Model of Slum Area Management Based on Socio-Spatial Approach. The Case of Baubau City, Indonesia

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A B S T R A C T

The socio-spatial approach is one of alternatives in urban spatial planning studies which can be applied to discover the causes of slum settlement problems. Various slum upgrading projects have been implemented to improve the living conditions of slum dwellers. Although many previous studies have highlighted the social, economic and physical condition of slum areas, this study examines slum management in small towns from a socio-spatial perspective because there is a reciprocal interaction between social formations and spatial formations which can be measured quantitatively. It aims to analyse and develop slum settlement management model based on socio-spatial characteristics of slum settlements in Baubau City on the riverbanks, in the coastal areas and the traditional *kampong* type using the Fuzzy-Multi Criteria Decision Making Method (F-MCDM) and Driver-Pressure-State-Impact-Response (DPSIR). Results showed that the slum management process should be prioritized, according to the following order of significance: slums located on riverbanks as first priority, slums in the coastal areas as second priority and the traditional *kampong* areas as third priority.These mixed methods are practically used for developing a slum management model and can be applied directly in the formulation of government policies. This research reveals a comprehensive policy recommendation for slum management planning for each different type, according to its socio-spatial characteristics.

1. INTRODUCTION

The rapid growth of urban population especially due to urbanization triggers environmental, social and economic impacts to sustainable development [1]. Commonly, population growth is followed by the growth of slum areas. Based on the UN HABITAT report, population growth has been recorded worldwide in densely populated areas over the past two decades. The same source estimates that about 1.4 billion people in urban areas of the world will occupy densely populated areas by 2030 [2].

The baseline data of urban slum areas in Indonesia that was updated until 2015 showed that the percentage of the national slum area is of 10% and will be targeted to 0% by 2019. Baubau City, as one of autonomous regions in Southeast Sulawesi Province, has registered high population growth. Over the period of 2010-2015, the population growth was of 13.06%, from 136,981 inhabitants to 151,877 inhabitants [3] with identified slum areas of 69.4 hectare based on the baseline of Program Kota Tanpa Kumuh (Cities Without Slums Program).

The implementation of slum upgrading programs in developing countries is highly dependent on the physical condition of the structures and socio-economic conditions of the community [4], [5]. Various slum quality improvement programs have shown progress so far, however, sustainability being still a major challenge [6]. Practically, Indonesia has had

successful experiences in improving slums, by implementing projects such as the Jakarta Kampong Improvement Program (KIP) in the 1970s [7], and more recently an Action Planning Program to Prevent and Improve the Quality of Urban Slums (Prevention Plans and Improving Urban Slum Quality / RP2KPKP) as part of City Without Slums program [8].

The implementation was strongly influenced by internal factors such as cultural perspectives [9], place of work, place of birth, home investment, type of house building and external factors, such as land ownership and government policy [10]. The program of City Without Slums is not only about facilities and infrastructures; it also addresses the problems of human and social development. This is a response to the failure of conventional approaches that emphasize physical development [11].

Difficulties in solving the problems of slum settlements in Indonesia are related to the lack of analysis of the main causes of slum area growth based on the socio-economic aspects of society. Although much qualitative research on the causes of slums has been conducted [12], [13], the formulation of slum management programs has not taken this research into account.

The transformation of socio-economic cohesion and the community as a social aspect provide great potential for the society, and also the possibility of increasing the source of program revenue [12]. Urban change is influenced by economic restructuring, which encourages people to live closer to the core of a region, representing a new link between the core and the new emerging urban areas in the region [14]. This phenomenon needs to be further studied to observe the occurrence of spatial segregation in the form of slums [15], [16].

A variety of slum upgrading projects have been implemented to improve the living conditions of slum dwellers [17]. However, the rapid dynamics of urban development poses the challenge that, in addition to dealing with existing slums, it is also necessary to prevent the emergence of new slums as a result of spatial segregation. Consequently, slums should be examined using an interdisciplinary approach, ensuring a more holistic and systematic assessment [18].

The socio-spatial approach is one of the alternatives proposed in urban spatial planning studies [19]. Based on the socio-spatial approach, more urban formation patterns are supported by the social patterns of society that shape the city life, not being a product of particular powers or business entities that have individual or group interests [20].

Urban planning management should be implemented by recognizing the positive impact of socio-spatial segregation and modifying the heterogeneity of social and economic conditions to support sub-centrality, social integration of urban space

and the selection of appropriate residential locations [21]. In this study, we examined the causes of slum area development through the socio-spatial approach, resulting in the formulation of specific and appropriate priorities and policy models for slum management in Baubau City, Indonesia.

2. THEORY AND METHODOLOGY

2.1. Socio-spatial approach

One of the most important forces of urban change is the large-scale migration from rural to urban areas. It generally affects one or more economic sectors (namely trade and services) [22]. The socio-spatial characteristics play an important role in triggering the segregation of residential areas [23], [24]. The change in development policy has contributed to the separation of settlements through socio-spatial differences in the society [23], [24], [25]. Rejuvenation program policies are implemented by local governments where socio-spatial differences and settlement segregation occur as a result of urban planning processes that divide urban areas based on socio-economic attributes [26], [27], [28], [29]. Socio-spatial segregation derives from the following: relationship between the shape of the city and the surrounding area (this can be categorized as an impact of urbanization), distribution of infrastructure development [11], [30], [15], value of the location of a region or region [31], affordability access to cost housing and ownership of transportation facilities, and affordability of transport costs [32]. Detailed socio-spatial identification data can be used to develop a model to anticipate and predict the possible consequences of segregation [33].

