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Sustainable Infrastructure Model in Handling Slum Settlements in Wolio Subdistrict Baubau City

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***Abstract*:-** This research aims to (1) determine the condition of slum settlements in Wolio District, Baubau City, (2) determine the factors that cause the formation of slum settlements in Wolio District, Baubau City , and (3) find out and find models for improving infrastructure through a sustainable approach in handling slum settlements in Wolio District, Baubau City. To determine the existing conditions and factors causing slum settlements in the Wolio sub-district, Baubau City, descriptive analysis was used based on the assessment of slum indicators in accordance with PUPR Meterial Regulation Number 14/PRT/M/2018 and to determine the handling strategy, SWOT analysis was used. The results show that there are 11 RTs in 5 RWs in the Bataraguru sub-district classified as slums which if accumulated get a score of 18 (eighteen) or with an average slum sectoral value of 17.63% and are classified as light slums with other considerations having the potential to become high slums caused by geographic and demographic factors as well as socio-economic factors so that handling can be done by means of restoration and rejuvenation. The results of the SWOT analysis show that the strength value is 2.94, while the weakness score is 1.88. Apart from that, opportunities have a score of 4.00 and threats have a score of 1.22 so that handling can be done by repairing and upgrading basic infrastructure through a sustainable approach, namely by utilizing available land to improve the social economy of the community in the research location.

Keywords: *Slum Settlements, Sustainable Infrastructure, SWOT, Baubau City*.

1. Introduction

Indonesia as a developing country is one of the countries with a high population density. According to data from the Ministry of Home Affairs, Indonesia has 514 regencies/municipalities with 416 regencies and 98 of them are cities. In percentage terms, the population density in Indonesia tends to be smaller in regencies and larger in urban areas because economic circulation generally tends to develop in urban areas. Cities are also a system of human life networks characterized by high population density and characterized by heterogeneous socioeconomic strata and materialist patterns [1]. This situation causes the population density in urban areas to be high. Population growth in urban areas is very rapid because urbanization factors can have an impact on the environment, social and economic or sustainable development [2]. This is what can trigger the emergence of new slum areas in urban areas which is contrary to the objectives sustainable development.

Sustainable development is development that meets the needs of generations today without sacrificing the fulfillment of the needs of the next generation by prioritizing economic, social and environmental aspects. In principle, development sustainable focuses on the utilization of the resources we currently have with keep considering its availability for future generations. Now there are about 40.39 percent of households in urban areas that occupy inadequate housing, where some of them occupy slums or illegal. To handle Slums in urban areas require restoration, rejuvenation, and settlement efforts return (Government Regulation Number 18 of 2020) [3]. Infrastructure is generally defined as infrastructure basic both physical and non-physical forms that can support human activities in daily life. Infrastructure is also a system that supports the system economic and social which

at the same time connects the environmental system and forms the basis in policy making. Sustainable infrastructure is a development concept infrastructure by paying attention to the balance between meeting infrastructure needs in the present and the future [4]. Continuous infrastructure integrates 3 (three) aspects of sustainable development in it, namely social, economic and milieu.

Baubau City is one of the municipalities in Southeast Sulawesi Province which became the center of trade and services which in the future was proclaimed as the capital preparation of Buton islands province. Baubau City administratively has 8 (eight) sub-districts are Betoambari District, Wolio District, Sorawolio District, District Murhum, Batupoaro, Bungi, Kokalukuna and Lea-Lea. Baubau is an economic buffer from several surrounding districts among them are Buton Regency, Wakatobi Regency, North Buton Regency, Regency South Buton and Central Buton Districts. This is also what makes Baubau as the target of ubanization so that it greatly impacts the level of population density in addition to high birth rate. The population growth rate is always increasing from in each year, which has an impact on the density level, which also increases variably. In 2016, the population density in Baubau City reached 540 people/ kilometre^2, in 2017 it was 552 people/ kilometre^2, in 2018 it was 568 people/ kilometre^2. The concentration of population growth and density in each year is focused in the urban center area, especially in Wolio district [5].

