Spatial Integration and Urban Aglomeration in the Mamminasata Metropolitan Area

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Abstract: The rapid development observed in metropolitan cities affects the spatial interaction between regions and urban cluster settlements, leading to the fiscal growth of suburbs. This study is therefore, aimed to examine and analyze the spatial integration, urban agglomeration, economic growth and formation of the social territorial structures in the Mamminasata Metropolitan suburb using a combination of qualitative and quantitative approaches. Meanwhile, data were obtained through observation, surveys and documentation studies. Furthermore, the results showed that an elevation in the pattern of urban activities elicited changes parameters assessed which lead to economic growth in the suburbs of Mamminasata Metropolitan. This finding further indicated that spatial integration an urban agglomeration and the increase of activity, led to land tenure inequality and differences in adaptation between migrants and the local community. However, changes in spatial use influenced the structure and pattern of space, therefore, causing the formation of social territorial structures in the area.

Key words: Spatial integration, urban agglomeration, economic growth, suburbs, Mamminasata Metropolitan, integration, economic

INTRODUCTION

Globalization and urbanization are important aspects in the assessment and measurement of development and growth indicators in cities and metropolitan areas in Indonesia. This has brought a number of challenges to the fore, particularly those that require collaboration, innovation and capability development between nations (Oyinlola *et al.*, 2018). Furthermore, a strategy for sustainable urbanization, especially, the land use policy has been implemented in some cities for years (Lu and Ke, 2018). This has lead to economic growth, changes in spatial attributes and integration of urban activity systems and its relative dynamics are much higher than in the centres of the largest cities (Kowalczyka *et al.*, 2019). Urbanization is a worldwide process which occurs rapidly, accompanied by adverse consequences on the environment and people (Hamma and Petrisor, 2018). Moreover, city planners and policy makers have an important role to play in tightening the village-to-city land conversion system and curbing expansions (Zhang *et al.*, 2018). Furthermore, the growth of suburbs has an impact on the changes in the environmental ecology, economic productivity and land allocation for various activities which are the key points to optimize its functions and resource allocation (Wang *et al.*, 2018).

Economic polarization and spatial propagation of centrifuges have led to the shift of productivity function in farmlands in the Mamminasata Metropolitan suburbs. This influences the changing spatial physical characteristics of rural agriculture, towards socio-economic activities. Therefore, preservation efforts must be present in the plans by focusing on two policy tools-prime which include farmland preservation and its conversion quotas (Zhong *et al.*, 2018). The increase in developmental activities and conversion of productive agronomic lands as well as the strength of the fiscal linkage are influenced by distance, population explosion and growth of economic activities (Ye *et al.*, 2019). Furthermore, urban land laws in the post-revolutionary era are considered as one of the most influential factors in the expansion of a city (Masoumi *et al.*, 2018).

This shift in land use has changed the morphology and typology of Mamminasata Metropolitan suburbs, characterized by developmental complexity which is responsible for changes in the spatial structures and patterns both linearly and concentrically. However, regional land use morphology is altered adaptively with socio-economic developments which became the use transition at the appropriate time (Qu and Long, 2018). This influences urban expansion and development while structures should be seen from both physical and socioeconomic perspectives (Azhdari *et al.*, 2018). Furthermore, economic growths lead to spatial integration in the Mamminasata Metropolitan suburbs which resulted in urban sprawl, characterized by several negative impacts on social, economic and environmental sustainability in the metropolitan area and the complexity of spatial use (Kovacs *et al.*, 2019). The financial resources from the structural funds do not contribute to the occurrence of eliminating regional disparities, rather it strengthens their position towards the periphery (Matlovic *et al.*, 2018).

Spatial integration is in line with changes in its use and is also capable of increasing the flow of transportation, due to socio-economic activities, industrialization and modernization which has led to

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mobility differentiation between external transit systems and that of the local communities in the suburbs of Mamminasata Metropolitan. Moreover, low and high socio-economic groups significantly differentiate the direction of their movements, adding up to the separation within and between settlements on the outskirts of the city (Kristof, 2018). Development oriented towards the center of fiscal growth (physically, economically and socially) positively influences spatial interaction, therefore, causing the formation of a system of municipal activities (Surya, 2015b). This reveals the interaction between migration and the level of development, therefore, suggesting the importance of geographic location, besides the socio-economic factors (Lukic and Stoilkovic, 2017). Hence, suburbanization of the Mamminasata Metropolitan area altered the way migrants and local communities responded to the change stimuli. However, suburbanization caused by economic agglomeration leads to the inability of local communities to access the reproductive resources in suburbs spaces (Surya *et al.*, 2018a).

Urban clusters affected the formation of activity systems, due to the concentration of various socio-economic conducts, especially, those arising from market processes (Wang and Tomaney, 2019). The development of space allocated in the Mamminasata Metropolitan suburbs, characterized by the presence of large-scale settlements (116,976 ha), trade and service areas of 3,829 ha, education section of 31.33 ha and various social economic activities. Meanwhile, the intensity of growth was influenced by the low value of land in comparison with the city center and its use limitation. Furthermore, core metropolitan areas where land is scarce and its values are usually much higher than in peripheral areas (Mualam *et al.*, 2019). These development dynamics is characterized by economic agglomeration which affects the grouping of urban activities, community segmentation and socio-economic segregation in the suburbs of Mamminasata Metropolitan. However, spatial discrimination has an enormous impact on poverty (Rochovska and Rusnakova, 2018) as the settlements possess complex social-economic problems (Balogh *et al.*, 2018).

With reference to the several description above, the following considerations were assessed in this study the effect of increase in the pattern of urban activities on the utilization of the Mamminasata Metropolitan suburbs space and the influence of the urban activity pattern on the formation of the suburb's social structure. Thus, the study objectivesare to examine and analyze the increase in patterns of urban activity against changes in spatial use and the formation of social structures in the suburbs of Mamminasata Metropolitan.

MATERIALS AND METHODS

This research was carried out in three Mamminasata Metropolitan suburbs locations, namely Manggala,

Hertasning-Samata and Moncongloe-Pattalassang, all of which tend to develop into centers of economic growth, spatial integration and urban agglomeration. This investigation involved the use of a concurrent triangulation strategy approach where a combination of quantitative and qualitative techniques was applied simultaneously. Meanwhile, the reasons for this include describing the phenomena of spatial integration, changes in its use and systematic urban agglomeration, data collection, carried out through comparison with the possibility of combination and differentiation, merging of information which requires the need for interpretation and discussion. Furthermore, the three steps were conducted carefully and holistically based on the facts collected from the field, the individual or group characteristics and the relationship between the phenomena investigated (Creswell, 2016; Denzin and Lincoln, 2009).