2.2. Fuzzy-MCDM and DPSIR framework

Geospatial information management has the potential to completely change the way informal settlements are developed [34]. In selecting socio-spatial indicators to be applied, researchers are limited by the nature and accessibility of data [33], [35]. If it is combined into a comprehensive socio-spatial database, it allows for spatial interventions directed to social needs that can be stratified according to scale [34]. Fuzzy Multi Criteria Decision Making (MCDM) is one application in geospatial information management [36], [37]. The integration of fuzzy logic into geospatial information systems has also been employed in various urban planning studies [38], [39], [40], [41], 42]. In addition, fuzzy logic is able to overcome multi-dimensional interactions, namely physical factors, nature, environment, socio-economic factors and multi-stakeholders who play a role in determining the criteria and alternative decisions [43], [44]. Meanwhile, policy recommendations will be developed by using the framework concept of Drivers, Pressures, States,

Impacts and Responses (DPSIR). This framework has proved effective in simplifying and managing interactions between people and their environmental systems through multidisciplinary understanding [45], [46] as support for decision-making [47]. DPSIR's multidimensional analysis of urban expansion is able to assess the negative consequences and potential benefits of urbanization from the socio-ecological perspective, to contribute to green city management and urban sprawl control and to develop decision-making for sustainable urban development planning [48].

2.3. Case study area

Baubau City is geographically located in the southern part of Southeast Sulawesi Province. Baubau City is located at 50°21'- 50°30' South latitude and between 12°20'30"- 12°20'45" East longitude on Buton Island.

The city is surrounded by a hinterland of a plain that is included in a rather steep slope class that ranges from 15% to 40%; the slopes in some places are above 40% and in some others slopes are of between 2% to 15% occupied mainly by District Betoambari and District Bungi. The high slope becomes a limitation in the development of the Baubau City residential centres, especially the South, in areas with slopes above 15%, which are utilized for plantations and forests. The reason for choosing this location is based on the high slum status located in the typology of the area with the priority of handling physical arrangement based on Slum Upgrading Profile of Baubau City 2015 (Fig. 1).
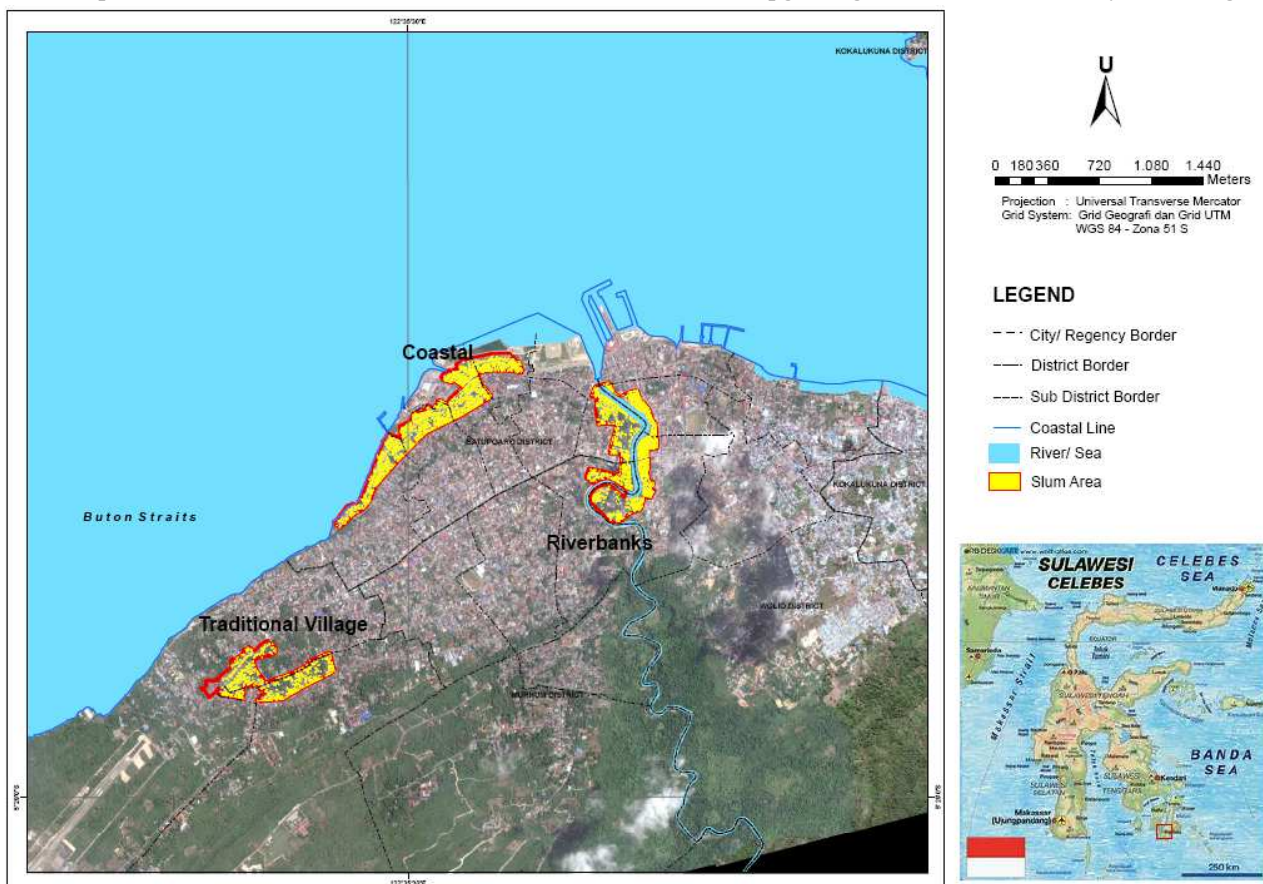

Fig. 1. Map of location study, Baubau City southeast Sulawesi, Indonesia.