Wolio District is one of the sub-districts in Baubau City with a level of the population density is quite high because in it there is a central area shopping and residential areas and designated as one of the slum districts the highest in accordance with the Decree of the Mayor of Baubau Number: 673/X/2019 concerning Determination of the Location of Slum Housing and Slum Settlements in Baubau City. Wolio district has problems in the slum arrangement program so far, the implementation space is limited by the physical condition of the building layout and socioeconomic conditions of the community [6]. As the oldest sub-district being the capital of the Baubau government, Wolio became the main target of urbanization so that has an impact on the uncontrolled spatial arrangement of the city. Wolio district as the center governance is a measure of progress and development for Baubau City and its region surrounding. The existence of slum areas should be an important concern for various parties to be resolved in order to improve the quality of life of the community. Repair infrastructure is one of the solutions for handling urban slums especially in infrastructure aspects related to improving economic quality, social and environmental so an in-depth study is needed to knowing the categories of slums, causal factors and sustainable infrastructure models as slum management solutions in Wolio district, Baubau City.

2. Material and Methods

Location and Research Design

This research was conducted in Bataraguru sub-district, Wolio district, Baubau city, Southeast Sulawesi Province. The type of research used is mixed methods with blends descriptive qualitative and quantitative SWOT.

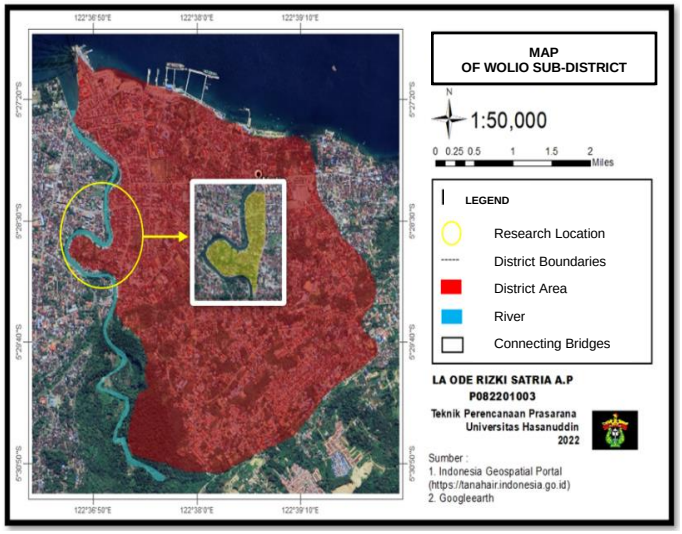

Figure 1: Slum Settlement Area of Bataraguru Village, Wolio Sub-district

Population and Sample

The population in this study were heads of households and heads of families who lived in the house is unfit for habitation using supporting data obtained through the Data Collection Division at The Baubau City Housing and Settlement Area Service in 2023 will have 618 families. Determining the sample in the population in this study uses the Slovin formula because population size is known. Apart from that, the researcher set a confidence level of 90% and the significance level is 10% (0.1) because each population element has the same character so we got a sample of 86 heads of families.

Data Collection Methods

Data collection was carried out using the field observation method to directly observe the existing conditions of the research location, the interview method to obtain information from government agencies (stakeholders) about the plan to organize residential areas in the Wolio sub-district, a questionnaire containing a series of directed lists of questions given to the Head of Family (KK) to obtain information about land ownership status, condition of buildings both permanent and non-permanent, social and economic conditions as well as document studies and literature review to obtain data on area development plans according to the Spatial and Regional Plan (RTRW) and slum area maps, land use maps, road network maps and drainage and data on uninhabitable houses located in Bataraguru village.

Data Analysis

Data on existing infrastructure conditions, factors causing slums and IFAS/EFAS values were tabulated and processed using SPSS windows 11 and microsoft excel to determine the percentage weight of each variable and factors that influence the results of the study based on the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number: 14/PRT/M/2018 concerning Prevention and Quality Improvement of Slum Housing and Slum Settlements and sustainable development goals.

3. Results

Sample Characteristics

The samples were heads of households and heads of families in 11 RTs in 5 RWs in Bataraguru urban village in Baubau city. The sample is dominated by people of productive age who are considered to have an impact on the population growth rate in the future. Household heads live in houses with 2 to 4 people and 5 to more than 12 people. The percentage of occupations of household heads in the sample was dominated by those working in the trade and services sector at 86.78%. In this group, the majority of household heads work as employees of shops scattered around settlements or in traditional markets and some others sell by opening stalls around the area as well as trading souvenirs, clothes and children's toys at the Kamali Baubau Beach night market located in Wale Village, Wolio Sub-district. In addition, the occupation of the head of household is divided into several groups, including 5.33% in the field of government employees, 4.48% in the field of construction / construction laborers, 2.99% in the field of fisheries / fishermen and 0.43% in agriculture / plantations and forestry.

