BHUMI: Jurnal Agraria dan Pertanahan
Volume 9, Number 1, May 2023
ISSN: 2442-6954
e-ISSN: 2580-2151
Doi: https://doi.org/10.31292/bhumi.v9i1.552

Study on the Implications of the Function and Role of Urban Areas on Population Projections in the Formulation of Detailed Spatial Planning (RDTR)

Anthony P Nasution[1], Anna Karenina[1], & Forina Lestari[1*]
[1]Program Studi Perencanaan Wilayah dan Kota, Institut Teknologi Indonesia
Jl. Raya Puspitek, Setu, Kec. Serpong, Kota Tangerang Selatan, Banten, Indonesia
[*]Coresponding Author: forina.lestari@iti.ac.id

Received: June 14, 2022; Reviewed: March 29, 2023; Accepted: June 23, 2023

Abstract: The initial and crucial stage in the spatial planning process involves identifying the function and role of a region or area. This step sets the course, establishes goals, and defines the parameters for the subsequent spatial arrangement planning. Currently, the expedited development of Detailed Spatial Planning in Indonesia is closely tied to the function and role of an area, which is influenced by numerous factors that require careful consideration. This study aims to compare population projections using conventional projection methods with projections that take into account the functions and roles of the region. This study uses population projection analysis, population development scenarios, and spatial availability analysis to assess the differences in spatial projections that can accommodate population growth. The calculations unveiled a significant disparity between population-based projections and projections that consider the functions and roles of a city/area. This input is crucial for assessing spatial needs and the necessary infrastructure and supporting facilities that will be incorporated in the formulation of the structure and spatial patterns of Detailed Spatial Planning. Hence, when estimating population projections, it is essential for planners to consider projections that incorporate the functions and roles carried out by the area.

Keywords: detailed spatial planning, functional implications, roles, population projections

INTRODUCTION

Defining the function and role of a region or area is a fundamental element that underpins the process of spatial planning (Moseley, 2013). The process of defining the function and role of a region or area is influenced by various factors and involves multiple parties (Tulumello et al, 2020). In terms of governance and development policies, different stakeholders (government levels and sectors) have their own interests they seek to fulfill in a particular region (Faludi, 2013). Occasionally, the policies of various parties work together harmoniously, resulting in successful development in the intended region/area. However, there are instances where the anticipated synergy does not occur, leading to the non-fulfillment of the designated functions and roles. An example of this is the large-scale conversion of agricultural land into housing areas, which has the potential to threaten food security. This happens because the definition of the region's function and role is still vague and abstract. Therefore, it is necessary to provide a more detailed description of the

interrelationships between the functions and roles of regions/areas. The effects, influences, and implications resulting from the establishment of functions and roles should be clarified and comprehended by all stakeholders during the planning process, particularly when calculating population projections. Nevertheless, population projections will influence the spatial needs of a specific region/area, especially in the current era of Detailed Spatial Planning (RDTR) (Hamidah et al, 2019; Mundia & Aniya, 2005).

Environmental damage, rising crime rates, and social disharmony in a region/area are manifestations of the improper implementation of the functions and roles of that area (Faludi, 2000). As an example, uncontrolled development leads to higher carbon emissions, traffic congestion, and air pollution, which are prevalent issues in numerous cities in developing countries like Indonesia, the Philippines, and India (Lebel et al., 2007). As an example, when a city's functions and roles are not balanced in relation to its environmental capacity, it leads to a decline in environmental quality due to unregulated land use changes. For instance, in the study (Chen et al., 2021), strict regulations are implemented to control agricultural activities in a specific area, aiming to prevent unregulated land conversion. Similarly in Britain, the government actively avoids the conversion of agricultural land into industrial areas. However, the designation of agricultural areas is carefully regulated through various indicators, ensuring that the delineated agricultural zones are preserved and protected from conversion. "*High-quality farmland is primarily concentrated and distributed in Wangcheng, Ningxiang, and Changsha in northwest Changsha City. Therefore, only high-quality farmlands were classified as basic farmlands for effective protection*".