The characteristics of socio-spatial areas include: 1) physical indicators and spatial patterns (variable spatial pattern, strategic area, building density, suitability of settlement land and slum development); 2) functional indicators (accessibility level, land use around slums); 3) social indicators which consist of the following variables: demographic status, economic status, and ethnic status [25], [35], [49], and phenomena socio-pathology [24], [35].

Data on physical indicators and spatial patterns were obtained from the spatial map pattern in the spatial planning plan (2014-2034), the World View-

2 image of 2016 slum profiles in 2009 and 2015, regional planning documents, settlement land maps, and planning documents of slum arrangement 2015. Functional indicators were obtained from 2016 road status and condition maps, and land use maps of 2007 and 2016.

The analysis of these two indicators used spatial temporal (overlay) analysis with Arc GIS 10.3 ESRI Tools software, and quantitative descriptive for obtaining the dominant data characteristics. Data on social indicators were obtained through structured interviews using a survey containing demographic,

economic, social and ethnic conditions, involving 97 heads of families as a sample of 3,331 population heads of households living in each type of area. The social indicators were analysed quantitatively using descriptive statistics by observing the dominant variables in each type of area and then a rating on the percentage of each indicator was performed. In addition, to determine the relationship between

variables and reduce some of the variables into new clustered components/factors, a Principal Component Analysis (PCA) was performed on social indicator variables. PCA is a procedure for identifying a small number of uncorrelated variables, from a large set of data. Its goal is to explain the maximum amount of variance with the fewest number of principal components [50], [51].

Table 1. Fuzzy rules in membership degrees.

Socio-spatial indicator / variable	Sub-variable	Unit	Fuzzy rules (Linguistic value)		
			Low priority	Medium priority	High priority
Physical and spatial indicator					
Land use planning direction	Strategic development area	Region	x < 4	4 ≤ x < 5	x ≥ 5
	Spatial pattern	Type	x < 1	1 ≤ x < 2	x ≥ 2
Level of building density	Building density	Unit/ha	x < 39	39 ≤ x < 45	x ≥ 45
Land suitability level	Percentage of unsuitable land for settlement development	%	x < 85.3	85.3 ≤ x < 92.3	x ≥ 92.3
Level of development of slums	Percentage growth of slum areas	%	x < 195	195 ≤ x < 243,5	x ≥ 243.5
Functional indicator					
Accessibility level	Percentage of roads with damaged conditions	%	x < 2.6	2.6 ≤ x < 4.4	x ≥ 4.4
Level of land use change	Settlement land use	%	x < 27,4	27.4 ≤ x < 47.1	x ≥ 47.1
Social indicator					
Demography status	Productive age structure	%	x < 67.23	67.23 ≤ x < 69.46	x ≥ 69.46
	Percentage of occupants > 4 people	%	x < 56	56 ≤ x < 60	x ≥ 60
	Percentage > 2 households	%	x < 3.3	32.3 ≤ x < 41,7	x ≥ 41.7
Economic status	Percentage education level <9 years	%	x < 29.6	29.6 ≤ x < 43.3	x ≥ 43.3
	Income < IDR 1.500.000	%	x < 77.6	77.6 ≤ x < 87.3	x ≥ 87.3
	Percentage of dominant occupation	%	x < 48.3	48.3 ≤ x < 51.3	x ≥ 51.3
	Percentage of dominant field business sector	%	x < 53.3	53.3 ≤ x < 61.6	x ≥ 61.6
	Average land price	Thousand IDR	x ≥ 1 000	700 ≤ x ≤ 900	x ≤ 600
	Building ownership status	%	x ≥ 81.6	73.3 ≤ x < 81.6	x < 73.3
	Legality of building ownership	%	x ≥ 63	39 ≤ x < 63	x < 39
	Average Hire Rates	Million IDR/year	x ≥ 4.4	3.2 ≤ x < 4.4	x < 3.2
Ethnic status	Status of population (percentage of migrants)	%	x < 27	27 ≤ x < 45	x ≥ 45
	Length of stay	Years	17 ≤ x ≤ 27	28 ≤ x ≤ 37	x > 37
Socio-pathology	Crime level	%	x < 80	80 ≤ x < 87	x ≥ 87
	Flood vulnerability (1-3 times per year)	Level	Low	Medium	High
	Vulnerability of residential fire disasters	Level	Low	Medium	High
	Vulnerability to social conflict disasters	Level	low	Medium	High

PCA analysis results were used to identify the social indicators that correlate with each other in shaping socio-economic constructions into three types.

The first step in PCA analysis was to find the matrix correlation between the observed indicators. There were several standards used as PCA analysis requirements

i.e. correlation matrix between indicators, partial correlation, and Kaiser-Meyer Olkin (KMO). If three required conditions are fulfilled, then the PCA analysis software through IBM SPSS Statistics 22 can be performed with the following stages: extraction factor, factor rotation, interpretation of factors, generation of factor score, and factor scores computation [51].