The diverse types of work cause 75% of the number of household heads to belong to low-income communities (MBR) due to the low education they have. The percentage of education of household heads who are dominated by SMA / SMK graduates is 67% or as many as 315 people. In addition, heads who completed education up to D3 / Strata 1 level are only now working as ASN by 5.33% or as many as 25 people, heads of households who completed education up to junior high school level by 19.62% or as many as 92 people, heads of households who completed education up to elementary school level by 4.48% or as many as 21 people and heads of households who were not touched by education (not in school) by 3.41% or as many as 16 people. This percentage shows that 21.57% of household heads did not pursue education for 9 years or only completed the education level up to junior high school, elementary school or even did not pursue education.

4. Discussion

The geographical and topographical location of Bataraguru is in a watershed area, making this kelurahan a riverbank slum area. The research data shows that there are 11 RTs in 5 RWs in Bataraguru urban village that are categorized as slums so that they are designated as slum verification areas and research zones.

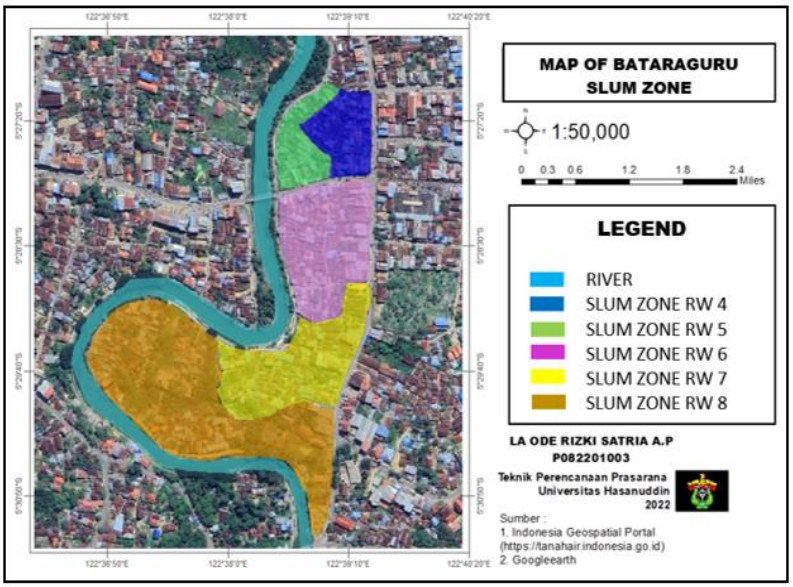

Figure 2: Slum zone map of kel. Bataraguru (study area)

Table 1. List of RW/RT of Bataraguru slum area

NO	Village	Citizens Association (RW)	Neighborhood Association (RT)
	Bataraguru		
1		04	01
2		05	01
			03
3		06	01
			03
			04
4		07	01
			02
5		08	01
			02
			03
	Amount	5 RW	11 RT

The limited area in each RT that is not directly proportional to the population growth rate in the last 5 (five) years has caused Bataraguru to have the largest slum area among other slum villages in Baubau City.

Table 2. Slum verification area

NO	Village	Citizens Association (RW)	Neighborhood Association (RT)	An area RT (Ha)	Extent of Slum Settlement (Ha)
	Bataraguru (22 Ha)				
1		04	01	0.70	0.40
2		05	01	0.70	0.31
			03	0.90	0.66
3		06	01	1.30	0.35
			03	1.10	0.77
			04	0.90	0.72
4		07	01	0.84	0.84
			02	1.14	1.14
5		08	01	2.20	0.25
			02	2.21	2.21
			03	2.69	2.69
	Amount	5 RW	11 RT	14.68	10.34

The results of the assessment and weighting of the existing infrastructure conditions in each RT above are then accumulated to determine the slum category for each RW. The results of the data analysis are depicted in the following table:

Table 3. The Results of the Assessment of the Existing Infrastructure Condition of the RW of the Research Location