The data collection methods include observation, used to measure and assess the spatial characteristics, space utilization, transportation systems and urban agglomeration in the Mamminasata Metropolitan suburbs. Survey which was conducted to evaluate the characteristics of the population, based on socio-economic conditions of the community and the inequality of land tenure, documentation was applied in the review of results obtained from several data sources including population data and density as well as the development of policies, related to development. Furthermore, the data analysis phase was initiated with the formulation of the basic hypotheses concept of the research, involving two stages which included, organizing research data where the information collected from field notes, surveys and observations were tabulated and categorized. Applying quantitative descriptive methods, based on the results of questionnaires and observations in order to create hypothesis which were then tested statistically on the established research variables.

Data analysis method: The methods of data analysis include, the qualitative analysis which was carried out through data collection, reduction, display and conclusion. These were further re-elaborated using domain evaluation, taxonomy, components and cultural themes. Quantitative analysis was used to prove the hypothesis of the research value. Therefore, both methods were used simultaneously to answer and prove the postulates including the effect of increasing patterns of urban activity on changes observed in the utilization of the Mamminasata Metropolitan suburbs space the effect of the pattern of these activities on the formation of its social structure.

Hypothesis testing was carried out by concurrent correlation using multiple regressions based on the characteristics and nature of the data which was ordinal. Furthermore, the evaluation of the effect (both direct and indirect) was carried out with the path analysis method using SPSS 23.00.

Fig. 1: Mamminasata Metropolitan suburbs as research objects; Satellite Imagery, 2018

RESULTS AND DISCUSSION

Development acceleration, marked by a shift in the functions of land use from productive agriculture to spatial and uneven distribution of development has an impact on the deterioration of environmental quality. This, alongside socio-economic development of local cities has reached or exceeded the carrying capacity of the environment and resources (Ye *et al*., 2019). However, changes in the space utility in the Mamminasata Metropolitan suburbs, lead to the positive association between an increase in population and fiscal activities, services, transportation infrastructure and large-scale settlements. Furthermore, this explosive population forces the city to become bigger and more complex than before, therefore, leading to an elevated demand for transportation and housing desires (Huang *et al*., 2019) as shown in Fig. 1.

Figure 2 shows a comparison between the various utility of Mamminasata Metropolitan suburbs space and three things that can be deduced regarding the process which include the increase in the conversion of farmland to settlements in Manggala of 29.70% (325.22 ha), between 2017-2018, the elevation in open land use of 26.51%, causing the high (intensive) land conversion experience. Furthermore, the location with dense urban form had a higher probability to contain more facilities for activities and services than a low-density built environment (Lang *et al*., 2019).

In addition, to the space polarization in Makassar city center, another factor that determines the change in land use includes the increase in population as a result of urbanization and suburbanization which is a measure adopted to meet the residential needs, socio economic activities and infrastructure, further influence the dynamics of the community. This increases the
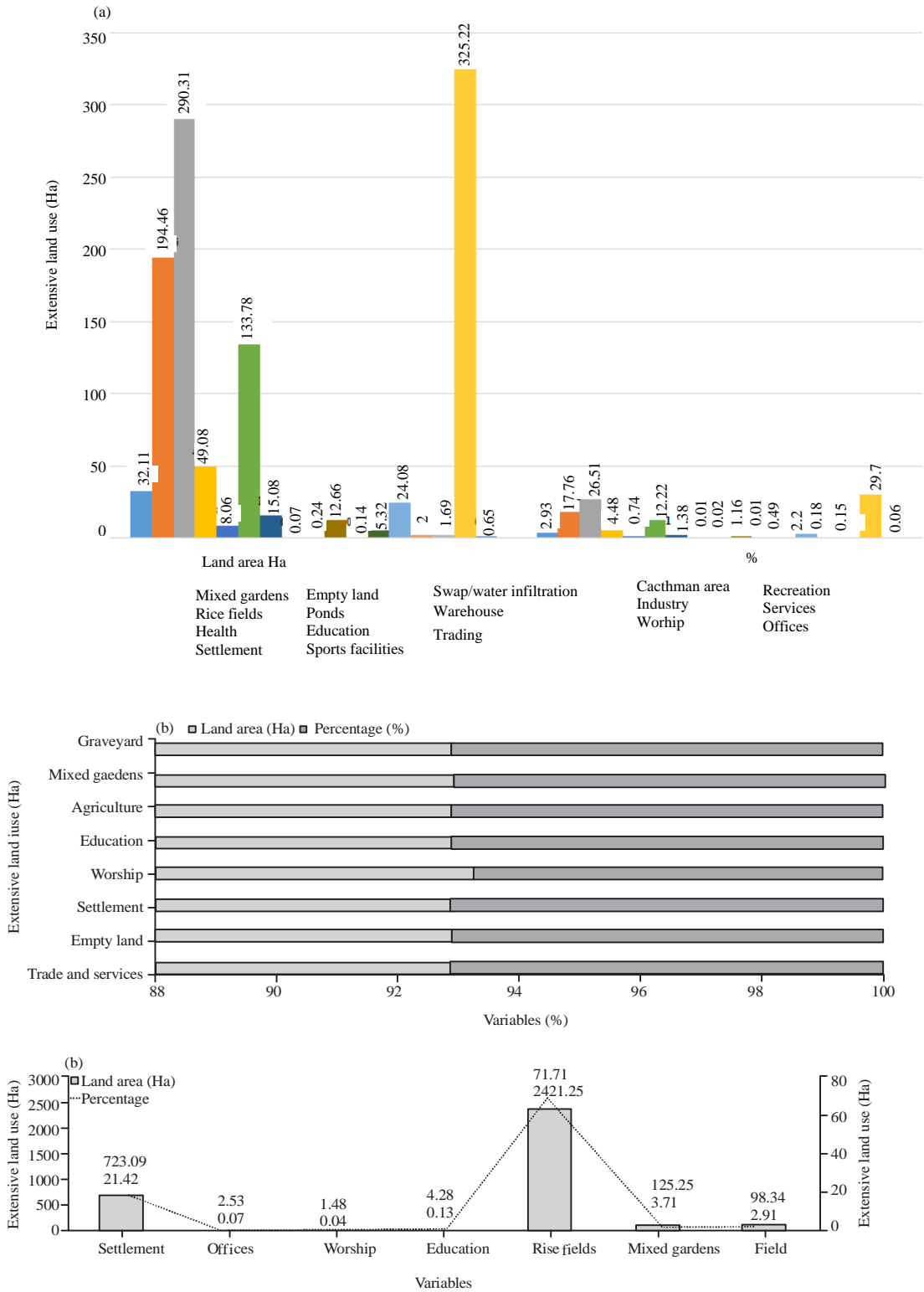
Fig. 2(a-c): The use of the Mamminasata Metropolitan urban suburbs space in 2010-2018 field observation results and Satellite Imagery, 2018, (a) Manggala urban suburbs, (b) Hertasning-Samata urban Suburbs and (c) Moncongloe-Pattalassang suburbs

concentration of people and critical services in cities which also upscale their exposure to acute shocks and long-term stresses such as floods, earthquakes, climate change or social dynamics (Hernantes *et al*., 2019).