The data processing results of identification of socio-spatial characteristics became the input in analysing and building the model of slum settlement management through the following stages:

1). The first stage consisted in entering the results of the analysis of socio-spatial characteristics into vector spatial data (polygon) in three types of area by filling information on tabular data of each slum area polygon. Modelling using fuzzy logic analysis can only be processed on spatial data of raster type. Therefore, vector spatial data were first converted into raster spatial data using Conversion Tools in Arc GIS 10.3 software through the Polygon to Raster extension.

2). The next step in Fuzzy logic modelling was to create the degree of membership of each criterion of socio-spatial variables that had been pre-rasterized. The membership value, degree or function is the main characteristic of reasoning with the fuzzy logic [36], [38], [52], [53]. The membership degree of each criterion is 0-1 using the fuzzy membership extension in Arc GIS 10.3 software. The output of this stage was the raster data of each criterion that had a membership value. The method used to design the model of slum areas management with Multi Criteria Decision Making (MCDM) using Fuzzy Mamdani logic is the knowledge base represented as linguistic rules "IF ... THEN". Fuzzy logic modelling with Mamdani operator is considered appropriate for modelling social variables. The fuzzy membership function and the output of the previous variable are described in Figure 2.
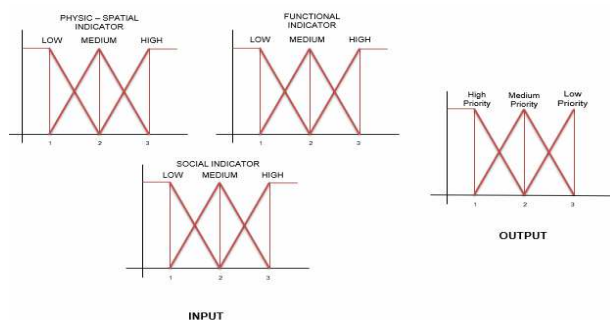

Fig. 2. Fuzzy membership function.

Fuzzy rules and assumptions in membership degrees are presented in Table 1.

Fuzzy overlay was determined by entering the output of the previous stages of raster data of each criterion which had a value of 0-1. Overlays were performed on physical indicators - spatial patterns, functional indicators and social indicators. Therefore, the output of the priority map of the slum settlement area was obtained.

3). The next step was to build the Driver / Driving Factor, Pressure, State, Impact and Response (DPSIR) framework based on the Fuzzy MCDM priority mapping results. This model is a spatial-based policy action plan for the management of slums.

3. RESULTS AND DISCUSSION

3.1. Socio-spatial characteristics

3.1.1. Slums in traditional Kampong

The slum area of traditional kampong is a region with 4 development areas based on Land Use Plan direction, with the function of spatial pattern as housing.

This area has a building density of 33 units/ha, 95.25% of unsuitable land for settlement development and a slum growth rate of 292% over the past 5 years. Functionally, the area has 0.9% of local roads in damaged conditions, and land use settlement changes (2007-2016) of 7.7 %.

Socially, the area has the following characteristics: the structure of productive age (65%), percentage of occupants > 4 persons/occupancy (52%), percentage > 2 households (23%), percentage of education level of head of family < 9 years (16%), income level < IDR 1,500,000 (68 %), type of work of head of family (45% traders), dominant business sector (45 % large and retail trade), average land price (IDR 700,000-900,000/sq m), building ownership status (90% own), legality of building ownership (87% have building permit), average rental houses rate (IDR 5.6 million/year), residence status (13% migrants), length of stay (36% of households have been living for 17-27 years), crime rates 1-3 times/year (84%), vulnerability level of flood disaster, vulnerability of fire disaster (low), social conflict vulnerability (high).

3.1.2. Slums on the riverbanks

The slum area on the riverbanks is a region with 5 development areas based on Land Use Plan direction, with the function of housing, trade and services. This area has a building density of 50 units/ha, 78.3% of unsuitable land for settlement development and slum growth rate of 185 % over the past 5 years. Functionally, this area has 6.2% of local roads in damaged conditions, and land use settlement changes (2007-2016) of 66.8%.

Socially, the area has the following characteristics: the structure of productive age (65.4%), percentage of occupants > 4 persons/shelter (64%), percentage > 2 households/51% 9 years (57%), income level < IDR 1,500,000 (85%), type of work of the head of family (55% traders), dominant business sector (70% - large and retail trade), average land price (< IDR 600,000/sq m), building ownership status (79% own

property), legality of building ownership (55% have building permit), average rental houses price (IDR 5.3 million/year), residence status (63% migrants), length of stay (45% of households have been living here for 28-37 years), crime rates 1-3 times/year (94%), flood vulnerability (high), fire vulnerability (high), and social conflict vulnerability (high).

3.1.3. Slums in Coastal Areas

The coastal slum area consists of 5 development areas based on Land Use Plan direction, whose functions are housing, trade and services. This area has a density of buildings (47 units/ha), 99.37 % of unsuitable land for settlement development and a slum growth rate of 146.6% over the past 5 years. Functionally, the area has 3.5% collector roads in damaged conditions, and land use settlement changes (2007-2016) of 29.4 %.

Socially, the area has the following characteristics: the structure of productive age (71.7%), percentage of occupants > 4 persons/occupancy (62%), percentage > 2 households/occupancy (35%), education percentage level of head of family < 9 years (47%), income level < IDR 1,500,000 (97%), type of work (50%

fishermen), dominant business sector (50% fishery), average land price (> IDR 1 Million/sq m), building ownership status (65% owned), legality of building ownership (15% have building permit), average house rent (IDR .2 million/year), residence status (9% migrants), length of stay (41% household has been living for > 37 years), crime rate 1-3 times/year (73%), flood vulnerability level (low), vulnerability level of fire disaster (medium), and vulnerability of social conflict (high).