VARIABLES	RW 4		RW 5		RW 6		RW 7		RW 8	
	NB	**K**	**NB**	**K**	**NB**	**K**	**NB**	**K**	**NB**	**K**
Building condition	3	KS	4	KT	3	KS	4	KT	5	KT
Neighborhood road condition									1	KR
Drinking water supply condition					1	KR	1	KR	2	KR
Environmental drainage conditions	5	KT	5	KT	5	KT	4	KT	5	KT
Wastewater management condition										
Waste Management Condition	5	KT	5	KT	5	KT	5	KT	5	KT
Fire Protection Condition	5	KT	5	KT	5	KT	5	KT	5	KT
	18		**19**		**19**		**19**		**23**	

Description: NB = Weight Value. **K** = Category. **KT** = High Slum. **KS** = Moderate Slum. **KR** = Low Slum

Based on the assessment and weighting of each RW as shown in the data above, it can be determined the presentation of the accumulative weight of each variable affecting slum in Bataraguru urban village as illustrated in the following graph:

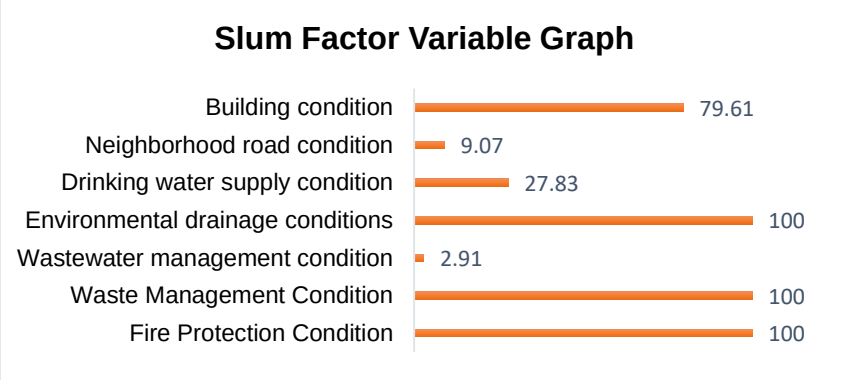

Figure 3. Slum factor variable graph

The graph above shows that the factors affecting slum in Bataraguru urban village are dominantly caused by physical factors, including wastewater management conditions of 2.91%, environmental road conditions of 9.07%, drinking water supply conditions of 27.83% and building conditions of 79.61%. While the condition of environmental drainage, waste management conditions and fire protection conditions averaged 100%. Based on the data above, it can be seen that there are 3 factors that have a major influence on the formation of slums in the research location, then the factors of irregular building conditions and not maximizing drinking water services also affect the formation of slums. The verified slum area in Bataraguru urban village, Wolio sub-district, Baubau city is 10.34 hectares, with a total of 469 buildings, a total population of 2,743 people and 618 households. The results of data analysis show that the value obtained in the slum baseline is 18 (eighteen) or with an average sectoral value of 17.63%. Thus, based on the existing physical condition of buildings and infrastructure, the level of slum in Bataraguru Village is classified as a light slum but has other considerations with high slum potential. In the context of locations with various slum classifications and different land statuses, the handling patterns applied also vary. Referring to the standards set by the government in accordance with PERMENPUPR Number 14/PRT/M/2018, the handling pattern that must be applied to Bataraguru village is carried out in the form of restoration and resettlement or by repairing and physically structuring settlement infrastructure.

In addition to physical factors, non-physical factors were found to cause the formation of slum areas in Bataraguru urban village. This factor is caused by demographic and geographical conditions that have an impact on the high Land and Building Tax Object Selling Value (NJOP), which affects the price of buying and renting a plot of land in the research location. The ethnic diversity and low income of the community has led to a lack of community involvement in participating in various government programs that should address the widespread of slums in the Wolio sub-district. Strategies and decision-making that are considered appropriate to address slum problems in Bataraguru kelurahan can be determined through SWOT analysis based on the respective weights of strengths, weaknesses, opportunities, and threats.

