Development Of The Bittuang District Area In Tana Toraja District With A Transportation Network System Approach

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Abstract

Regency Tana Toraja is Wrong One regency in Sulawesi South. Development Regency Tana Toraja need area or buffer area so that development is not concentrated in the district capital that is in Makale. City Bittuang more potential For developed become city satellite as city buffer city Makale than other sub-districts. Study This aim to analyze the concept satellite city in development region Bittuang District in the Regency Tana Toraja with infrastructure approach transportation network system . Analyzing the synergy between Bittuang City as a Satellite City and Makale City as the main city in terms of transportation network system infrastructure . The application of the Satellite City concept in the development of the Bittuang District area in Tana Toraja Regency using a transportation network system approach has been proven to have a significant impact. The results of statistical analysis show that the Satellite City Concept has a very strong correlation with various variables that influence the development of this region, including transportation, infrastructure, housing, social life, sustainable development, and investment partnerships. Therefore, the application of the Satellite City concept in the development of Bittuang District is very relevant, especially in the context of transportation network system infrastructure. This concept not only provides an alternative to reduce population pressure in key areas but also encourages improvements in transportation infrastructure that supports population mobility and economic growth. Implementing a network system for transportation planning in Bittuang District as a Satellite City with Makale City as the main city is an important step in optimizing connectivity between the two cities. The results of the analysis show that the synergy between these two cities can be improved through partnership efforts and investment in integrated transportation infrastructure. Good transportation network system infrastructure is very important to support population mobility, distribution of goods, and access to important services. Therefore, integrated transportation planning between Bittuang City and Makale City needs to be a priority in sustainable regional development efforts. Investments in improving roads, developing integrated public transportation, and utilizing modern technology to optimize traffic flow can be strategic steps to improve transportation network system infrastructure in this region.

Keywords: *Bittuang, Transportation Network, Satellite City, Tana Toraja.*

Introduction

Regency Tana Toraja is Wrong One regency in Sulawesi South. By astronomical, Regency Which capital city Makale This elongated from north to south between 2 0 -3 0

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South Latitude and stretches from west to east between 119 0 -120 0 BT . Tana Toraja Regency continues to develop well economically nor social. Development Regency Tana Toraja need area or buffer area so that development is not concentrated in the district capital that is in Makale. Condition so that development No centralized is with build infrastructure transportation Which connect to all over city And center production in all over region give chance And encourage development and increase regional economic growth. Regions new growth needs to be formed. Therefore, regional development is needed that is in Bittuang District.

City Bittuang more potential For developed become city satellite   as city buffer city Makale compared to other sub-districts, namely Remboon District , Saluputti District and Masanda District. Rembon sub-district and Saluputti sub-district are sub-district cities whose development is slightly stagnant because they are close to Makale city with geographical conditions that are less strategic to be used as development cities to support Makale City as a patent district city . For Masanda sub-district , economic growth is concentrated in Ponding City, which is located on the border of Tana Toraja Regency and Mamasa Regency, West Sulawesi , making it less possible for development as a buffer city for Makale City.

The following is a map of the road network that connects Bittuang City with Makale City, Tana Toraja Regency.
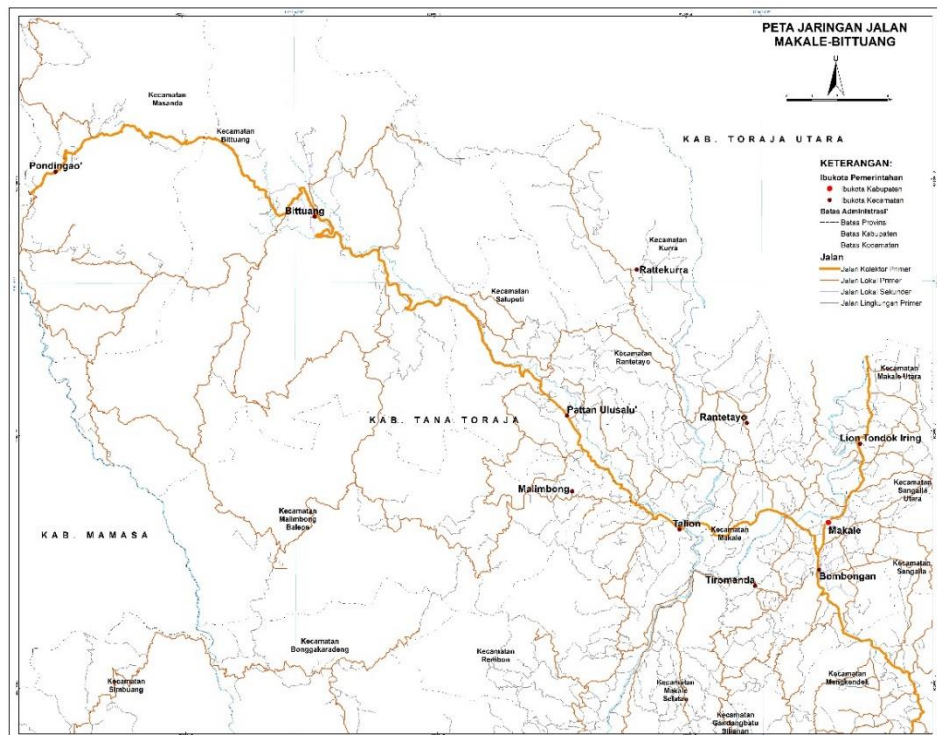

Figure 1. 1 Connectivity map of the Bittuang – Makale road

Bittuang is a sub-district and also the center of the Bittuang sub-district government, with its capital in the Bittuang sub-district. The distance from the sub-district capital to Makale is 36 km. Bittuang was chosen because in regional development, Bittuang is very strategic because transportation coverage with several surrounding areas is good so that with the development of the city of Bittuang it will have leverage for the development of the surrounding area. Bittuang is a growing city with a strategic geographical location and is a city located in the middle of the Tana Toraja - Mamasa axis road supported by topography that is very possible for city development . Location of the city Bittuang the as factor main Which make it potential become city satellite, Where results earth from

regency Mamasa (province Sulawesi west) come marketed in city Bittuang, furthermore need they in Mamasa brought from _ Tana Toraja (Bittuang).

Development planning in Bittuang District is a crucial step in optimizing its potential as a satellite city and ensuring that its development is in line with the vision of Tana Toraja Regency as a whole. In this context, planning must refer to the city spatial plan that has been prepared by the Tana Toraja Regency Government. This will ensure that physical development in the Bittuang Satellite City urban area is carried out strategically, avoiding unwanted overlaps, and promoting synergies between Bittuang and other areas in the district.

Regional development in Bittuang should be planned as well as possible perhaps to remain synergistic with other regions in Tana Toraja Regency or area other. Development physique area urban City Satellite Bittuang with still refers on plan system room city Which has arranged by Government Regency Tana Toraja. The more dynamic Tana Toraja, the more transportation infrastructure is needed that connects growth points with all areas. In this case, the city of Bittuang is one of the points growth that requires transportation infrastructure in the form of roads, bridges, etc. In this case, the regional government of Tana Toraja Regency continues do opening segment road new To use increase accessibility public.

Regional development in Bittuang must be an integral part of the overall regional development vision of Tana Toraja Regency. This means that development in Bittuang cannot be separated from planning and development of other areas around it. Synergy between regions is the key to achieving sustainable growth and having a positive impact on the economy, social and environment.