3.1.4. Major components of social indicators

This phenomenon was clarified through the results of PCA analysis of social indicators in which 7 variables were mutually influential and formed a group of factors that played a role in triggering social slum, i.e. component 1 consists of income, occupation, and business field; component 2 consists of the number of occupants of the house, the number of households in one building; and component 3 consists of education and legality of building ownership (building permit). Component 1 is called the economic factor, component 2 is called the demographic factor and component 3 is a factor of human resource level (Table 2).

Table 2. Results of the Principal Component Analysis.

Rotated component Matrix[a]	Component		
	1	2	3
Education level	0.051	- 0.234	0.748
Income level	0.626	- 0.197	0.374
Number of family members (occupants)	- 0.056	0.903	-0.112
Number of households in 1 (one) building	- 0.118	0.920	0.057
Occupation	0.871	0.025	0.172
Business field	0.837	- 0.099	- 0.184
Legality of building ownership	0.078	0.195	0.840

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
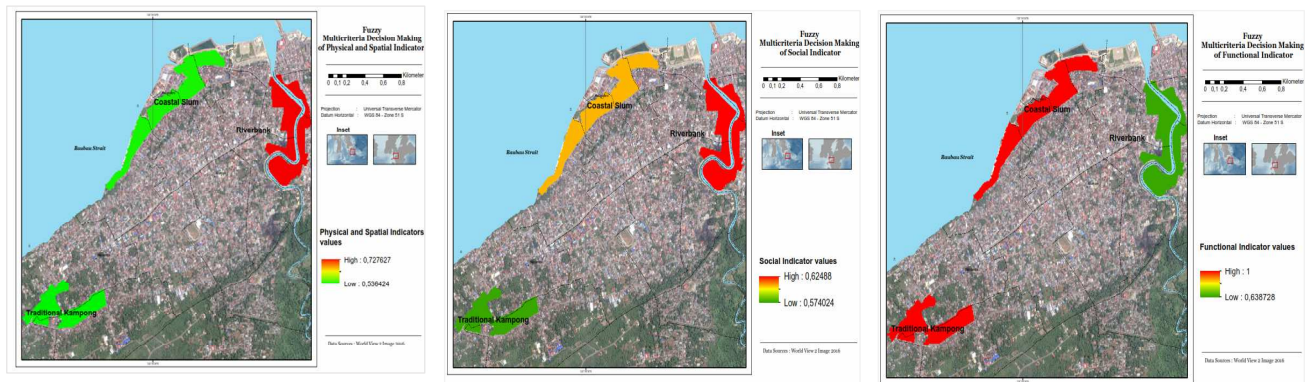a. Rotation converged in 4 iterations.

Fig. 3. Fuzzy-MCDM analysis of the three types of slums.

3.2. Priority of slum management planning

The priority slum areas individualized according to the physical and spatial indicators for management measures are those located on the

riverbanks (score 0.727), followed by slums on coastal areas (scores 0.669) and slums located in in traditional *Kampong* (scores 0.536). The priority rank is different when considering the functional indicators, as follows: first priority - slums on coastal areas (score 1.0) and

those in traditional *Kampong* (score 1.0) followed by the slums on the river banks (score 0.638). According to the social indicator, we found the same priority hierarchy of management, namely: slums on the riverbanks (score 0.6248) as first priority, followed by slums on the coastal areas (score 0.599) and slums in the traditional *Kampong* (score 0.574) (see Fig. 3).

Based on the combination of all indicators, we concluded that areas in most need to be prioritized for slum management are those on riverbanks (score 0.624), followed by the coastal areas (value 0.599) and the traditional *kampong* areas (value 0.536) (Fig. 4).
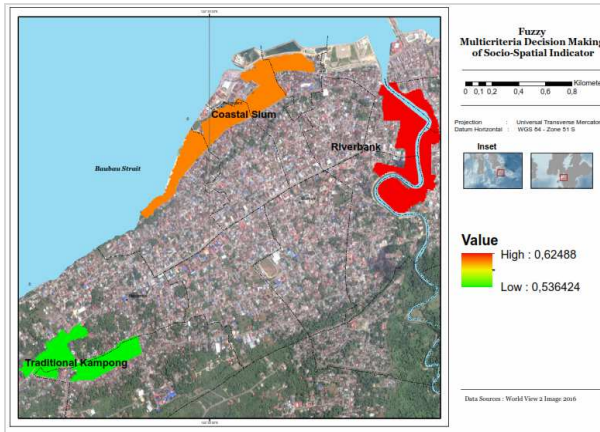

Fig. 4. Priorities of slum management model.

This research shows that using space for the development of trade and services area, has a social impact; in this case, the growth of slums can increase regional microeconomic growth.

The expansion of trade and service areas initiated by the government will ultimately be driven by the private sector. The private sector, which has large capital, will dominate the field of trade and services. However, in the case of low-income communities, this region becomes an attraction factor for them to open small-scale businesses. This pull factor also results in a high level of urbanization in trade and services. Thus, the emergence of slum areas cannot be avoided. Lefebvre (1991) described that space contained by policies and plans (master plan) often collide with the actual space conditions in the society [20]. Understanding the uniqueness of regional characteristics is crucial for building and developing policies that will decrease the negative impact of urbanization [54]. Physical and socio-economic conditions found in informal settlements are generally hazardous to health and tend to exacerbate the severe socio-economic conditions of the urban poor as well as environmental pollution and degradation of the local ecosystems [8]. Based on the results of prioritizing Fuzzy-MCDM, the slum settlement management model is formulated through the Driving Factor – Pressure – State – Impact – Response framework (DPSIR

Framework) and it is described in the following subsections.