The concentration of various activities in urban centers has led to imbalances among the surrounding areas. In a different scenario, the expansion of industrial activities can result in a significant increase in population due to the availability of employment opportunities in the industrial sector. However, the growth of the industrial sector does not necessarily translate into support from other sectors, particularly housing, especially for the labor force (Carmona, 2019; Chen et al., 2021; Hersperger et al., 2018). As an example, in some industrial areas, the need for housing has increased dramatically. Eventually, slums emerged to accommodate migrant workers in the vicinity of industrial zones. The aforementioned examples demonstrate how unforeseen consequences of a function and role can result in less-than-optimal outcomes. From an economic standpoint, the overemphasis on the function and role of a specific area or the ineffective implementation of functions and roles can result in *economic losses*. This can occur when infrastructure, which has already been constructed, remains underutilized and fails to meet the intended targets (Lebel et al., 2007; Sitányiová & Masarovičová, 2021).

It is crucial to carefully consider the population size that arises as a consequence of fulfilling the function and role of a region/area when making such determinations. In the process of spatial planning, population estimation frequently relies on projections derived from the prevailing population growth trends. In practical terms, there are often discrepancies

between projected population estimates for the future and the actual outcomes, primarily due to inaccuracies in effectively implementing the function and role of regions/areas (Tulumello et al., 2020). The employment multiplier approach is a commonly employed method for estimating population, wherein an expansion of the workforce in a specific sector leads to the proliferation of *employment* opportunities across other sectors (Pangastuti, 2015; Zenda, 2017). Simplifying the concept, the addition of workers in the primary sector leads to an expansion of the workforce in the service sector. It is essential to conduct a comprehensive analysis of this addition to effectively anticipate meeting essential societal needs, including housing, clean water, electricity, and other vital requirements.

Spatial planning faces a similar dilemma in various other countries, posing diverse challenges, particularly in terms of ensuring the availability of fundamental infrastructure (Tulumello et al., 2020). This analysis plays a critical role in making informed decisions and considerations for the future (Feltynowski et al., 2018; Wang et al, 2019). As a result, numerous studies are actively exploring ongoing efforts to improve the efficient and sustainable management of regions (Chen et al., 2021; Longato et al, 2021).

Presently, the formulation of Regional Spatial Planning (RDTR) in Indonesia is undertaken as an effort to regulate and manage urban development in a systematic and efficient manner, preventing random and inefficient growth. The process of organization becomes increasingly challenging due to a combination of factors (Sutaryono & Dewi, 2022), such as inadequate control mechanisms, high land prices coupled with limited government budget for compensation, and ambiguity surrounding land ownership status, whether it belongs to the government or the public (Havel, 2014). Hence, in numerous countries, the effectiveness and clarity of land-related regulations play a pivotal role in achieving successful spatial planning. However, at present, the implementation of real zoning management restrictions on urban development is not evident in the planned outcomes in Indonesia. To this day, there is a lack of comprehensive studies that specifically address RDTR, particularly after the issuance of the Omnibus Law on Job Creation No. 11 of 2020 with its derivative regulations. As a result, conducting a study on the function and role of cities becomes crucial in the process of developing RDTR, as it can provide guidance for more structured and sustainable development.

The Urban Market Area in Batang Anai Sub-district, situated in Padang Pariaman Regency, West Sumatra Province, is officially designated as one of the urban areas outlined in the Regional Spatial Plan (RTRW) of Padang Pariaman Regency. It is essential to undertake preparations for this area to ensure effective anticipation of the evolving dynamics of urban activity development. Given the policies and evolving development dynamics of the areas directly bordering the city of Padang, the main city in West Sumatra Province, a comprehensive examination is necessary to understand the implications of the assigned function and role on population projections in those regions.

