood by making observations on components from their forming aspects. Settlements are part of sustainable development that has three forming pillars namely Economic, Social and Environmental [7]. Balanced interaction between these pillars in the development of settlements will lead to sustainable development. The concept of sustainable settlement is a strong global concept that is expressed and actualized locally. Sustainable settlements must have a strong economy, a harmonious environment, equal and full levels of justice, high levels of community participation, and well-controlled energy conservation.

On the other hand according to Doxiadis (1976) [8], settlements can be analogous to living things that have body parts as formers. When one part of the body does not function properly it will affect the other part. Physically, for example with regard to buildings and the availability of infrastructure, if these physical parts are not fulfill properly, the quality of the environment formed will also not be good and will lead to a decline in the quality of life of the community.

To find out the factors that influence the growth of settlements, two major theories regarding sustainable development and characteristics of the elements forming settlements are closely related. If it is spelled out between the pillars of sustainable development and elements forming settlements, the economic and social aspects are related to human and community elements (the content) while the environment is related to natural elements, housing / housing conditions, and networks (the container). The results of balanced interaction complement each other between the elements forming settlements are adjusted to the pillars of sustainable development will form a sustainable and ideal settlement with good aspects, both physically and non-physically.

1.3 Ekistic

Human settlement is a place that is inhabited by humans that includes content elements and container elements. Elements of ekistics are divided into five parts, namely nature (human), human (antrophos), society (society), reflection (shells) and networks (networks)[8]. Ekistics theory is a theory to explain settlement (human settlement) developed by doxiadis.

a. Natural
Theoretically, it can be said that settlements are part of nature. The research was carried out by looking at natural elements related to physical appearance of the earth, availability and ability of the environment.

b. Human
Humans initially started by changing nature by building huts. After that, began to have expertise in the agricultural revolution which subsequently created various types of houses. In research, the human element examined is related to the conditions, numbers, and relationships between individuals.

c. Community
This study examines the elements of society through sub-variables in the form of social conditions that exist in the scope of settlements (such as livelihoods, income, education level, economic conditions and cultural characteristics that exist in the community in the scope of the research room)

d. Protection
Protection is divided into several categories, namely education, health, administration, security, industry, storage and others [10].
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The choice of a comfortable dwelling will take into account the availability of the network, especially the transportation network that contributes to the access of occupancy to centers of activities and clean water networks as a means of basic human needs.

2. Methodology

2.1 Research Variable

The research variables used in this study are residential building elements that describe the characteristics of settlements comprehensively. This variable is obtained from a literature review related to theories about settlements.

Table 1 Research Variable

| INDICATORS                  | VARIABLES | SUB VARIABLES                                                                 |
|-----------------------------|-----------|-------------------------------------------------------------------------------|
| Physical                    | Nature    | 1. Availability of natural resources                                           |
|                             |           | 2. Land capability                                                            |
|                             | Housing   | 1. Type of housing (permanent or non-permanent)                                |
|                             |           | 2. Housing model                                                               |
|                             |           | 3. Location of settlement                                                      |
|                             |           | 4. Density level of residential area                                           |
|                             |           | 5. Housing facilities (completeness and distribution)                          |
|                             |           | 6. Land use                                                                    |
|                             | Settlement infrastructure and facilities | 1. Clean water infrastructure                                               |
|                             |           | 2. Electricity infrastructure                                                  |
|                             |           | 3. Road infrastructure                                                         |
|                             |           | 4. Waste and waste processing infrastructure                                   |
|                             |           | 5. Telecommunications infrastructure                                           |
| Non physical                | Social    | 1. population                                                                  |
|                             |           | 2. Livelihoods                                                                 |
|                             |           | 3. Education level                                                             |
|                             |           | 4. Existence of social institutions                                            |
|                             |           | 5. Human growth                                                                |
|                             | Economic  | 1. Level income distribution                                                   |
|                             |           | 2. Existence of economic institutions                                          |
|                             | Culture   | 1. Habits                                                                      |
|                             |           | 2. Activity                                                                    |

2.2 Source of data and information

1. Determination of the Analysis Unit

The unit of analysis in this study is urban residential environmental units which are recently developed in the urban area of Situbondo Regency.

2. Determination of Observation Units:

The observation unit of this study is a variable that indicates the characteristics of settlements based on settlement elements in residential areas.

3. Determination of Information Units:

The information unit of this study is government stakeholders in residential areas (on a district, sub-district and village scale) as influential and understanding parties to the conditions of settlement development in Situbondo and also the developers (formal sector) as formal housing providers who contribute to the development of settlements.