The Hertasning-Samata suburbs showed an increase in land use to settlements of 47.93% (621.45 ha) which was intended to meet the needs of residential facilities for the urban population of Mamminasata Metropolitan. Hence, it can be concluded that urbanization leads to changes in spatial use and subsequently, environmental dilapidation in the Hertasning-Samata suburbs. However, ecological degradation gradually exhibits a limiting effect on socioeconomic subsystem, further restricting the improvement of the coordinated development (Yang and Hu, 2019).

The horizontal change in spatial use, characterized by the existence of urban activity functions which develops linearly, along the road corridor has a positive correlation with the dynamics of spatial transformation and economic growth of suburbs. Furthermore, the accessibility to the main roads, cities and services positively affected while the proximity to industrial lands most negatively influenced growth patterns (Dadashpoor *et al*., 2019). This is characterized by centralized urban activities in certain locations, leading to agglomerations and sprawl or shrinkage which indicates the expansion of the built area, therefore, causing environmental degradation in the city area (Patra *et al*., 2018). However, facts gathered from the field show that the Hertasning-Samata road corridor contributes to the increase in the rate of urbanization and local economic productivity which is positively associated with the conurbation that leads to the integration of the Metropolitan Mamminasata municipal system. Local economic factors and the spatial influence of the infrastructure network both contribute to the changes in urbanization to a varying extent (Zeng *et al*., 2019).

In 2018, Moncongloe-Pattallassang suburbs showed an increase in residential land by 723.09 ha. Thus, its spatial characteristics changed from rural to urban. Hence, physical configuration, population as well as socio-economic activities, significantly developed (Olajide *et al*., 2018).

Facts collected from the fields showed that about 80% of the 3, 376.22 ha of land in this area was initially productive plantations for agriculture which declined after changes in ownership and the initiation of development in residential areas. Therefore, the relationship between urban depreciation and economic growth provides important information for the government in the formulation of urban development policies (Zhang *et al*., 2019).

Increasing the farmland conversion rate directly encourages the development of linear and concentric municipal activities, therefore, causing a decrease in the environmental quality and morphology of urban suburbs

(Surya *et al*., 2018b). Meanwhile, the implications are observed through the changes in the structure and pattern of space as well as the presence of a considerable potential role in regional and rural development in the Mamminasata Metropolitan urban area (Rasoul, 2017). Furthermore, the alteration in spatial structure and its associated effects on the Moncongloe-Pattalassang suburbs led to a modification in the urban transportation system and increased connectivity between urban areas of Makassar city, the system of Maros regency and that of Gowa regency. However, this road network is one indicator which measures the sustainability of municipal deployment for existing and new urban areas (Ahmadzai *et al*., 2019). Furthermore, another follow-up uncoordinated and unplanned impacts that arise from these changes include environmental ecosystem changes, agricultural land cover and water catchment areas along the periphery of the metropolitan, leading to shrinkage of environmental resources (Nengroo *et al*., 2017).

The level of accessibility to these areas is basically measured by the availability of road infrastructure, transportation modes as well as distance and travel time. Hence, it can be concluded that the suburbs under study possess a fairly high level of ease of access. Furthermore, the facts gathered from the field shows that road corridors support the interconnection of these municipal areas including itsopenness through, Antang Raya road, Borong Raya road, Batua Raya road and Tamangapa Raya road and the Hertasning-Samatastreet corridor.

Figure 3 shows the condition of road infrastructure in the Mamminasata Metropolitan suburbs which are generally of two types, asphalt and concrete, measuring 8-12 m. However, facts gathered from the field shows that the transportation infrastructure facilitates accessibility from the city center to suburbs and vice versa. Hence, the functional socio-economic transport system is capable of accommodating the mobility, safety, comfort and convenience of all inhabitants (Soyinka *et al*., 2016). Therefore, Makassar city, Maros regency and Gowa regency have a fairly high intensity of mobilization.

Connectivity among these areas and inadequate policy implementation cause differences in resource distribution and disparity in their services based on population grouping (Ngoran and Xue, 2015). However, the facts obtained in the field show that the confluence of mobilization from Makassar city to Maros regency and Gowa regency places the Mamminasata Metropolitan suburbs in crossing line. Therefore, spatial strategic planning is an important factor in coordinating activities of individuals, groups, organizations as well as the private sector (Lalehpour, 2016).

The complexity of the dynamic allocation of space for socio-economic activities and urban agglomeration has led to the formation of functional areas of unity with the

(a) (b)

(c)

Fig. 3(a-c): Accessibility towards the Mamminasata Metropolitan urban suburbs

city concerned, comprising the central and also its suburbs (Suzuki and Nijkamp, 2018). There are two types of spatial expressions related to changes its use in the Mamminasata Metropolitan suburbs including linear pattern or manner and concentric physical development. Meanwhile, each of them is capable of standing alone or appearing simultaneously which means that centrifugal advancement shows the complexity of spatial expression. Therefore, the complexities of activity patterns tend to be sporadic are positively associated with the progress within slums mostly inhabited by local communities. Hence, the typology of these areas includes houses on stilts with inadequate infrastructure conditions (Surya and Saleh, 2018).

The process physical development of centrifuges has an undeviating positive contribution to the expansion of suburbs and also directly changing the spatial structure and pattern of the municipal space in Mamminasata Metropolitan. Furthermore, planning initiatives are also employed within social systems that are governed by the institution which also intervenes with and may further reconfigure these institutions, therefore, resulting in social changes (Rahman, 2016). This polarization also has a direct impact on the additional areas built towards economic urbanization because large metropolitan areas where the positive factors associated with it as well as the negative factors of diseconomization, coexist (Nakamura, 2013). Hence, alongside the main road corridor is the area, built towards Gowa regency and Maros regency and the linear pathway controls the growth of settlements and shopping centers by creating more linear over than concentric spatial patterns (Surya, 2015a).