Until 2020, the length of district roads in the Regency area Tana Toraja reaches 1,180.3 km, although it is still dominated by roads paved with details of 667.15 km of roads in good condition, 145 km of roads in fair condition, 76.35 km road condition damaged And 291.8 km road in condition damaged heavy (Tana Toraja Regency, 2022). Existing road sections are poorly maintained due to a very limited budget which is indicated by the condition of the sections road the Lots in circumstances damaged. Government area should increase And look after network road Which Already There is For guard smoothness accessibility so that more push growth economy in frame enhancement welfare of its people.

Study Miri, G., B. Barus, and S. Soma (2014) revealed that network road in Regency Tana Toraja on generally has in accordance with There are potential areas, but most of them are in damaged condition (74%). Based on the regional development index, Makale and North Makale Districts is at on hierarchy I Which become center service; Subdistrict Gandasil, Mappak, Bonggakaradeng, Kurra, and Sangalla are in hierarchy II which are sub- center service; Subdistrict Simbuang, Rano, Rembon, Masanda, Bittuang, Saluputti, Malimbong Balepe, Makale South, Shortened South Sangalla, North Sangalla and Rantetayo are in hierarchy III which are regions hinterland . In development, Bittuang become subdistrict most develop moment This. In his research, Indrajaya (2020) conclude that   development of road network infrastructure in Bittuang is needed within the framework support accessibility area urban. Moment Which The same need done arrangement route transport general urban Which followed with development mode transport transportation.

According to Xinglei YAN & Hongwei LI (2015), the development of satellite cities must be based on correct ideological guidelines. This includes the concept of fourth generation satellite city development which introduces symbiosis to more effectively coordinate satellite cities with the parent city and strengthen cooperation between satellite cities so that they are on par with the parent city. In this era, satellite cities not only act as secondary entities, but are also able to extract more resources for their own growth. This will not only reduce the negative impact that satellite cities have on their environment,

but will also encourage the growth of both in a more balanced and harmonious way and accelerate their development significantly.

The more dynamic a city is, the more movement its people will have getting higher too. So it needs to be balanced with the speed of transportation facilities (mode) And its infrastructure. Generally problem Which arise is when mode Which chosen public is vehicle personal. Problem even So the more quaint, when growth vehicle personal No comparable with increase the length of the existing road. This is the background for policy makers began to reduce the use of private vehicles and improve facilities as well infrastructure public transport more adequate (Kadarisman, et al, 2015).

The development of land transportation is important in overcoming traffic congestion and other negative impacts caused by increased use of private vehicles. This involves measures such as expanding the road network, building efficient public transport systems, and developing infrastructure to support various modes of transport, such as bicycles and pedestrian walkways. In addition, efforts need to be made to promote the use of sustainable transportation such as mass transit, car sharing and walking to reduce pressure on roads.

Transportation facilities in Bittuang District are still not good. There are only 29.75 km of paved roads and 67.32 km of unpaved roads. Of the total existing roads, only 49.33 km of roads are in good condition (Bittuang District, 2019). This condition is clearly a problem for creating accessibility for people from surrounding sub-districts to get to the centers of social and economic activities in Bittuang City. These activity centers are characterized by markets, shopping centers, health centers, schools, tourist attractions and sports venues.
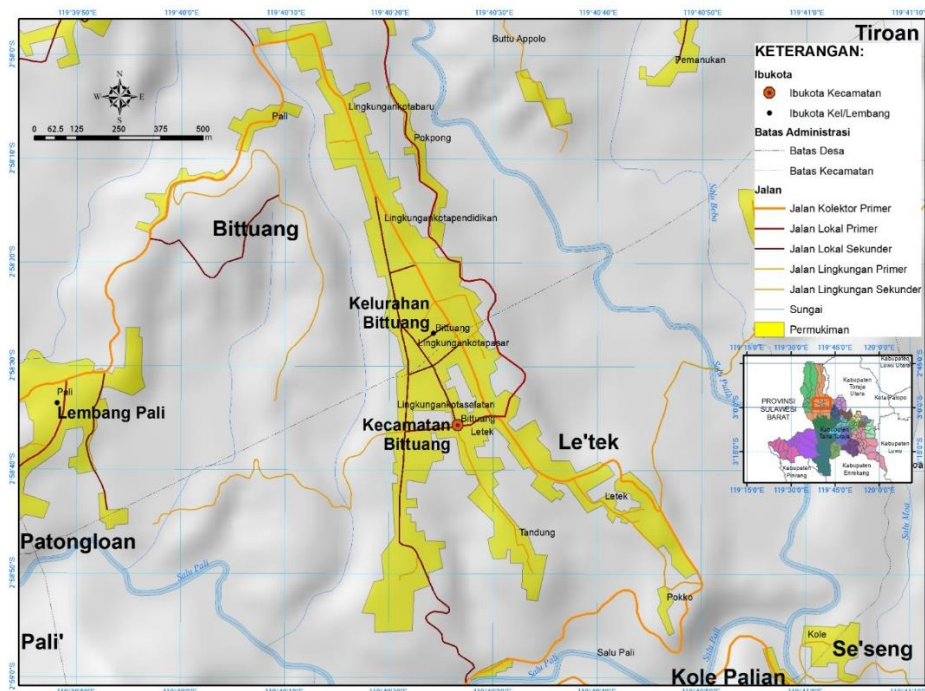
Figure 1.2. Bittuang City Map

There are 4 markets, 3 health centers, 5 tourist attractions and 2 football fields. The number of schools in Bittuang District consists of 17 elementary schools, 5 middle schools, 1 high school and 1 vocational school . Schools are the destination for mobility for teachers and students, as well as parents of students and business actors who support educational activities at schools. The various facilities in Bittuang are available to the population of Bittuang which reaches 15,222 people (Bittuang District, 2019). Physically,

the facilities and infrastructure of the city of Bittuang are still lacking, so there is a need to develop urban facilities to be able to support the growth of the urban center in Macale .

Satellite Cities are a concept in urban planning that advocates the development of small cities that function as supporters or complements to the main city. The main function of a satellite city is to relieve population density, traffic, and infrastructure pressure on the main city, with the satellite city having close economic, social, and transportation ties with the main city. Satellite city development must be carefully planned, pay attention to environmental impacts, and support sustainable regional growth. By designing good satellite cities, we can create a more balanced and orderly urban environment and help overcome the problem of over-urbanization in main cities.

The concept of urban area development is an effort to increase land capacity and synergize facilities and infrastructure infrastructure that ultimately forms urban characteristics . This research was conducted to develop a concept for developing a new city in Bittuang District as an alternative for regional planning. The application of the new city concept has an important meaning for future regional planning . A well-planned area will reduce the occurrence of space problems in the future and create harmony with the natural environment.

Literature Review

Satellite City

1.   Draft Satellite City

The concept of satellite cities was born in England. United States Scholar Taylor has officially put forward and used a clear concept of "satellite". City satellite is idea in arrangement metropolitan Which on basically refers on zone metropolitan Which more simple Which found rather near but generally free from region metropolitan Which more big (S Ananda Krishnan & KM Sujith, 2021). There are certain characteristics of satellite towns/cities, some in among them can be registered as:

1.   A simpler city is almost a large metropolis own government And economy nearest Which free from city big neighbor.

2.   There are many impacts of large cities near satellite cities. Urban area satellite own method life they Alone, Suite experience they Alone, and framework their free finances.