2.3 Stages of Analysis

Table 2 Stage of Analysis
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| No. | The Analysis Stage | Data Input | Analysis Tools | Output |
|-----|-------------------|------------|----------------|--------|
| 1.  | Mapping the conditions of development of settlements | Periodic image area | Analysis of regional images with GIS devices | Knowing the direction of trends in residential growth |
| 2.  | Identification of factors causing settlement growth | Variables were obtained from literature review | AHP Analysis supported by stakeholder descriptions | Knowing the factors that cause the growth of settlements |

- **Stage 1: Mapping the conditions of development of settlements**
  Mapping the conditions of development of settlements is done by analyzing the regional image to see the form of development and direction of settlement growth. This is done by comparing the built up area and not being built in each year period. The development of periodically built and non-built areas can be known with the help of ArcGIS software on remote sensing tools.

- **Stage 2. Identification of factors causing settlement growth**
  The analysis technique used at this stage is Analytical Hierarchy Process (AHP). AHP is used to determine the magnitude of the priority of each criteria variable that affects the growth of settlements based on the studies that have been conducted. In process, each of the indicated variables has an influence on the development of settlements in the study area compared to each other and then assessed by respondents (expert stakeholders who understand the condition of the research area).

- **AHP analysis stages:**
  1. Compilation of hierarchies
     Hierarchy preparation is done by elaborating the influence of each variable that has been determined on the growth of settlements. This hierarchy is based on understanding according to the study of the theory that the growth of settlements is influenced by the characteristics of settlements and the aspects of sustainable development that are described by their constituent elements.
  2. Distribution of questionnaires
     Questionnaire that contains a comparison between the determinants that influence the growth of settlements which will later be used as a reference in controlling the development of settlements.
  3. Processing with Pairwise Comparisons)
     The results of the comparison questionnaire between the criteria were processed with pairwise matrices (Pairwise Comparisons), where processing with this paired matrix to find out the comparison values of the importance of a criterion relative to other criteria which are then processed to determine relative rank / priority of all criteria.
  4. Comparison to get priority (Normality Test)
  5. Consistency Test
  6. Merging Respondents' Opinions
The output of the AHP analysis is to know the weight of the influence of each variable and sub-variables forming the settlements on the phenomenon of residential growth in the research area. The description of output is supported by an explanation of the results in deep determined stakeholder interviews into a sample. The results of in deep interview are in the form of understanding the phenomenon of settlement areas from the point of view of several related stakeholders.

3. Result and Discussion
Based on the results of the AHP calculation in Situbondo Regency, it is identified that the most influential factor on settlement growth is natural factor with an assessment value of 0.243. The condition of natural resource presents a significant effect because of the urban location of Situbondo which is affected by coastal areas. The tendency of body settlement growth takes form of a ribbon settlement pattern, extending along the road close to sea access. The condition of the pattern is related to human activities in Situbondo which are related to coastal areas. This condition is corroborated by the results of the assessment of the second most influential factor on residential growth, namely community factors (eco-culture) with a value of 0.238. The highest variable is in the livelihood variable.

![Figure 1 Hierarchical structure of criteria in AHP (factors that influence the development of settlements based on forming elements)](image)

![Figure 2 Results of AHP Calculation](image)
If seen in a spatial pattern, the growth of settlements in the urban area of Situbondo can be divided into two classification zones, the central zone of the urban center growing extensively from east to west and the northern zone approaching the coastal areas growing from 2003 in Tanjung Chinatown.

**Figure 3** Growth Point from 1997 to 2005

**Figure 4** Growth Point from 2009 to 2015

**Figure 5** Growth Point from 1997 to 2018
The settlement growth with a ribbon settlement pattern, extending along the road close to sea access. The condition of the pattern is related to human activities in Situbondo which are related to coastal areas.

![Image of ribbon and octopus patterns]

**Figure 6 Octopus Pattern**

The development of settlements at the beginning of the research year in 1997 showed that there were concentrations of settlements in the city center, namely Situbondo sub-District, Panji sub-District with horizontal forms from west to east following arterial roads. But in the period 2009 to 2012 the development of settlements began to spread southward sporadically, but the highest density concentrations remained in the city center. In the physical organization of space, the development of settlements forms the octopus pattern (Octopus / Star Shape Cities) where in this octopus pattern there are several dominant transportation routes.

4. **Conclusion**

Based on the results of the AHP calculation in Situbondo Regency, it can be seen that the most spatial influential factor in the development of settlements in Situbondo Regency is a natural factor with an assessment value of 0.243. Natural factors consisting of natural conditions and availability of natural resources are important factors in the growth of settlements in Situbondo Regency. This physical factor greatly affects the development of residence in Situbondo because the existence of houses and settlements will not be separated from the conditions of land and natural resources from the location occupied. These natural factors will later provide a pattern for expanding settlements in Situbondo Regency with a value of 0.238. Moreover, the community factors consist of community quality, income distribution, livelihoods and culture.

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