Table 4. SWOT Matrix

Internal Factors	**Strength**	**Weakness**
	Trade and service centers High community work ethic The administrative capital of the city of Baubau Land legality status Availability of unused land as residential areas Education level of society	Unmet road length and width coverage in accordance with established standards Unavailability of waste and drainage infrastructure Unavailability of fire fighting facilities High MBR value High land prices in residential areas Overlapping government programs Lack of public concern for surrounding conditions Diversity of society
External factors		
	Strategy (SO)	**Strategy (WO)**
Opportunity		
Areas supporting national tourism destinations Availability of remaining land Local and central government program priorities Community tenacity	Utilizing central and local government programs as opportunities for infrastructure improvement Utilizing the position of the Baubau River as a supporting zone for the national tourism area of the Buton palace fortress Building a souvenir and culinary handicraft center typical of Buton as an opportunity to improve the community's economy	Improvement and improvement of basic infrastructure in each RT Conducting massive counseling on development in the community
Threat	**Strategy (ST)**	**Strategy (WT)**
Fire disaster Health problems Rising slums	Procurement of hydrants in each RW Maximizing various prevention programs and improving the quality of slums Construction of temporary waste shelters (TPS) in each RT Strict implementation of local regulations regarding Building Permits (IMB) Setting the schedule for transporting household waste Government involvement on land leasing issues	Road infrastructure development program in areas that have not yet become residential areas RT Forum as an educational medium

Source : Data analysis results, 2023

In sustainable infrastructure development schemes, infrastructure is not just about building roads and buildings, but also lifting the quality of life and triggering economic revival. Infrastructure often provides resources for the future to build a strong foundation for generations to come. To overcome the slum problem in Bataraguru urban village, Wolio subdistrict, Baubau City, a sustainable infrastructure planning model is needed based on the results of the SWOT analysis that has been carried out previously by doing (1) basic infrastructure improvements such as roads and drainage which are hampered by the lack of available land so that infrastructure development can be carried out with a type of multi-purpose drainage that functions to drain rainwater and channel household waste. Channel specifications and dimensions can be adjusted to the available resistant conditions based on the results of hydrological analysis and hydraulics calculations in each settlement location. At the top of the channel, a cover plate is built using K175-K225 quality concrete which will be used as a neighborhood road. Thus, the available land can function as a road as well as a drainage channel. The funding source for this development can be allocated through the Human Settlements Division of the Baubau PUPR Office in the sub-activity of managing and developing drainage systems directly connected to rivers in the district/city area. In some locations that do not have latrines and do not yet enjoy piped clean water sourced from Regional Drinking Water Company (PDAM), the procurement can be done through the community sanitation development program attached to the Settlement Division of the Housing, Settlement and Land Agency as well as the urban drinking water grant program which is a PUPR ministry program through the Baubau City PDAM.

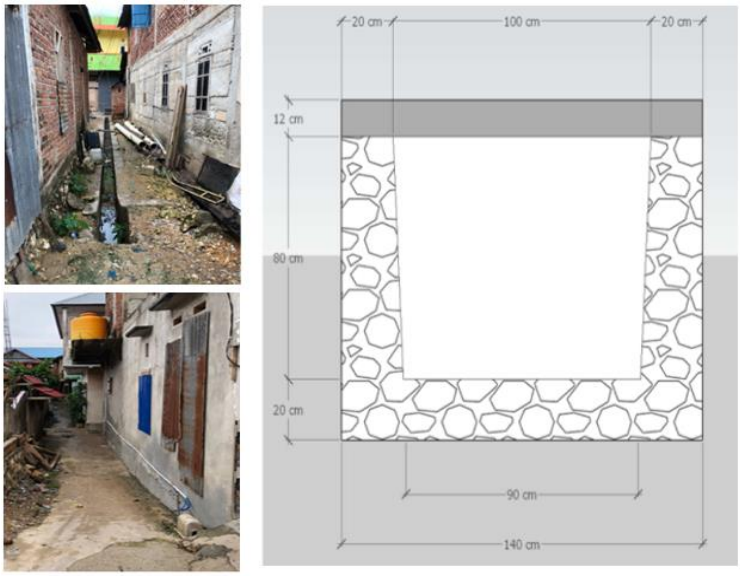

Figure 4. Design of basic infrastructure improvements by utilizing available land

Improvement of solid waste infrastructure because it was found that the community still utilizes open areas as locations for household waste collection due to the unavailability of TPS. This can lead to piles of garbage in several open areas and potentially trigger the emergence of diseases due to environmental pollution. To prevent this potential threat, it is necessary to provide 3 in 1 fiberglass trash cans with a capacity of 100 L that separate organic, non-organic and hazardous waste types in each RT. Meanwhile, in each RW, the availability of land can be considered for the location of the construction of 3 in 1 concrete waste bins with a volume of 17 m each3 designed to separate organic, non-organic and B3 waste. On a large scale in Bataraguru village, the high work ethic of the community can be empowered through the TPS 3R development program with a land area capacity of 150-200 m2 which in its management involves the community in each RT as an effort to increase the economy. In the development of waste infrastructure in residential areas, funding can be sourced from the Environmental Agency (LH) which is included in the waste bank building development program and its supporting facilities.