3.   Community city satellite each other relate with area urban Which more big but really free from big city in nearby.

4.   Area urban satellite it's not expansion from city big in nearby. By topography there is a clear qualification between a large capital city and a city satellite.

5.   Area urban satellite No develop like area urban Which more big nearby. The number of residents in satellite cities is much smaller compared to with large urban areas around it.

6.   Community urban This own Suite experience Alone, region middle city or city original old, and has character social Alone

7.   Typically, goods and brands are advertised to satellite urban areas on the side area large urban area nearby.

8.   There is often an acceptable vehicle service between satellite cities and city large brood nearby

9.   Students often travel to further education institutions in the main city because usually quality educational institutions are located in the nearest big city and No in the city satellite or urban area

Satellite towns/cities are not suburbs of nearby large cities. This is really city free Work Which different, ward separated, jurisdiction separated. Thereby also, Satellite cities are not commuter cities which are defined as small towns in near cities big Which like fringe city, Which part big the residents work in the main city very close by but remain in the city suburban areas, namely only serving residential and growth needs resident main city (Nath & Sengupta 2016).

A satellite city is a separate city with its commercial and residential zones itself and has its own local government and administration. That is, too maintain limit Which different Which separate it from city parent. Edge urban communities are large metropolitan zones on the edge of cities with grouping business And recreation. Area urban fringe This own companies, shopping centers, and entertainment zones and far from the city center center in big city. Satellite cities will function similarly to larger cities & own cultural autonomy himself (S Ananda Krishnan & K M Sujith, 2021).

Need in come back cities satellite is For give harmony Which ideal among residents And resource, connection with replacement climate friendly events. The point is to make accommodation affordable For part big public general. There is need fundamental For form area satellite cities become city urban Which brilliant.

1.   For Reduce congestion Main City

2.   Develop Sub Central Economy

3.   Utilization Land with the best

4.   For Save degradation ecology

5.   Change Force Work become Power Work

6.   For Strengthen Growth Economy Whole & Optimization Source Power (S Ananda Krishnan & KM Sujith, 2021).

So in the concept of a satellite city, it is a city that is smaller than the big city nearby, but is separate both administratively and independently of the city. The development of the city is not as fast as the main city, but it supports the development of the main city in various fields such as economic growth, education , city development, as well as the construction and development of facilities and infrastructure.

2.   Draft Infrastructure Transportation

Transportation is always part of the problem in every major city or town big city. Transportation problems are characterized by heavy traffic and Lots happen congestion. Congestion has give rise to consequence chain in among them that is time journey to place Work Which more long Which regardless from the cost of time for the individual will result in loss of productivity due to worker fatigue; decreased access to open space and countryside; increasing pollution air; problem health Which worsen; And even increase decline morals and crime.

Transportation according to (Miro , 2012) in general can interpreted as business transfer or movement person or goods from something location Which called origin location, to another location which is usually called the destination location, for certain purposes with use tool certain also. Activity transportation contains three things: cargo to be shipped, vehicle availability as means of transportation, and the existence of roads that can be passed (Nasution , 2004). There is a process of moving from place origin movement, And Then There is transportation from beginning And objective in where activity the stopped. T ransportation or transportation is the activity of moving people and

goods from one place (origin) to another (objective) by using the means (vehicle) (Warpani , 2002) .

From understanding This transportation have dimensions: Location (origin And objective), Tools (technology), And needs certain in location objective like economy social And etc. So that transportation does not face congestion problems in the future day, then the development of the transportation system needs planning. Intervention According to Tamin (2000), humans in transportation matters can be done with various the method is:

a.   change technology transportation

b.   change technology information

c.   change characteristic vehicle

d.   change characteristic segment road

e.   change configuration network transportation

f.   change policy operational And organization

g.   change policy institutional

h.   change behavior journey

i.   change choice activity

The micro transportation system consists of: activity system, system network infrastructure transportation, system movement Then cross And system institutional. Movement Then cross arise Because exists process fulfillment need. Public move Because his needs No Can fulfilled in his place. The community activity system will generate movement And will interesting movement in process fulfillment need. System the is a system of activity patterns in all fields such as social, economic, culture, and others.

Activity Which arise in system This need movement as tool _   fulfillment need Which need done every day. The size movement very related tightly with type And intensity activity Which done. Movement Which form movement man and/or goods the clear requires a mode of transportation (means) and media (infrastructure) place mode transportation it moves.

The transportation infrastructure required is the second micro system Which normal known with system network Which covers system network road kingdom, terminal bus, train fire, airport, And harbor sea. Infrastructure transportation is buildings needed to provide services or services for need base resident Which consists on road, bridge, harbor, airport (Directorate General of Spatial Planning, 2007). Providing transportation infrastructure is very important depends on two factor (Directorate General Relations Land, 2008): (a). economic growth, and (b). general fund, which is dependent on growth economy And wisdom government about street And vehicle general.

Interaction between system activity And system network This produce movement of people and/or goods in the form of vehicle movement and/or people (pedestrians). Activity systems, network systems, and movement systems will influence each other as seen in figure 2.1. Changes to the system activities will clearly affect the network system through changes in levels services on the movement system. Likewise changes to the network system will can influence system activity through enhancement mobility And accessibility of the movement system.
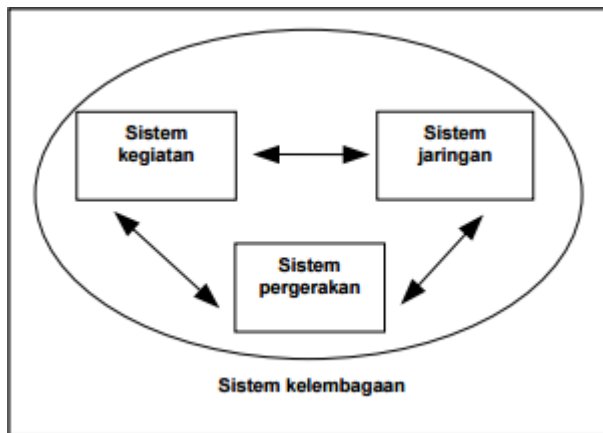
Picture 2.1 Diagram System transportation macro

Source: Tamin, 2000

Roads are the most important requirement in transportation. Without road No Possible There is service transportation for its users. Road intended And provided as base For means transportation. Development And progress road And equipment transportation is two element Which each other need or are related to each other (Nasution, 2004). Lots research results that explain the relationship between transportation infrastructure and progress or economic growth in an area. Road infrastructure has a positive and significant effect on growth economic efforts, people's income, social benefits and economic benefits accepted by the city community (Lus Prapti et al, 2015). Regional connectivity requires the development of transportation infrastructure as well integration between mode as effort For push cost logistics And grow economy of a region (Sitorus and Sitorus , 2017).

Transportation said Good, if journey Enough fast, No experience congestion, frequency service Enough, safe, free from possibility accident and comfortable service conditions. To achieve ideal conditions such as This, very determined by various factor Which become component transportation This,   namely the condition of infrastructure (roads), road network system, condition of facilities (vehicles) And attitude mentally user facility transportation the (Setijadji , 2006). Good transportation will play an important role in development region especially in accessibility, as for Which intended Accessibility is the ease and capability of an area or space to be accessed or reached by parties from outside the area either directly or indirectly. It's easy to connect a location location other past network transportation Which There is, form infrastructure road And tool transport moving on it. Development is increasingly slow and hampered Because lack of means transportation which exists (Margaretta, 2000).