3.3. Constructing the management model of slum areas

Slums on the river banks are the first set priority in which indicators that play the role of drivers of slum-dwelling levels in the region are physical-spatial and social indicators. Physical factors and spatial patterns next to the city centre shaping the Central Business District (CBD) also have close access to ports and river routes. In line with the research findings of Surtiani (2006), the strategic location supported by the determination of the area as a trade and service area led to the proliferation of activities of goods and services [16]. So, this area became the attraction of urbanization as a driving factor. As Jeong (2011) pointed out, slums are prevalent in commercial centres, causing population density in these areas. Both driving factors put pressure on population density, housing demands, availability of residential land, micro, small and medium economic activities and changes in the function of area utilization [55], [44]. The condition of the area leads to the characteristics of slum areas, such as land limitations and land differences for the development of settlements, thus affecting the relatively cheap land prices but high rents so housing density is even denser. Slums on the riverbanks are inhabited by migrants who work as small retailers with a relatively low level of income and education. In addition, the percentage of migrants inhabiting this area is quite large and is dominated by a high productive age structure. As indicated by some previous findings, low-income communities tend to remain in the downtown area, due to limited access to housing in accordance with their financial capabilities [23]. Residential stability and family size significantly affect investment and increase housing demand [56]. On the other hand, rural migrants make significant contribution to the overall urban economy and the local districts where migrant settlements are located [55]. These conditions will have an impact on the deterioration of the quality of the settlement environment, the deterioration of the quality of health, the vulnerability to floods and fires, crime, poverty, social conflicts including impacts on private investment. Private investment is the power of financiers who are able to change the function of urban space [57]. Therefore, the policy and program response that can be applied in this area is the policy to give priority to residents who live in the region to obtain the assistance of ownership of residential at affordable costs either through the program of Rusunawa (Vertical dwelling/Apartment) or financing scheme for simple housing located outside this area. In addition, community empowerment, and the acceleration of

community-based riverbanks development are expected to address social impacts in the region (Fig. 5).

Slums on coastal areas are the second priority. The functional driving factor is the level of accessibility based on road status and conditions. The social driving factor is characterized by the inability to use the function of the region, which triggers a low economic level and an increase in population. Both driving factors put pressure on population density, settlement needs, land use change, fishery port development and development of trade and service areas. These pressures have led to the conditions of high occupancy density, close kinship factors, relatively low building ownership legality, high housing density, low-rent housing,

increased size of settlements, including inappropriate housing growth and high land prices. The productivity of fishermen is low although the productive age structure and education level are high. This is marked by a decline in fisheries production from 5198.6 tonnes during 2014 to 4,080 tonnes in 2016 [3]. These conditions trigger environmental degradation, declining quality of human resources, high levels of social conflicts, which are also contributing to poverty. Unlike slum settlement, the direction (response) of settlement development for fishermen in this area should be applied based on the pattern of vertical housing development such as the development of fishery apartments located in coastal areas.
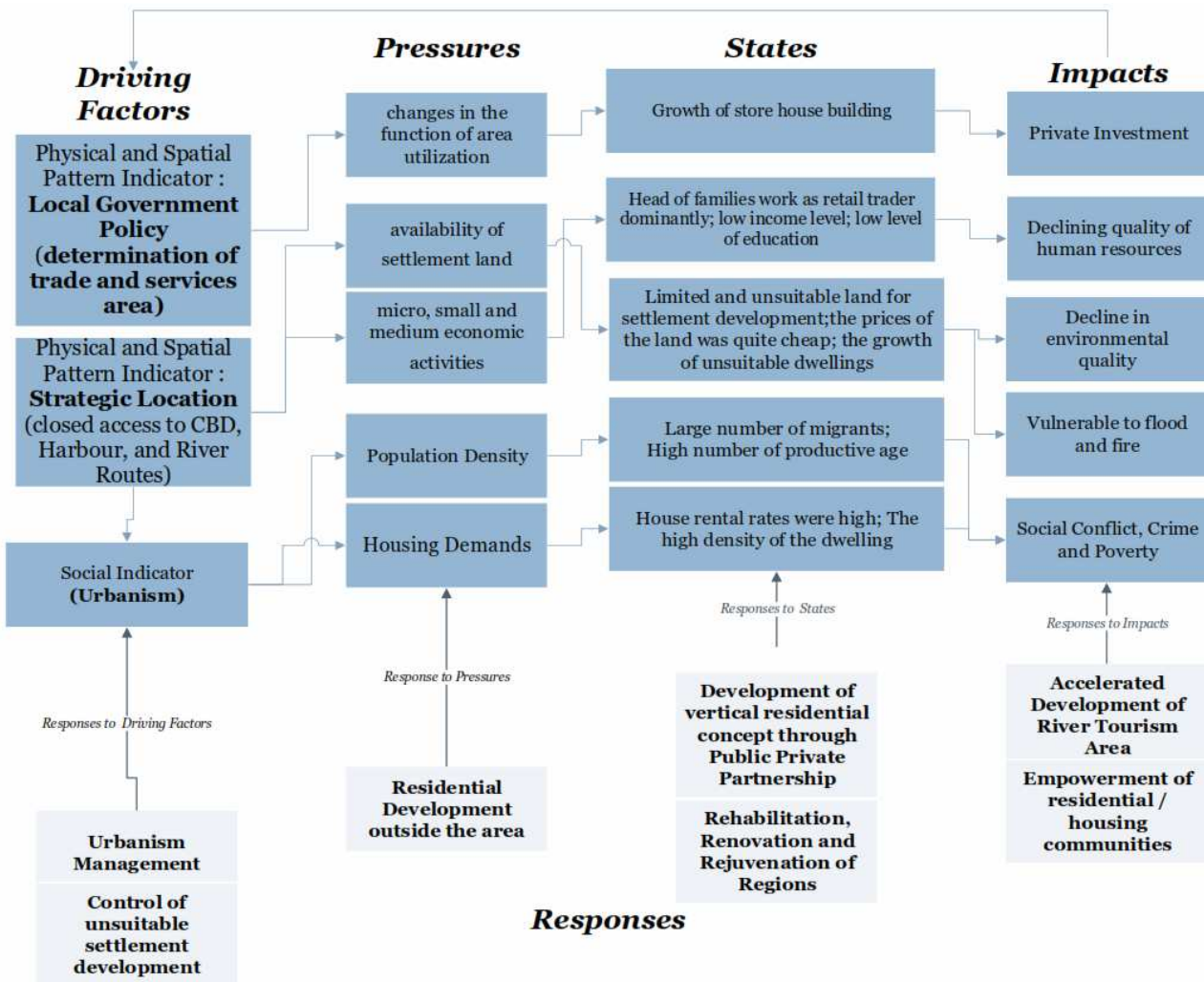