Figure 4 shows the development of the Mamminasata Metropolitan suburbs space structure in both linear and concentric manner as those that occur along the main road corridors, generally include residential areas, shopping centers, services and economic activities. Field reports indicate the ease to carry out morphological control outside the built area which currently has an empty land with relatively flat topography (Surya, 2015c).

The physical spatial development of centrifuges and concentricity's was related to social, economic and cultural changes which occur in the life of infiltrative and expansive migrants as well as local communities. Meanwhile, field reports show that the Mamminasata Metropolitan suburbs were in transition from rural to municipal as a result of urbanization and suburbanization. This rapid process, alongside ad hoc and unplanned spatial distribution and allocation of spatial activities has an impact on decreasing the quality of the environment quality (Qiu *et al.*, 2015). Furthermore, the spatial structure leads to alterations and formation of social territorial structures due to differentiation and increasing scale of modern industrial society. However, there are three cases that underlie the process which include distribution, range and intensity of the relationship between migrants and local communities, differentiation of space functions and complexity of spatial organizations. Conversely, observed facts show these changes to possess a positive influence on the social relationship between migrants and local communities, towards economic alterations (Surya *et al.*, 2018 c). Therefore, the scale of social transformation increases and is marked by the vicissitudes in the lifestyle of the urban community (Surya, 2016 b).

Characteristics of urban economic suburbs: The acceleration in economically oriented growth of the
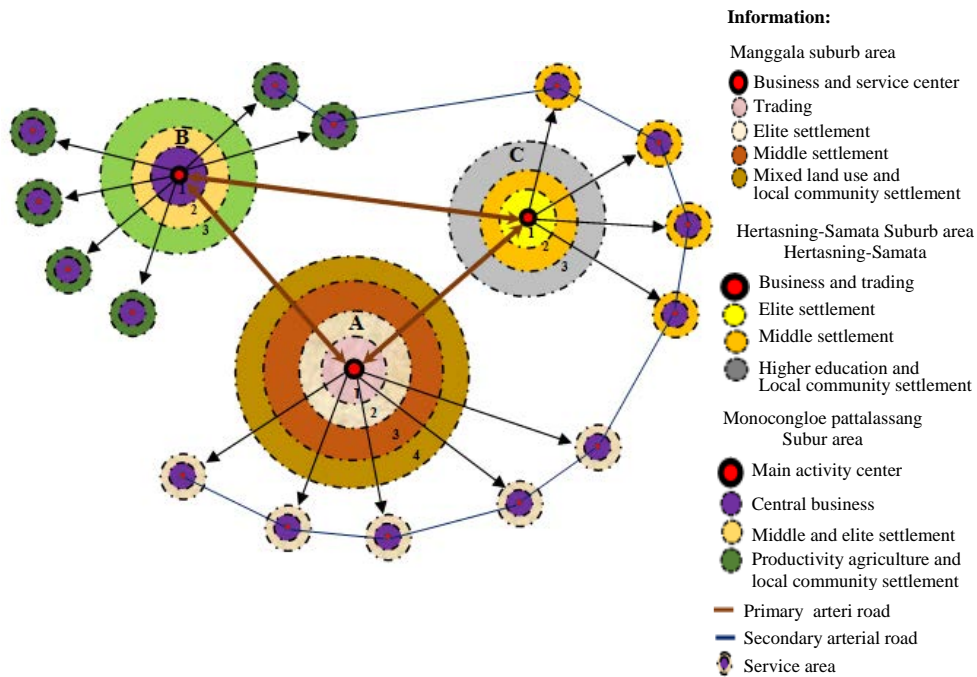
Fig. 4: Comparison of the Mamminasata Metropolitan suburbs space structure analysis result

Mamminasata Metropolitan suburbs also affected changes in land ownership status. These increased the price at a function of its position and location and the comparison is shown in Fig. 4.

Figure 5 shows a comparison of the price of land in the urban suburbs of Mamminasata Metropolitan and three things that can be explained in relation to the changes in the suburbs observed include its value in the Manggala is IDR 1,000,000-5,000,000 m^{-2}, influenced by the location, distance and position, the price of plots in Hertasning-Samata was elevated from Rp. 50,000 m^{-2} to Rp. 1,000,000 within the built settlement and Rp. 4, 000,000 m^{-2} for those along the main road corridor. Furthermore, the amount for land in Moncongloe Pattalassang is Rp. 1, 000,000-3,000,000 m^{-2}. Hence, it can be concluded that its value and price in the Mamminasata Metropolitan suburbs was largely determined by the development of the economic activity, meaning that the closeness of land to these functions, positively correlates with the elevation of value and vice versa. However, differences between the city centers and peripheral locations indicate the important role sites play in combination with income and governance factors (Acolin *et al.*, 2019).

The rapid acceleration of development has a positive correlation with changes in social formation and interaction within the urban suburbs of Mamminasata Metropolitan in response to the stimulus of environmental change. Furthermore, the adaptation process, carried out by the local community, towards infiltrative migrants

involved the provision of accommodation in a residential environment and their willingness to build mutually beneficial cooperation. Hence, it is important for the population to understand population-environmental relations (Ma and Hofmann, 2019). Information from the field showed that mutual acceptance among communities possesses the capacity to strengthen social relations, leading to welfare improvement. Therefore, interactive values are generated from the meeting point of motivation which develops towards social relations (Mohamed *et al.*, 2019).

Different conditions are shown in the process of migrant social adaptation which is dominantly geared towards land tenure, space reproduction and local community empowerment as workers. Therefore, it can be concluded that changes in spatial use determine social formation and differentiation of economic business activities, towards inequality in land tenure by disregarding various policy contributions towards inequality in developing countries (Forster *et al.*, 2019). Furthermore, the discriminatory relationship between low and middle income earners causes financial inequality (Sulemana and Kpienbaareh, 2018). Conversely, the simultaneous coexistence of production modes, characterized by job differentiation, leads to differences in the processes of social interaction and adaptation between local communities and migrants in the urban suburbs of Mamminasata Metropolitan.