Development infrastructure transportation must capable realize connectivity and maximum possible accessibility. There are three principles of the connectivity concept. First , maximizing growth through unity area, No uniformity (inclusive development) with connect centers growth. Second , expand growth through regional connectivity-region through an inter-modal supply chain system that connects the hinterland And Which left behind with centers growth. Third , reach growth inclusive with connect area isolated with infrastructure And basic services in getting development benefits.

Accessibility is a measure of ease for road users reach an activity center (PK) or activity nodes in the area Which served road. Accessibility evaluated from connectedness between center activities by the road in the area served by the road and its value taken into account to wide region Which served. Index accessibility be measured based on level availability road in standard service minimum field road (Kepmenkimpraswil No. 534/KPTS/M/2001). Level availability road is comparison between long wide

road region.

Table 2.1 Road Availability Table

Nilai KtJ (Indeks Aksesibilitas)	Keterangan	Katagori
0,05	1 km jalan melayani 20 km^2 wilayah	Sangat Rendah
0,25	1 km jalan melayani 4 km^2 wilayah	Rendah
1,25	1 km jalan melayani 0,8 km^2 wilayah	Sedang
2,00	1 km jalan melayani 0,5 km^2 wilayah	Tinggi
5,00	1 km jalan melayani 0,2 km^2 wilayah	Sangat Tinggi

From the description above, it shows that regional development with satellite city planning will appear characterized by human intervention, including interference in transportation planning. Development of transportation modes will be needed to improve or maintain adequate accessibility.

Development Region

Theory Development Region consists from theory location And theory center growth, will but in development furthermore known also theory agropolitan.

Location theory can be defined as a science that investigates spatial planning (spatial order) economic activities. Or it can also be interpreted as the science of geographical allocation of scarce resources, and their relationships or its influence on the location of various kinds of businesses or other activities (activity). In general, the choice of location by an activity unit is determined by several factors factor like: material standard local (local input); request local (local demand); material standard Which can moved (transferred input); And request outside (outside demand).

There is a number of location theory between others (Hoover and Giarratani. 2007) namely:

Theory Von's location Thunen.

Von Thunen identified differences in location from various places agricultural activities based on differences in land rent (economic considerations). According to Von Thunen level rent land is most expensive in center market And increasingly low if increasingly Far from market. The result is something pattern use land form diagram ring. Development from theory Von Thunen This is apart from the high land prices in the city center and will decrease further if increasingly far from city center.

Theory Location Alfred Weber

Alfred Weber analyze the location of industrial activities. According to Weber's theory of industrial location selection is based on principles minimization cost. Weber stated that the location of each industry depends on the total cost transportation And power Work in where summation both of them must minimum. The place where the total transportation and labor costs are minimum is identical to maximum profit level.

Theory center growth

A growth center is a location that has many facilities and convenience so that become center Power pull (pole of attraction), Which cause various type business interested For located in there And public like come utilise facility Which There is in city the, although possibility No There is pattern interaction between efforts the (Inspiration Mirzasa Putra, 2010). The basic idea of this growth point concept is that activity economy in in something area tend agglomerate in around a small number of focal (central) points. In a region the polarization current will gravity towards these focal points, which is due to the

distance of the current will decrease. Around this focal point, the border line can be determined current density drops to a minimum critical level, the center can is said to be a growth point while the area within the boundary line is area its influence.

Something city said as center growth must characterized (Robinson Dance. 2012):

There is a relationship internal from various type activity connection internal greatly determines the dynamics of a city. There is a link between one sector with other sectors so that if one sector grows, it will push growth sector other, Because each other related. With thereby life city create synergy For each other support creation growth.

multiplier element effect) existence sectors Which each other related And each other support will create effect multiplier. Meaning when There is request One sector from outside region, enhancement production that sector will have an effect on enhancement other sectors.

The existence of geographic concentration geographic concentration of various sectors or facilities, apart from being able to create efficiency between mutual sectors need, Also increase Power pull (attractiveness) from city the. Person Which come to city the Can get various need on nearby location. So necessities can be obtained more economically time, cost, And power. Matter This make city the interesting For visited And Because volume transaction Which increasingly increase will create economics of scale so it was created efficiency Furthermore.

Encouraging _ growth area behind him throughout there is connection Which harmonious in between city as center growth with city behind him so growth city center will push growth city behind him. The city needs raw materials from its rear areas and provide various facilities or needs of the area behind it for can self development.

In the concept of regional development there are two things that are quite influential which can be related to each other, such as the choice of location depending on its purpose, the location for development for agriculture is different from development for industry. Another is the concept of a growth center, with the linkage between one sector and another sector it will encourage the growth of other sectors, supporting each other and creating a multiplier effect, increasing the attractiveness of the city, and will encourage the growth of the city behind it.

The theoretical basis presented begins with an exploration of the Satellite City concept, including its development over time and the pattern of its relationship with the Parent City. This concept highlights the symbiotic relationship between the Satellite City and the Home City, which is the main focus in developing a better symbiotic environment. This analysis discusses the positive significance of symbiotic thinking in city development. Apart from that, the theory also includes norms and prerequisites that must exist in the context of a Satellite City.

Next, the theory of the Transportation Infrastructure concept, which involves City Transportation Network Systems and Satellite Cities. Transportation Infrastructure includes traffic engineering and management, with an emphasis on public transportation priorities, such as dedicated bus lanes and traffic control.

Then, this theoretical sequence leads to an understanding of Regional Development which summarizes the concepts previously explained. This creates a foundation for understanding how the development of Satellite City areas can be influenced by previous concepts, such as symbiotic relationships and transportation infrastructure.

As a whole, this theoretical sequence describes a comprehensive theoretical foundation for understanding the regional development of Satellite Cities, with a focus on its relationship with the Parent City and the importance of efficient transport infrastructure in the context of positive symbiosis.

Research Methodology

The research method used is a descriptive method with a quantitative approach. This descriptive method involves collecting data to test hypotheses or answer questions about people's opinions on an issue or topic. Quantitative research is research that is based on collecting and analyzing data in the form of numbers (numerics) to explain, predict and control phenomena of interest. Quantitative research emphasizes analysis on numerical data processed using statistical methods. With quantitative methods, the significance of the relationship between variables will be obtained.

The data collection technique used in this research is through two sources, namely:

Data type requirements

Primary Data

Primary data is data obtained directly from the object under study. The questionnaire method is one of the data collection methods used in this research. The questionnaire used in this research is a closed questionnaire. Closed questionnaires are used to collect data relating to variables for which alternative answer choices have been provided in each question, for which four answer choices are provided, for household income and consumption variables, namely in the categories:

a.   Strongly agree with score 4.

b.   Agree with score 3.

c.   Disagree with score 2.

d.   Disagree with score 1.