Fig. 5. DPSIR framework for slums on then riverbank (first priority).

In contrast to the research findings of Noorloos and Steel (2016) where social separation and exclusion were caused by the privatization and securitization of residential coastal settlements [58], the coastal area of Baubau City has been reclaimed but has not yet reflected the privatization of the investor/developer group. This is because the inhabitants of the coastal Baubau are mostly fishermen with a fairly high level of kinship. However, the

potential for this separation due to privatization needs should be considered in the next 10 to 20 years, if there is no alignment with the existence of fisherman settlements (Fig. 6).

Traditional slums are the third priority with functional indicators being the driving factor and the main handling locus for optimizing regional functions. These factors put pressure on land use, the development of regional functions and the culture of

traditional societies. Conditions (state) shown by the pressure include inadequate public utility infrastructure facilities, traditional house buildings inappropriate for habitation, land unsuitable for formal settlement development, and low level of settlement improvement.
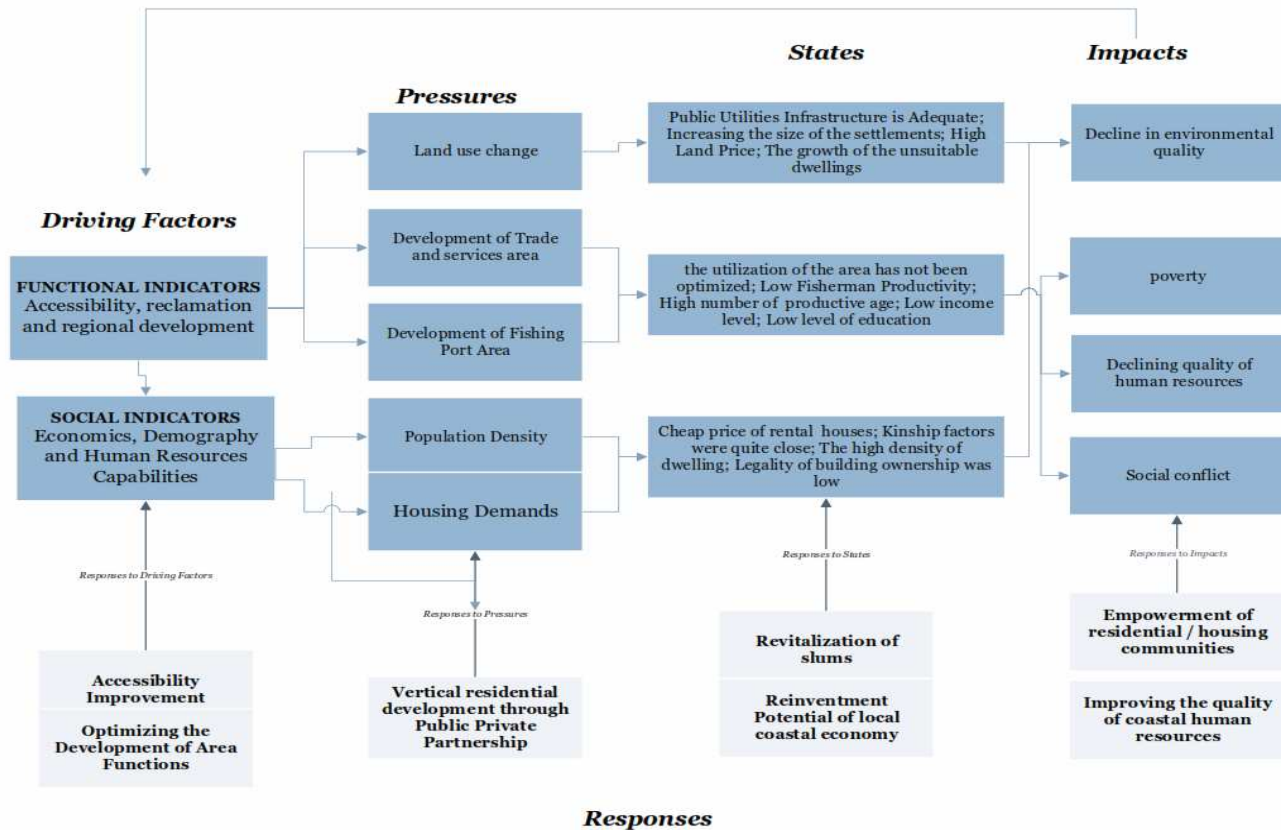