The differences observed in patterns of social relationships, based on the type of business, work orientation and fragmentation in the lives of local
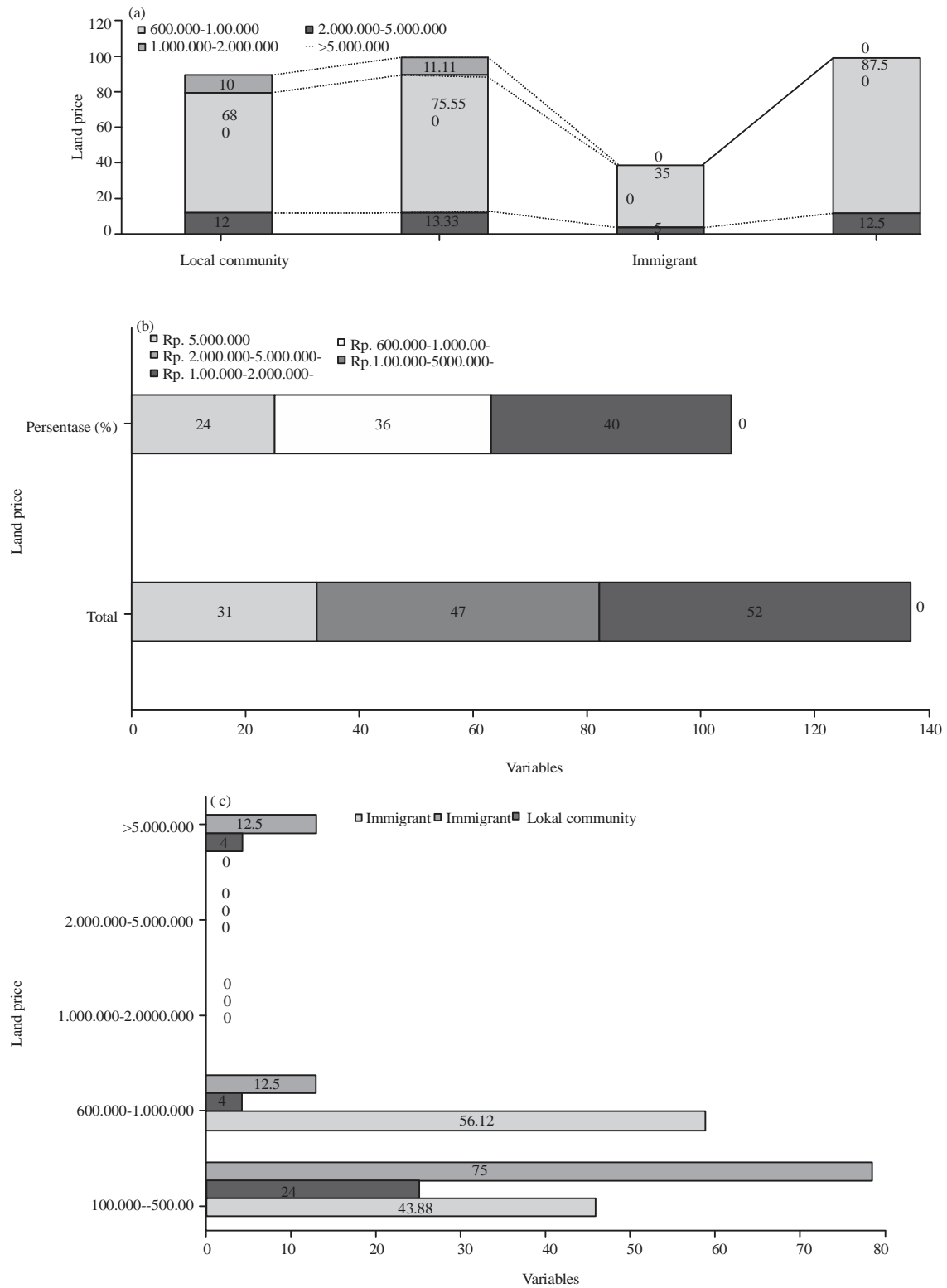
Fig. 5(a-c): Effect of increased patterns of urban activities on changes in the utilization of the Mamminasata Metropolitan suburbs space analysis result, (a) Land price in Manggala suburn, (b) Land price in hertasning Samata and (c) Land price in Moncongloc-Pattalassang

Table 1: Matrix of differences in social relations based on local community work orientations

Characteristics of social relations

Business activities	Pre-changes in spatial use	Social relations	Post-changes in spatial use	Social relations
Informal sector (street vendors)	Relations with the core family Relationship with close relatives Relationships with local community groups	High intensity and reciprocity and mutual benefit	Relationship with close relatives Relationship with business relations Relationships with community groups Relationship with consumers (buyer)	Low frequency Reciprocity and mutual benefits through agreements that are built Low frequency only lasts in certain situations Mutually beneficial (mutualism symbiosis)
Parking attendants at economic activity centers	Relations with the core family Relationship with close relatives Relationships with local community groups	High intensity is reciprocal and helps each other based on togetherness values	Relationship with close relatives Relationship with work relations Relationships with community groups Relationship with visitors	Low frequency Mutually beneficial and reciprocal cooperation relationships One-way nature to maintain harmonization of local community groups Mutually beneficial
Building construction	Relations with the core family Relationship with close relatives Relationships with local community groups	High intensity is reciprocal and helps each other based on togetherness values	Relationship with work relations Relationships with community groups Relationship with close relatives Relations with building supervisors	High frequency and mutual reciprocity High frequency and is related to the profession that is lived and fosters mutual solidarity High frequency by involving families as workers and reciprocal One-way (control over work)
Formal workers	Relations with the core family Relationship with close relatives Relationships with local community groups	High intensity is reciprocal and helps each other based on togetherness values	Relationship with close relatives Relationships with community groups Relationship with work relations Relations with management Relationship with visitors	Low frequency Low frequency and only takes place in certain situations High frequency, mutually supportive and reciprocal Class contradictory relationship High frequency and reciprocal

Result analysis

Tabele 2: Changes in social stratification in local communities

Old social stratification	New social stratification
The social coating is characterized by land ownership The developing social strata are characterized by an economic class structure based on two strata classification namely farm laborers and land owners Social relations are a small takeover The power structure is lineage Variation in wealth is indicated by ownership of means of production and ownership of land	The social coating is characterized by the complexity of the activities of local communities The developing social strata are characterized by an economic class structure based on strata classification namely economic enterprises, building construction workers, urban formal workers and subsistence farmers Social relations are groups of workers The power structure is based on the achievements of the local community Variation in wealth is not based on land ownership but is based on the ability of local community businesses to respond to a stimulus for environmental change

communities is shown in Table 1. Hence, it can be concluded that changes in the use of space in the Mamminasata Metropolitan suburbs indicates differences in the type of social and economic relations built in the local community whose pattern was originally characterized by gemeinschaf or tight social ties which changed towards gesselschaft or voluntary and contractual public ties (Surya, 2015b). Rapid revolutionary changes influence the formation of new communal territorial structures in the Mamminasata Metropolitan suburbs based on stratification and economic background.