Secondary Data

Documentation is an activity to collect secondary data. In terms of This researcher tracing document Which There is in agency related like Bappeda, Service PUPR and BPS. Apart from that, documentation is also carried out by tracing the results study Which relevant with Satellite City concept and development region urban Data Collection Tools

Data Source

Primary Data Source

Primary data from the results of the respondent's questionnaire

Secondary Data Source

The data used is in the form of performance documentation data in the field of work General _ and Regency Spatial Planning Tana Toraja. Data This obtained from agency related Which relevant as well as References Which support study This. Data secondary Which needed that is:

Data condition physique study area Which covers geographical.

Condition of transportation infrastructure in Tana Toraja Regency and District Bittuang.

Population data with data specifications in the form of population, density population, development and dissemination resident.

Data Potency Region in each sector.

Data Analysis Techniques

The purpose of the data analysis method is to interpret and draw conclusions from the amount of data collected. This research uses multiple linear regression analysis methods using the SPSS analysis tool. The data analysis technique uses the following steps:

Multiple Regression Analysis

The analysis technique used is multiple linear regression. Multiple linear regression analysis is used by researchers, if the researcher intends to predict what the condition will be (up and down) of the dependent variable (criterium), if two or more independent variables as predictor factors are manipulated (increasing and decreasing their value) (Sugiyono, 2019). The model of multiple linear regression is as follows:

$Y = a + b_1 X_1 + b_2 X_2$

Information:

Y : Dependent variable (Data Robustness)

a : Constant

b_1: Regression coefficient X1 against Y

b_2: Regression coefficient X2 against Y

X_1: Free value 1

X_2: Free value 2

Correlation Coefficient (r)

Correlation is one of the data analysis techniques in statistical tests. This correlation is used to find the relationship between two quantitative variables. The correlation coefficient test is used to measure how much linear the independent variable under study is related to the dependent variable. The Correlation Coefficient is also called the Pearson Correlation Coefficient because this formula was discovered by Karl Pearson, a mathematician from England. The formula used to calculate the correlation coefficient is as follows:

$$r = \frac{\in_{xy} - (\in_x)(\in_y)}{\sqrt{\langle n \in x^2 - (\in x)^2 \rangle \left[n \in y^2 - (\in_y)2^2) \right]}}$$

Information:

n   : Number of pairs of data X and Y

Σx   : Total Number of Variables

Σy   : Total Number of Y Variables

Σx^2 : Square of the Total Number of Variables

Σy^2 : Square of the Total Number of Y Variables

Σxy   : Multiplication result of the total number of variables X and variable Y

According to Sugiyono (2019), the guidelines for interpreting correlation coefficient values are:

Table 3. 2 Guidelines for Measuring Correlation Coefficient Values

Range of Correlation Values	Decision
0.00 – 0.199	Very low
0.20 – 0.399	Low
0.40 – 0.599	Currently
0.60 – 0.799	Strong

0.80 – 1,000   Very strong

Source: Sugiyono, (2019) processed by researchers, 2023

Results

Researchers have distributed questionnaires to 50 respondents. Based on data processing, the following results were obtained.

1.   Descriptive Statistical Test

Table 4.4 Descriptive Statistics for Variable Y Regional Mapping

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Y1	50	3	5	4.50	,580
Y2	50	3	5	4.42	,883
Y3	50	3	5	4.24	,847
Y4	50	3	5	4.38	,855
Y5	50	3	5	4.14	,904
Y6	50	3	5	4.28	,858
Y7	50	3	5	4.18	,983
Y8	50	3	5	4.22	,954
Y9	50	3	5	4.08	,944
Y10	50	3	5	4.38	,878
Y11	50	3	5	4.34	,917
Y12	50	2	5	4.22	,932
Y13	50	3	5	4.38	,923
Y14	50	3	5	4.44	,812
Y15	50	2	5	4.32	,844
Valid N (listwise)	50				

The descriptive statistics table for variable Y, regional mapping in regional development research for Bittuang District in Tana Toraja Regency using a transportation network system infrastructure approach reveals a number of important information. In this data, there are 15 variables (Y1 to Y15) that are analyzed. The regional mapping average (Mean) on these variables ranges from 4.08 to 4.50, with a standard deviation (Std. Deviation) reflecting the level of variation from 0.580 to 0.983.

A relatively low standard deviation on some variables indicates that the data tends to cluster around the mean, while a higher standard deviation indicates greater variation. These results provide an initial picture of the characteristics of regional mapping in the context of the development of Bittuang District, which can be used as a basis for further analysis in research. With this information, research can go further to explore patterns or trends that may influence the development of the region, especially in relation to the transportation network system and the synergy relationship between Bittuang City as a Satellite City and Makale City as the main city.

Table 4.5 Descriptive Statistics for Variable X1 Norms of satellite cities

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
X1.1	50	2	5	3.78	,790
X1.2	50	2	5	3.78	,790
X1.3	50	2	5	3.78	,737
X1.4	50	2	5	3.74	,751
X1.5	50	2	5	3.78	,737
X1.6	50	2	5	3.78	,737
X1.7	50	2	5	3.70	,763

	N	Minimum	Maximum	Mean	Std. Deviation
X1.8	50	2	5	3.84	,766
X1.9	50	2	5	3.78	,737
X1.10	50	2	5	3.78	,790
Valid N (listwise)	50				

Results Descriptive Statistics Table Variable X1 Satellite city norms provide information about variables related to the Satellite City concept in this research. There are 10 subvariables (X1.1 to X1.10) that are analyzed. The average (Mean) of this subvariable ranges from 3.70 to 3.84, with a standard deviation (Std. Deviation) indicating the level of data variation from 0.737 to 0.790.

These results provide an overview of the norms or values related to the Satellite City concept in the context of regional development research in Bittuang District with a focus on the infrastructure aspects of the transportation network system. This data can be used as a basis for further analysis related to the implementation of the Satellite City concept and the synergy between Bittuang City and Makale City in the development of the region.

Table 4.6 Descriptive Statistics for Variable X2: Transportation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
X2.1	50	3	5	3.84	,710
X2.2	50	3	5	3.82	,748
X2.3	50	3	5	3.82	,748
X2.4	50	3	5	3.80	,700
X2.5	50	3	5	3.76	,716
X2.6	50	3	5	3.80	,700
X2.7	50	3	5	3.80	,700
X2.8	50	3	5	3.72	,730
X2.9	50	3	5	3.92	,724
X2.10	50	3	5	3.92	,724
Valid N (listwise)	50				

Results from Variable Descriptive Statistics Table X2: Transportation describes descriptive statistics for variables related to transportation in the research context. There are 10 subvariables (X2.1 to X2.10) analyzed.

The average (Mean) of this subvariable ranges from 3.72 to 3.92, with a standard deviation (Std. Deviation) indicating the level of data variation from 0.700 to 0.748. These values indicate norms or characteristics related to transportation in the research area, Bittuang District.

This data is important because it helps research to understand the level of adequacy and quality of existing transportation infrastructure, which is an important element in regional development. Further analysis can be used to evaluate how the Satellite City concept and synergy between Bittuang City and Makale City can be improved through improving or developing transportation infrastructure.

Table 4.7 Descriptive Statistics for Variable X3 Infrastructure

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
X3.1	50	3	5	3.84	,710
X3.2	50	3	5	3.82	,720
X3.3	50	3	5	3.92	,724
X3.4	50	3	5	3.82	,748
X3.5	50	3	5	3.82	,748
X3.6	50	3	5	3.80	,700
X3.7	50	3	5	3.76	,716

	N	Minimum	Maximum	Mean	Std. Deviation
X3.8	50	3	5	3.80	,700
X3.9	50	3	5	3.80	,700
X3.10	50	3	5	3.72	,730
Valid N (listwise)	50				

Results from Variable Descriptive Statistics Table X3: Infrastructure describes descriptive statistics for variables related to infrastructure in the research context. There are 10 subvariables (X3.1 to X3.10) analyzed.