Fig. 6. DPSIR framework for slums on coastal areas (second priority).
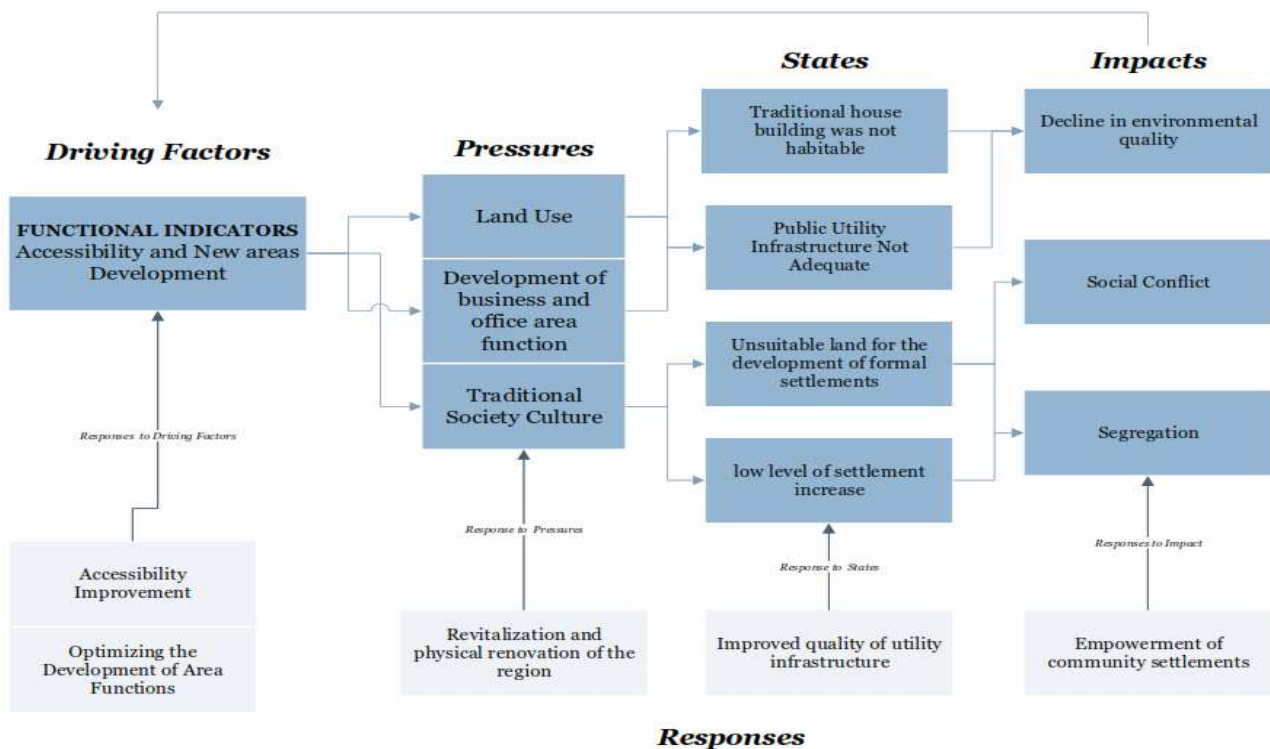

Fig. 7. DPSIR Framework for slums in traditional kampong (third priority).

These conditions have an impact on deteriorating environmental quality, social conflicts and potentially triggering segregation of settlements (impacts). Traditional community culture is an aspect

that needs to be observed in this area. Traditional culture has a very strong influence on the distribution of settlements [24]. In line with the research conducted by Špačkováat al (2016), ethnic differentiation will lead to socio-spatial segregation, especially if local infrastructure policies are not pro-localist in the region [49]. Spatial planning practices should be conducted at an ideal level, organized, created, shaped, restructured, and designed to carry out the activities of all inhabitants [57]. It seems that the pattern of regional development set by the government does not support the condition of the local community. Although the area is also designated as a home industry development area, the policy has not been synchronized with the pattern of slum area management. By looking at the economic characteristics of the residents living in the area, the policy model (response) in the form of home improvement could be held by the residents themselves. In addition, the actions should be taken based on its driving factors, to increase accessibility, optimize the development of regional functions and empower settlement communities (see Fig. 7).

4. CONCLUSION

Slum management should consider appropriate models based on socio-spatial characteristics of regional typology. Taking into account the socio-spatial characteristics in the handling and management of residential areas, it will facilitate the decision-making process of the method to be used. The conditions and socio-spatial characteristics show that phenomena of living space in society can shape and change urban space including slums. Meanwhile, the space contained in the form of spatial planning policies and handling of physical slums often clashes with the real conditions of the society.

Besides considering the physical settlement of slum areas, the underlying factors causing the emergence of slums need to be examined. By using a combination of Fuzzy-MCDM and DPSIR framework, this model is expected to be used by urban planners. Based on the results of the research, we propose the following suggestions:

1) the government should consider the socio-spatial factors behind the slum level according to the characteristics of each type of area;

2) programs/policies of slum area management should be synchronized with the policy of urban economic development and the policy of area development;

3) this research still needs to be continued by predicting the decline in the area of slums if this model is applied.. Coordinated multi-sectorial interventions and focus on handling and managing may be able to overcome urban problems and at the same time improve the urban welfare.

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