Interpretations that can be proposed based on the data on Table 2 include the social coating that develops in the structure of local communities leads to complexities that are based on land ownership while the changes observed in stratification was influenced by the work and land ownership system as well as the related patterns of employment. This means that the nature of change is dominantly influenced by the presence of capitalism which acts as an agent of change, trusted by the government. However, the complexity of social coating leads to a gap in the tenure of spatial reproduction and income inequality and evidence shows a positive association with urbanization (Sulemana *et al.*, 2019). The developing social strata are influenced by changes in spatial use and differences in the orientation of local community work. Public relations are strongly influenced by forms of cooperation, built into the structure of local communities. The structure of power in terms of social status is not based on lineage but abilities and
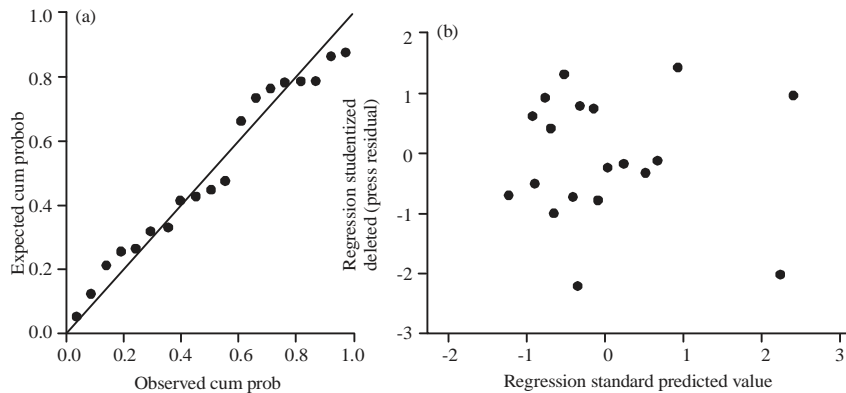
Fig. 6(a, b): Effect of patterns of urban activities on the changes in the utilization of the Mamminasata Metropolitan suburbs space

Table 3: Effect of increased activity on changes in spatial use of the Mamminasata Metropolitan suburbs model summary

Modeles	R	R^2	Adjusted R^2	SE of the estimate
1	0.918[a]	0.842	0.684	5.213
2	0.914[b]	0.836	0.705	5.037
3	0.906[c]	0.821	0.707	5.022

Predictors: (Constant), investment/capital flows, economic activities, social activities, facilities and infrastructure, services, availability of land, housing and settlements, informal economy, transportation system; [a] Predictors (Constant), investment/capital flows, economic activities, social activities, facilities and infrastructure, services, land availability, informal economy, transportation system; [b] Predictors (constant), investment/capital flows, economic activities, social activities, facilities and infrastructure, services, land availability, transportation systems

achievements instead. Variations in wealth are based more on the ability to respond to a stimulus for environmental change. Furthermore, the five parameters cause the social coating of the community in the urban suburbs of Mamminasata Metropolitan.

Spatial integration and economic growth: The development of spatial integration and economic growth contributes positively to the intensity of business centers, large-scale settlements, services, offices, education and other socio-economic activities. This framework and arrangement of retail planning require the support of political decision making (Brunetta *et al*., 2018). Facts gathered from the field showed that this expansion was followed by the dynamics of urban informal fiscal activities carried out by local communities, alongside formal economic events, causing urban sprawl based on the comparison between the rate of population growth and that of built-up areas (Buchori *et al*., 2017). The results of statistical tests are shown in Table 3 and Fig. 4.

The backward method the best regression equations obtained: Y = 20,150-0.439X1+1.159X2+0.221X3-0.210X4-0.560X5+0.642X5-0.749X6; R_{square} = 0.821. This was obtained by removing the variables of housing, settlements and the informal economy in order to consider the significant effect of independent variables on the spatial use.

Table 3 and Fig. 6 show the effect of increasing patterns of urban activity on changes in spatial use in the suburbs of Mamminasata Metropolitan, some of which are explained based on the results of the analysis which include: R^2 = 0.698 = 69.80% characterized by 9 independent variables including investment/capital flows, economic and social activities, facilities and infrastructure, services, availability of land, housing and settlements, informal economy and transportation system. However, the remaining (100-69.80% = 30.20%) is explained by other reasons, outside the scope of this model. The results of the ANOVA F test table obtained a count value of 5,872 with a probability of 0.005 which indicates the probability of using regression models to predict changes in spatial use. This can also be applied in the explanation of the nine independent variables, jointly influence the utilization of space in the Mamminasata Metropolitan suburbs. Furthermore, out of the nine included in the regression model, the following were not significant: economic activity variables = 0.080, social activities = 0.055, housing and settlement = 0.528 and formal economy = 0.336 as seen from the probability of significance while the availability of land, transportation systems, services, facilities and infrastructure and investment/capital flows were significant at 0.05. Hence, they are concluded to have an influence on spatial use.

From the analysis of the results, the following can be explained if the independent variable is considered
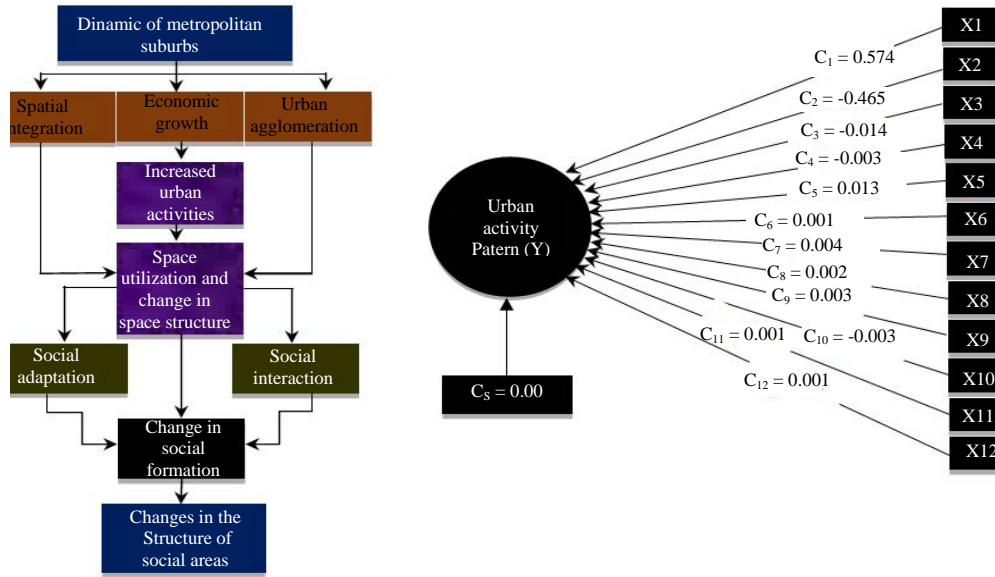
Fig. 7: Effect of patterns of urban activities on the formation of the structure of social areas analysis result