The average (Mean) of this subvariable ranges from 3.72 to 3.92, with a standard deviation (Std. Deviation) indicating the level of data variation from 0.700 to 0.748. These values reflect norms or characteristics related to infrastructure in the research area, Bittuang District.

This data provides insight into the quality and availability of infrastructure in the region, which is an important factor in regional development. Further analysis can be used to evaluate the extent to which existing infrastructure meets regional development needs and how this infrastructure can be improved or developed to support the Satellite City concept and synergy between Bittuang City and Makale City in the development of the region.

Table 4.8 Descriptive Statistics for Variable X4 Settlement

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
X4.1	50	3	5	3.82	,748
X4.2	50	3	5	3.82	,748
X4.3	50	3	5	3.80	,700
X4.4	50	3	5	3.76	,716
X4.5	50	3	5	3.80	,700
X4.6	50	3	5	3.80	,700
X4.7	50	3	5	3.72	,730
X4.8	50	3	5	3.84	,710
X4.9	50	3	5	3.92	,724
X4.10	50	3	5	3.92	,695
Valid N (listwise)	50				

Results from Variable Descriptive Statistics Table X4: Settlement describes descriptive statistics for variables related to settlement in the research context. There are 10 subvariables (X4.1 to X4.10) analyzed.

The average (Mean) of this subvariable ranges from 3.72 to 3.92, with a standard deviation (Std. Deviation) indicating the level of data variation from 0.695 to 0.748. These values reflect the norms or characteristics related to settlements in the research area, Bittuang District.

This data provides information about residential conditions in the region, which is also an important factor in regional development. Further analysis can be used to evaluate the extent to which current settlements meet standards or needs in the context of the Satellite City concept and the synergy between Bittuang City and Makale City in the development of the region. With this information, research can design recommendations for improving or developing settlements that are in line with regional development goals.

Table 4.9 Descriptive Statistics for Variable X5 Social Life

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
X5.1	50	3	5	3.86	,729
X5.2	50	3	5	3.84	,710
X5.3	50	3	5	3.84	,710
X5.4	50	3	5	3.82	,748

	N	Minimum	Maximum	Mean	Std. Deviation
X5.5	50	3	5	3.82	,748
X5.6	50	3	5	3.80	,700
X5.7	50	3	5	3.76	,716
X5.8	50	3	5	3.80	,700
X5.9	50	3	5	3.80	,700
X5.10	50	3	5	3.72	,730
Valid N (listwise)	50				

Results from Variable Descriptive Statistics Table X5: Social Life describes descriptive statistics for variables related to social life in the research context. There are 10 subvariables (X5.1 to X5.10) analyzed.

The average (Mean) of this subvariable ranges from 3.72 to 3.86, with a standard deviation (Std. Deviation) indicating the level of data variation from 0.700 to 0.748. These values reflect norms or characteristics related to social life in the research area, Bittuang District.

This data provides an overview of aspects of social life in the region, which is also an important factor in regional development. Further analysis can be used to evaluate the extent to which current social life meets the needs and expectations of society in the context of the Satellite City concept and the synergy between Bittuang City and Makale City in regional development. With this information, research can formulate recommendations to improve or improve relevant aspects of social life.

Table 4.10 Descriptive Statistics for Variable X6 Sustainable Development

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
X6.1	50	3	5	3.82	,720
X6.2	50	3	5	3.86	,756
X6.3	50	3	5	3.86	,756
X6.4	50	3	5	3.84	,710
X6.5	50	3	5	3.78	,737
X6.6	50	3	5	3.84	,710
X6.7	50	3	5	3.84	,710
X6.8	50	3	5	3.76	,744
X6.9	50	3	5	3.96	,755
X6.10	50	3	5	3.98	,742
Valid N (listwise)	50				

Results from Variable Descriptive Statistics Table X6: Sustainable Development describes descriptive statistics for variables related to sustainable development in the research context. There are 10 subvariables (X6.1 to X6.10) analyzed.

The average (Mean) of this subvariable ranges from 3.76 to 3.98, with a standard deviation (Std. Deviation) indicating the level of data variation from 0.710 to 0.756. These values reflect norms or characteristics related to sustainable development in the research area, Bittuang District.

This data provides insight into how sustainable development in the region is assessed by respondents or the community, which is an important aspect in the context of regional development. Further analysis can be used to evaluate the extent to which the Satellite City concept and the synergy between Bittuang City and Makale City support sustainable development. This information can help formulate recommendations to strengthen sustainable development aspects in the development of the Bittuang District area.

Table 4.11 Descriptive Statistics for Variable X7 Partnership and Investment

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
X7.1	50	3	5	3.88	,718
X7.2	50	3	5	3.92	,724
X7.3	50	3	5	3.82	,748
X7.4	50	3	5	3.82	,748
X7.5	50	3	5	3.80	,700
X7.6	50	3	5	3.76	,716
X7.7	50	3	5	3.80	,700
X7.8	50	3	5	3.80	,700
X7.9	50	3	5	3.72	,730
X7.10	50	3	5	3.92	,724
Valid N (listwise)	50				

Results from Variable Descriptive Statistics Table X7: Partnerships and Investments depicts descriptive statistics for variables related to partnerships and investments in the research context. There are 10 subvariables (X7.1 to X7.10) analyzed.

The average (Mean) of this subvariable ranges from 3.72 to 3.92, with a standard deviation (Std. Deviation) indicating the level of data variation from 0.700 to 0.748. These values reflect the norms or characteristics related to partnerships and investment in the research area, Bittuang District.

This data provides information about how partnerships and investments in the region are assessed by respondents or the community, which is an important aspect in the context of regional development. Further analysis can be used to evaluate the extent to which current partnerships and investments support the Satellite City concept and synergies between Bittuang City and Makale City in regional development. This information can help formulate recommendations to strengthen the partnership and investment aspects in developing the Bittuang District area.

2.   Regression Test

Table 4.12 Regression Test Results

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5668.803	7	809.829	286,117	,000 [b]
	Residual	118,877	42	2,830		
	Total	5787.680	49			

a. Dependent Variable: Y
b. Predictors: (Constant), X7, X4, X5, X6, X1, X3, X2

These results provide information about the extent to which the independent variables (X1,

The ANOVA results show that the regression model used has an F value of 286.117, with a very low significance (Sig.) (0.000). This indicates that the independent variables consisting of X1,

In other words, these results show that the variables analyzed in the research, including the concept of Satellite City (X1), transportation (X2), infrastructure (X3), housing (X4), social life (X5), sustainable development (X6) , partnership, and investment (X7), together have a significant impact on regional mapping (variable Y) in the context of developing the Bittuang District area using a transportation network system infrastructure approach.

These results can be used to better understand the factors that contribute to the development of the Bittuang District area and can be the basis for designing more effective strategies or policies in developing the region.