Figure 5. Design of the TPS construction plan

The construction of hydrants is an important step in preparing adequate infrastructure for fire management in various areas, especially in settlements with high building density. In the research location, hydrants can be built across the main road of the settlement along the Baubau river or on the embankment road as a fire protection tool for each RW.

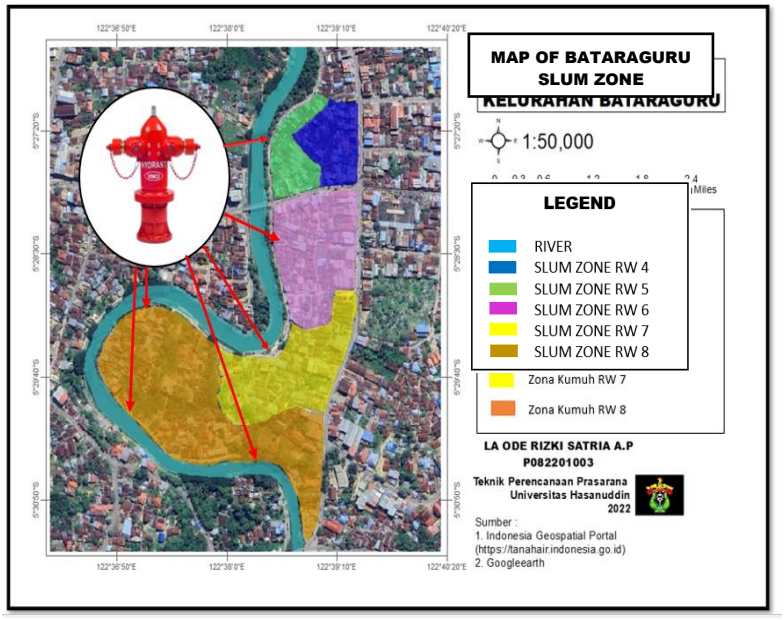

Figure 6. Hydrant construction location plan

Referring to data on the density and size of slums, the number of hydrants that should be built in RW 8 is 3 and placed in each RT that is the location in this study. Funding for hydrant construction can be budgeted through the Baubau City Fire Department by utilizing various central government programs in the prevention and improvement of slum quality. (4) The arrangement of Baubau River must be done because it is currently one of the eight points of government concentration in infrastructure arrangement in 2024. Referring to the results of the interviews, respondents answered that the Baubau river arrangement scheme could be focused as a souvenir center

to support the tourism destination of the Buton palace fortress which in its master plan makes this area a supporting area.

Figure 7. Baubau river arrangement plan

The results of the previous data analysis show that the availability of land and the high work ethic of household heads are the strengths to realize the program. In addition, there is government-owned land with an average area of ± 4 meters along the embankment road which is currently used as a parking area and some residents who have built non-permanent residential buildings in the area. The government's assertiveness in applying the rules needs to be done as an effort to prevent the widespread construction of semi-permanent buildings in this area. To prevent this from happening, the area that belongs to the government needs to be organized and utilized as a new economic area or used as a culinary center and typical Buton souvenirs with a management model that involves the local community as an effort to improve the economy. To realize this program, initial data collection is important to avoid horizontal conflict. Thus, areas that have the potential to cause new slums can be managed into new centers of economic growth.

5. Conclusions and Suggestions

Based on the results of the research that has been done, it can be concluded that Wolio is a sub-district of Baubau's capital city which in the Baubau RTRW Regional Regulation is designated as a trade and service service center and is currently a supporting area for the national tourism destination of the Buton palace fortress. Physically, slums are caused by the density of residential buildings and their non-compliance with standard technical requirements as well as the unavailability of land, which causes the development of basic infrastructure to be unfulfilled. In addition to physical conditions, factors that cause the formation of slums in the research location are demographic and geographical factors that cause an imbalance in the number of residents and the availability of existing land, diversity that affects community involvement in participating in government programs so that it causes slow development, social and economic factors of the average low-income household head (MBR) so that it has difficulty acquiring land. The results of the SWOT analysis found a strategy as a basis for decision making that is considered appropriate in handling by repairing and improving basic infrastructure through a sustainable approach by utilizing available land to improve the social economy of the community.

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