constant, the average spatial use is 27,116. The regression coefficient of land availability, reading -0.404, indicates that every 1000 added, reduces spatial use by 404 units. The transport system test value of 1.139, states that subsequent addition of 1000 increases spatial use by 1.139 units. The increase in service by 1000 reduces the use by 526 units as seen in the coefficient value of - 0.526. (d) coefficient of facilities and infrastructure of 0.643 states that every addition of facilities and infrastructure equal to 1000 will add spatial use of 643 units. The investment/capital flow regression coefficient of -0,694 states that every additional investment/capital flow of 1000 will reduce spatial use by 694 units. Thus it can be concluded that the pattern of urban activity that continues to increase in line with economic growth will trigger spatial integration and change in spatial use in the urban suburbs of the Mamminasata Metropolitan and have a direct influence on the surrounding urban and rural areas.

The best regression model was obtained by removing the variables of housing and settlements as well as the formal economy in order for only the independent variables, considered to significant influence spatial use variables. This assessment was carried out in 3 stages which include analysis using the enter method, meaning that all variables are included in the model in order to produce a regression model: $Y = 27,549-0.411X1+1.151X2+0.186X3-0.210X4-0.060X5 +0.546X6-0.096X7+0.644X8-0.701X9$; $R_{square} = 0.842$. Analysis with the backward method, through the issued housing and settlement variables (Probability of F-to remove> = 0.100) from the model in order to form the regression: $Y = 23,473-0.425X1+1.155X2+0.193X3-0.228X4-0.558X6+ 0.105 X7+0.633X8-655X9$; $R_{square} = 0.836$ and . Analysis with the backward method, through

the allotment of housing and settlement as well as informal economy variables (Probability of F-to-remove > = 0.100) from the model, so that, a new regression model is formed: $Y = 20,150-0.439X1+1.159X2+ 0.221X3-0.210X4-0.560X6+0.642X8-0.749X9$; $R_{square} = 0.821$.

The agglomeration of urban suburbs: Economic growth which runs parallel to spatial integration in the Mamminasata Metropolitan suburbs, causes changes in spatial attributes, morphology, typology and rural characteristics towards urbanization. This growth produces extensive ecological and environmental problems both in municipal and suburban areas (Tan *et al*., 2014). Therefore, the results of the analysis carried out on the effect of these activity patterns on the formation of social territorial structures in the studied region are shown in Table and Fig. 6.

Structural equations:
$Y = 0.574 X1+(-0.465)X2+(-0.014) X3+ 0.003X4+ 0.013X5+0.001 X6+0.004 X7+0.002 X8+0.003 X9+(-0.003) X10+0.001 X 11+(-0.001) X12 +0\varepsilon$; $R_{square} = 1.000$.

The results of the analysis in Table 4-10 and Fig. 7, explains three points which include (i) the magnitude of the coefficient terminated R square or $R2Y \times 1 \times 2 \times 3, ... , \times 13 = 1.000$ as well as the influence of other variables = $\sqrt{1-1} = 0\%$ which means that there is no influence or contribution from other affiliates (0%). Thus, it can be concluded that the studied parameters directly influence the formation of social territorial structures which develop in the Mamminasata metropolitan suburbs, the results

Table 4: Effect of increased activity on changes in spatial use of the Mamminasata Metropolitan suburbs ANOVA[a]

Models	Sum of squares	df	Mean square	F-value	Sig.
Regression	1305.111	9	145.012	5.336	0.010[b]
Residual	244.573	9	27.175		
Total	1549.750	18			
Regression	1295.923	8	161.990	6.384	0.004[c]
Residual	253.761	10	25.376		
Total	1549.684	18			
Regression	1272.276	7	181.754	7.207	0.002[d]
Residual	277.408	11	25.219		
Total	1549.684	18			

Dependent variable: spatial use; [a]Predictors: (Constant), investment/capital flows, economic activities, social activities, facilities and infrastructure, services, availability of land, housing and settlements, informal economy, transportation system; [c] Predictors: (Constant), investment/capital flows, economic activities, social activities, facilities and infrastructure, services, land availability, informal economy, transportation system; [d] Predictors: (Constant), investment/capital flows, economic activities, social activities, facilities and infrastructure, services, land availability, transportation systems

Table 5: Effect of increased activity on changes in spatial use of the Mamminasata Metropolitan suburbs coefficients[a]

	Unstandardized coefficients		Standardized coefficients		
Models	B	SE	Beta	t-values	Sig.
1 (Constant)	27.549	20.286		1.358	0.208
Improving land	-0.411	0.103	-0.868	-3.978	0.003
Transportation system	1.151	0.196	1.592	5.872	0.000
Economic activity	0.186	0.099	0.292	1.879	0.093
Social activities	-0.210	0.101	-0.318	-2.081	0.067
Housing and settlement	-0.060	0.103	-0.101	-.581	0.575
Services	-0.546	0.170	-0.663	-3.217	0.011
Informal economy	-0.096	0.113	-0.150	-.844	0.421
Infrastructure	0.644	0.118	1.044	5.472	0.000
Invesment/capital flows	-0.701	0.225	-0.718	-3.115	0.012
2 (Constant)	23.473	18.395		1.276	0.231
Improving land	-0.425	0.097	-0.896	-4.356	0.001
Transportation system	1.155	0.189	1.598	6.104	0.000
Economic activity	0.193	0.095	0.302	2.023	0.071
Social activities	-0.228	0.093	-0.345	-2.447	0.034
Housing and settlement	-0.558	0.163	-0.678	-3.430	0.006
Services	-0.105	0.109	-0.164	-.965	0.357
Informal economy	0.633	0.112	1.026	5.637	0.000
Infrastructure	-0.655	0.204	-0.671	-3.218	0.009
Invesment/capital flows	20.150	18.014		1.119	0.287
3 (Constant)	-0.439	0.096	-0.927	-4.576	0.001
Improving land	1.159	0.189	1.602	6.142	0.000
Transportation system	0.221	0.090	0.346	2.441	0.033
Economic activity	-0.210	0.091	-0.317	-2.307	0.042
Social activities	-0.560	0.162	-0.681	-3.457	0.005
Housing and settlement	0.642	0.112	1.042	5.759	0.000
Services	-0.749	0.178	-0.768	-4.213	0.001
Informal economy	27.549	20.286		1.358	0.208
Infrastructure	-0.411	0.103	-0.868	-3.978	0.003
Invesment/capital flows	1.151	0.196	1.592	5.872	0.000