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	16,808	1,701		9,883	,000
	X1	1,937	,449	1,697	4,318	,000
	X2	-1,405	1,311	-1,316	-1,072	,290
	X3	1,352	,457	1,189	2,956	,005
	X4	,250	,201	.211	1,241	,222
	X5	-.719	,319	-.657	-2,253	,030
	X6	-.593	,342	-.571	-1,733	,090
	X7	,458	1,389	,430	,330	,743

a. Dependent Variable: Y

The results of the Coefficients table in this research are used to evaluate the impact of each independent variable (X1, The following are the results from the Coefficients table:

Constant: The constant value is 16.808, and the significance (Sig.) is 0.000. This shows that the constant has a significant influence on the dependent variable Y.

X1 (Satellite City Concept): The coefficient for X1 is 1.937, and the significance is 0.000. This shows that the Satellite City concept has a significant positive influence on the dependent variable Y in the context of regional development.

X2 (Transportation): The coefficient for X2 is -1.405, but the significance is 0.290, which is greater than alpha (0.05). This shows that the Transportation variable (X2) does not have a significant influence on the dependent variable Y.

X3 (Infrastructure): The coefficient for X3 is 1.352, and the significance is 0.005. This shows that Infrastructure (X3) has a significant positive influence on the dependent variable Y.

X4 (Settlement): The coefficient for X4 is 0.250, and the significance is 0.222. This shows that the Settlement variable (X4) does not have a significant influence on the dependent variable Y.

X5 (Social Life): The coefficient for X5 is -0.719, and the significance is 0.030. This shows that Social Life (X5) has a significant negative influence on the dependent variable Y.

X6 (Sustainable Development): The coefficient for X6 is -0.593, but the significance is 0.090. This shows that the Sustainable Development variable (X6) does not have a significant influence on the dependent variable Y.

X7 (Partnerships and Investments): The coefficient for X7 is 0.458, and the significance is 0.743. This shows that the Partnership and Investment variable (X7) does not have a significant influence on the dependent variable Y.

Thus, in the context of this research, the concepts of Satellite City (X1) and Infrastructure (X3) have a significant positive influence on regional mapping (variable Y), while Social Life (X5) has a significant negative influence. The other variables (X2, X4, X6, X7) do not have a significant influence on the dependent variable Y in the development of the Bittuang District area.

From the table given, the variables that are directly related to the dependent variable Y are variables X1, X3, and X5. This can be seen from the significant standard coefficient

value (p-value < 0.05) and the beta coefficient value which is positive for variables X1 and X3, and negative for variable X5. Meanwhile, variables X2, X4,

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,990 ª	,979	,976	1,682

a. Predictors: (Constant), X7, X4, X5, X6, X1, X3, X2

In the Model Summary table results, there are several statistics that describe the extent to which the regression model used in this research is suitable for explaining the relationship between the independent variables (X1, development of the Bittuang District area using a transportation network system infrastructure approach. Here is a statistical summary of this table:

R (Correlation Coefficient): The R value is 0.990. This indicates the level of relationship between the dependent variable and the independent variables in the model. An R value close to 1 indicates a very strong relationship between these variables in the model.

R Square (Coefficient of Determination): The R Square value is 0.979. It describes the proportion of variability in the dependent variable Y that can be explained by the independent variables in the model. In this context, about 97.9% of the variability in mapping area (Y) can be explained by the independent variables (X1, X2, X3, X4, X5, X6, X7) in the model.

Adjusted R Square (Adjusted Coefficient of Determination): The Adjusted R Square value is 0.976. This is an adjusted version of R Square that takes into account the number of independent variables in the model. A high value indicates that this model is quite good at explaining variability in the dependent variable Y.

Std. Error of the Estimate (Standard Error of Estimate): This value is 1.682. This is the estimated standard error of the model's prediction of the dependent variable Y. The lower this value, the better the model can predict Y.

Overall, the results from the Model Summary table show that the regression model used in this study has a high level of fit and can explain most of the variability in area mapping (Y) based on the independent variables analyzed (X1, X6, X7). This shows that this model can be used to understand the factors that influence the development of the Bittuang District area with a good transportation network system infrastructure approach.

3.   Correlation Test

Table 4.13 Correlation Test Results

Correlations

			X1	X2	X3	X4	X5	X6	X7	Y
Spearman's rho	X1	Correlation Coefficient	1,000	,992 **	,983 **	,968 **	,981 **	,993 **	,992 **	,994 **
		Sig. (2-tailed)	.	,000	,000	,000	,000	,000	,000	,000
		N	50	50	50	50	50	50	50	50
	X2	Correlation Coefficient	,992 **	1,000	,978 **	,981 **	,980 **	,989 **	1,000 **	,984 **
		Sig. (2-tailed)	,000	.	,000	,000	,000	,000	,000	,000
		N	50	50	50	50	50	50	50	50
	X3	Correlation Coefficient	,983 **	,978 **	1,000	,967 **	,996 **	,989 **	,979 **	,989 **
		Sig. (2-tailed)	,000	,000	.	,000	,000	,000	,000	,000
		N	50	50	50	50	50	50	50	50
	X4	Correlation Coefficient	,968 **	,981 **	,967 **	1,000	,970 **	,966 **	,982 **	,974 **
		Sig. (2-tailed)	,000	,000	,000	.	,000	,000	,000	,000
		N	50	50	50	50	50	50	50	50
	X5	Correlation Coefficient	,981 **	,980 **	,996 **	,970 **	1,000	,984 **	,981 **	,985 **
		Sig. (2-tailed)	,000	,000	,000	,000	.	,000	,000	,000

		N	50	50	50	50	50	50	50	50
X6	Correlation Coefficient		,993 **	,989 **	,989 **	,966 **	,984 **	1,000	,989 **	,990 **
	Sig. (2-tailed)		,000	,000	,000	,000	,000	.	,000	,000
		N	50	50	50	50	50	50	50	50
X7	Correlation Coefficient		,992 **	1,000 **	,979 **	,982 **	,981 **	,989 **	1,000	,984 **
	Sig. (2-tailed)		,000	,000	,000	,000	,000	,000	.	,000
		N	50	50	50	50	50	50	50	50
Y	Correlation Coefficient		,994 **	,984 **	,989 **	,974 **	,985 **	,990 **	,984 **	1,000
	Sig. (2-tailed)		,000	,000	,000	,000	,000	,000	,000	.
		N	50	50	50	50	50	50	50	50

**. Correlation is significant at the 0.01 level (2-tailed).

The results of the Correlations table show the correlation coefficients between various pairs of variables in this study. Correlation measures the extent to which two variables are related to each other. Below is a summary of the correlation coefficients between the analyzed variables:

X1 (Satellite City Concept) has a very high and significant correlation (p<0.01) with X2, X3, others and with regional mapping (Y).

X2 (Transportation) also has a very high and significant correlation (p<0.01) with X1, X3, with area mapping (Y).

X3 (Infrastructure) has a very high and significant correlation (p<0.01) with X1, X2, X4, area mapping (Y).

X4 (Settlement) has a very high and significant correlation (p<0.01) with X1, area mapping (Y).

X5 (Social Life) has a very high and significant correlation (p<0.01) with X1 , and with area mapping (Y).

X6 (Sustainable Development) has a very high and significant correlation (p<0.01) with X1, and with area mapping (Y).

X7 (Partnership and Investment) has a very high and significant correlation (p<0.01) with X1, X2, other variables and with regional mapping (Y).

Variable Y (Regional Mapping) has a very high and significant correlation (p<0.01) with all independent variables X1, X2, X3, X4, X5, X6, and X7. This shows that regional mapping (Y) is strongly influenced by all the independent variables in this study.

These results indicate that the variables in this study have a strong correlation with each other and are closely related in the context of the development of the Bittuang District area using a transportation network system infrastructure approach.

Discussion and Conclusion

Discussion

1.   Analysis of the Satellite City Concept in the Development of the Bittuang District Area

The results of statistical analysis show that variable X1 (Satellite City Concept) has a very strong and significant correlation with various other variables, including regional mapping (Y). This shows that the Satellite City Concept has a big influence in the context of the development of the Bittuang District area. In other words, the use of the Satellite City concept in the development of the Bittuang District area is closely related to the transportation network system infrastructure and other factors analyzed in this research.

This research has succeeded in illustrating that the Satellite City concept has a very important role in the development of the Bittuang District area in Tana Toraja Regency, especially in the context of transportation network system infrastructure. The results of strong and significant statistical analysis show that variable X1, which measures the Satellite City Concept, has a large impact on the development of this region.

It is important to understand that a Satellite City is a regional planning concept that prioritizes urban development outside the central city or main city with the aim of reducing population and development pressure in the main area. The findings from this research show that in the context of Bittuang District, the application of the Satellite City concept is closely related to various factors related to the transportation network system. This indicates that to achieve sustainable regional development, it is important to consider the development of supportive and adequate transportation infrastructure .

The variable Sustainable (X6), and Partnership and Investment (X7). This indicates that the Satellite City Concept cannot be separated from these factors in the context of the development of the Bittuang District area.

In other words, the application of the Satellite City concept will be very effective if it is translated into concrete actions involving improvements to the transportation system, adequate infrastructure, orderly settlements, and development of social and economic aspects in this region. These results provide an in-depth view of how the Satellite City development strategy can be well integrated in the context of transportation network system infrastructure to achieve optimal results in the development of the Bittuang District area. Therefore, the policy recommendations that emerge from this research can help policy makers and regional planners to take the right steps in developing Bittuang District with a Satellite City approach that focuses on strong and efficient transportation network system infrastructure.

2.   Synergy Analysis between Bittuang City as a Satellite City and Makale City as the Main City

The results of the analysis also show that variable X7 (Partnership and Investment) has a strong and significant correlation with variable X2 (Transportation). This indicates that the synergy between Bittuang City as a Satellite City and Makale City as the main city in the context of transportation network system infrastructure can be realized through partnership and investment efforts. Thus, good cooperation and investment between these two cities can increase the effectiveness of the transportation network system in the region.

The results of the analysis which reflect the existence of a strong and significant correlation between variable X7 (Partnership and Investment) and variable , in the development of transportation network system infrastructure.

The importance of synergy between these two cities can be explained as follows:

a.   Bittuang City serves as a center for economic growth outside of Makale City, and therefore, an efficient and integrated transportation system between the two is very important. The analysis results show that variable X7 (Partnership and Investment) influences variable

b.   Partnership efforts between these two cities can include various aspects, such as building roads connecting the two, developing integrated public transportation, or even using modern technology to optimize traffic and transportation flows between satellite cities and the main city. In addition, investment in transportation infrastructure can also increase population mobility, support economic growth, and increase accessibility to services and jobs.

The synergy between Bittuang City as a Satellite City and Makale City as the Main City in the context of transportation network system infrastructure is very important to achieve

sustainable regional development. With good cooperation and the right investments, these two cities can support each other in efforts to increase the effectiveness of transportation systems and infrastructure which in turn will provide benefits to residents, entrepreneurs and local governments. In this case, policy recommendations could include the promotion of cross-city cooperation, budget allocation for transportation infrastructure, and the development of integrated planning between the two cities to achieve better synergy in their regional development.

3.   Analysis of Road Segment Characteristics

Analysis of the Satellite City concept and synergies between Bittuang City and Makale City can involve a deeper understanding of the condition of the existing transportation network. The application of the Satellite City concept can consider the characteristics of existing roads to plan appropriate transportation infrastructure. In addition, synergy between cities could include investment in improving and developing roads connecting the two.

Integration between analysis of the Satellite City concept and road segment characteristics can provide a more comprehensive view of how regional development can be achieved with a strong and efficient transportation network system approach. Emerging policy recommendations can cover both conceptual and technical aspects to improve connectivity and overall regional development.

Conclusion

Based on the previous chapter, this research can be concluded as follows.

1.   The application of the Satellite City concept in the development of the Bittuang District area in Tana Toraja Regency using a transportation network system approach has been proven to have a significant impact. The results of statistical analysis show that the Satellite City Concept has a very strong correlation with various variables that influence the development of this region, including transportation, infrastructure, housing, social life, sustainable development, and investment partnerships. Therefore, the application of the Satellite City concept in the development of Bittuang District is very relevant, especially in the context of transportation network system infrastructure. This concept not only provides an alternative to reduce population pressure in key areas but also encourages improvements in transportation infrastructure that supports population mobility and economic growth.

2.   Implementing a network system for transportation planning in Bittuang District as a Satellite City with Makale City as the main city is an important step in optimizing connectivity between the two cities. The results of the analysis show that the synergy between these two cities can be improved through partnership efforts and investment in integrated transportation infrastructure. Good transportation network system infrastructure is very important to support population mobility, distribution of goods, and access to important services. Therefore, integrated transportation planning between Bittuang City and Makale City needs to be a priority in sustainable regional development efforts. Investments in improving roads, developing integrated public transportation, and utilizing modern technology to optimize traffic flow can be strategic steps to improve transportation network system infrastructure in this region.

Suggestion

Based on the research results and conclusions that have been described, the following are several suggestions that can be given in order to develop the Bittuang District area in Tana Toraja Regency using a transportation network system approach.

1.   Application of the Satellite City Concept

The local government needs to seriously consider implementing the Satellite City concept in planning the Bittuang District area. This concept can help reduce population pressure in key areas, while encouraging growth in surrounding areas. Improving the quality of transportation infrastructure, housing and public services in the Satellite City area must be the focus of planning.

2.   Transportation Infrastructure Improvements

Investment in repairing and maintaining the road network connecting Bittuang District with other areas must be a priority. Damaged road sections need to be repaired to improve accessibility and mobility of the population. Apart from that, the development of an integrated public transportation network can also increase the efficiency of population movement.

3.   Partnerships and Investments

The local government needs to encourage partnerships and investment between Bittuang City as a Satellite City and Makale City as the main city. Good cooperation and appropriate investment in transportation infrastructure can increase synergies between the two cities and support sustainable regional development.

4.   Development of Access to Education

The availability of access to schools needs to be considered in regional planning. The development of roads connecting to schools in the Bittuang District area will support education in this area.

5.   Support for the Agricultural Sector

Good connectivity to agricultural areas is important to support the agricultural sector and food security. Improving the road network to agricultural areas must be part of the regional development strategy.

6.   Consider the Environmental Impact

During the development of transport infrastructure, it is necessary to consider environmental impacts. Steps must be taken to protect the environment, reduce potential damage, and maintain sustainable land use patterns.

7.   Integrated Planning

It is important to adopt integrated planning between Bittuang City and Makale City in developing transportation network system infrastructure. This will enable optimal transportation and infrastructure system effectiveness.

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