Dependent variable: use of space

Table 6: Effect of increased activity on changes in spatial use of the Mamminasata Metropolitan suburbs excluded variables[a]

					Collinearity statistics
Models	Beta in	t-values	Sig.	Partial correlation	Tolerance
Settlement and housing	-0.101[b]	-0.581	0.575	-0.190	0.577
Settlement and housing	-0.122[c]	-0.715	0.491	-0.220	0.588
Economic in formal	-0.164[c]	-0.965	0.357	-0.292	0.566

obtained from the ANOVA table showed F values of 4,707,805 with probability values (sig.) = 0.000. Moreover, if this value is <0.05, it means that simultaneously, the variables studied and involved in the model, influences the pattern of urban activity and the value of coefficients obtained as sig. <0.05 include variable space structure and pattern as well as activity system with their respective values, encompassing space

Table 7: Effect of urban agglomeration on formation of social area structures model summary

					Change statistics				
Models	R	R^2	Adjusted R^2	SE of the estimate	R^2 change	F change	df1	df2	Sig. F change
1	1.000[a]	1.000	1.000	0.181	1.000	4707.805	13	16	0.000

Predictors: (Constant), social status, social interaction, economic productivity, space structure, social adaptation, availability of residential facilities, economic relations, city service access, social stratification, social relations, land tenure, activity system, space pattern

Table 8: Effect of urban agglomeration on formation of social area structures model summary ANOVA[a]

Model	Sum of squares	df	Mean square	F-value	Sig.
Regression	2014.840	13	154.988	4707.805	0.000[b]
Residual	0.527	16	0.033		
Total	2015.367	29			

[a]. Dependent variable: urban activity pattern; [b] Predictors: (Constant), social status, social interaction, economic productivity, space structure, social adaptation, availability of residential facilities, economic relations, city service access, social stratification, social relations, land tenure, activity system, space pattern

Table 9: Effect of urban agglomeration on formation of social area structures model summaryccoefficients[a]

	Unstandardized coefficients		Standardized coefficients		
Models	B	SE	Beta	t-values	Sig.
(Constant)	-0.182	0.887		-0.205	0.840
Space structure	1.016	0.016	0.574	64.123	0.000
Space pattern	0.984	0.019	0.465	51.758	0.000
Activity system	-0.024	0.011	-0.014	-2.153	0.047
Social relations	-0.005	0.011	-0.003	-0.499	0.625
Economic relation	0.026	0.013	0.013	1.980	0.065
Land tenure	0.000	0.004	0.001	0.119	0.907
Social adaptation	0.003	0.003	0.004	0.738	0.471
Social interaction	0.003	0.010	0.002	0.283	0.781
Economic productivity	0.002	0.005	0.003	0.432	0.671
City service access	-0.002	0.004	-0.003	-0.420	0.680
Social stratification	0.002	0.010	0.001	0.158	0.876
Availability of residential facilities	-0.001	0.006	-0.001	-0.245	0.809
Social status	-0.002	0.003	-0.004	-0.729	0.476

Dependent variable; Urban activity pattern

Table 10: Summary of complete structure path coefficient results

Variables influence	Directly	Indirect effects through variables												Total influence
		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	
X1 to Y	0.574	-	0.267	0.008	0.002	0.007	0.001	0.002	0.001	0.002	0.002	0.001	0.001	0.85
X2 toY	0.465	0.267	-	0.007	0.001	0.006	0.000	0.002	0.001	0.001	0.001	0.000	0.000	0.74
X3 to Y	-0.014	0.008	0.007	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.03
X4 to Y	0.003	0.002	0.001	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.01
X5 to Y	0.013	0.007	0.006	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.03
X6 to Y	0.001	0.001	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.00
X7 to Y	0.004	0.002	0.002	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.01
X8 to Y	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.00
X9 to Y	0.003	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.01
X10 to Y	-0.003	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.01
X11 t oY	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000	0.00
X12 to Y	-0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	0.00
X13 to Y	-0.004	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.01

structure (X1) = 0.000, spatial pattern (X2) = 0.000 and system activity (X3) = 0.047. This means that the variable significantly affects the pattern of urban activity in the studied region. Conceptually, based on the assessment of the effects of urban activity patterns on the formation of social territorial structures, economic growth, spatial integration and urban agglomeration in municipal suburbs confirms changes in spatial structure and patterns as well as the integration of surrounding areas and changes in social adaptation between migrants and local communities. This further led to the modification of communal formation, towards that of the Mamminasata Metropolitan structure Table 4-10.

CONCLUSION

Based on the results obtained from the discussion, the following conclusions were derived. The tendency of developing Mamminasata Metropolitan suburbs towards economic growth is characterized by the direct influence

of significant spatial use changes on integration and urban agglomeration. Therefore, the elevating intensity of development affects the integration of the studied system including the surrounding rural areas which has also triggered an increase in population, augmented economic productivity, morphological changes and typology of suburbs. Conversely, the improved pattern of urban activity cause changes in spatial structure and patterns, impacts on inequality of land tenure as well as the differences recorded in adaptation between migrants and local communities which begin with alterations in communal interaction and adaptation and also changes in social formation, towards the creation of regional suburb structures in Mamminasata Metropolitan.

The economic growth observed in the studied area has a positive contribution to the development of business centers, large-scale settlements, services, offices, education and socio-economic activities. Hence, developing centers of fiscal interests have a direct influence on its development in formal urban areas. Moreover, its coexistence with the official economy of these areas causes municipal sprawl to be characterized by the complexity of spatial use. However, in-formal events, development was due to the existence of local communities in response to a stimulus for environmental change which also directly influences transportation and movement systems within Mamminasata Metropolitan suburbs.

Urban agglomerations occurring parallel to spatial integration causes an increase in the pattern of developmental activities and the subsequent integration of urban systems. Therefore, changes in spatial use and its amalgamation impacts on the attributes, morphology and typology observed, towards inequality in land tenure. Furthermore, modification of spatial structures and patterns, characterized by elevated land values and prices lead to differentiation of business deeds between migrants and local communities.

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