The examination will focus on the implications of assigning the function and role to the Urban Market Area of Batang Anai from the perspective of population growth. How many employment opportunities will be generated when the function and role of this area are fully realized? The identified functions and roles that have a significant impact on the resulting population are as follows: serving as a hub for the processing industry of agricultural products, functioning as an agropolitan area, particularly in the development of Sustainable Food Agriculture Land (LP2B) encompassing more than 20% of the area, providing residential areas for individuals employed in the city of Padang and its neighboring regions, and serving as an urban area with various service-related activities. These functions and roles are deemed influential in determining the population that will be generated in the area.

METHODS

The designation of a region's function and role in the spatial planning process is highly significant and must be carefully considered. This is because it has implications for the spatial requirements of various aspects, such as residential areas for the population, public and social facilities, as well as other necessary infrastructure.

The required data for this research comprises a collection of documents containing policies and guidelines concerning the function and role of the Urban Market Area. These documents encompass the Regional Spatial Plan (RTRW) of West Sumatra Province, the RTRW of Padang Pariaman Regency, the Medium-Term Regional Development Plan (RPJMD) of West Sumatra Province, the RPJMD of Padang Pariaman Regency, as well as other pertinent policy documents. Furthermore, it is necessary to obtain various statistical data that portray the state of the Urban Market Area, and these data can be obtained from Statistics Indonesia (BPS). Additionally, spatial data depicting the geographic condition of the Urban Market Area is also needed. In addition to the aforementioned data requirements, it is also feasible to collect information from informants regarding the implementation of development policies for the expansion of Pasar Usang Urban Area.

The methods used involve reviewing relevant literature on government policies at the national and regional levels concerning regional development, particularly focusing on the function and role of Pasar Usang Urban Area. Furthermore, statistical data analysis and thematic mapping are employed to examine social and economic characteristics. Moreover, descriptive analysis is conducted based on interview findings and discussions with informants to address the issues and future development plans in the Urban Market Area.

To address the implications of the function and role of a city on population growth, it is necessary to compare population trends based on population projection formulas and population projections based on scenarios related to the functions and roles undertaken, such as industry and agriculture. Some of the methods employed to analyze population projections in this study are:

1. Population Projection Analysis is conducted to examine the future population growth. This analysis will be used to compare population growth with the current trends, without the intervention of the development of the function and role of Pasar Usang Urban Area. The population growth using the exponential method is chosen because this method represents a gradual increase in population throughout the year, unlike the geometric method which assumes that population growth only occurs at one specific moment during a certain period of time (Adioetomo and Samosir, 2010). In addition, this method can also lead to overestimation if there are specific policies or factors that influence it (Davis, 1995; Gulseven, 2016). The formula used in the exponential method is:

   $Pt = Poert$

   To obtain the population growth rate (r), the equation is used.

   $$r = \frac{\left\{\ln\left(\frac{Pn}{Po}\right)\right\}}{t}$$

   Notes:
   Pn is the number of populations in the year n
   P0 is the number of populations in the base year
   r is the population growth rate.
   t is the difference between the years

2. The analysis of population development scenarios is based on the potential population growth resulting from the development of the function and role of the area. In this case, there are three functions of the area that will be assessed for their potential population growth: the function as a center for industrial development, the area for the development of Sustainable Food Agriculture Land, and the analysis of housing capacity in potential housing development areas within the Pasar Usang Urban Area. In this analysis, several assumptions are used based on guidelines, including the Guidelines for Determining Environmental Carrying Capacity in Regional Spatial Planning Number 17, 2009, and technical guidelines such as the guidelines for industrial area development issued by the Ministry of Industry of the Republic of Indonesia Number 35M-INDPER32010 and Ministry of Industry Regulation No. 40 of 2016, Government Regulation of the Republic of Indonesia Number 12 of 2021 concerning Amendments to Government Regulation Number 14 of 2076 concerning the Implementation of Housing and Settlement Areas, and SNI 03-1733-2004 concerning Procedures for urban housing environmental planning.

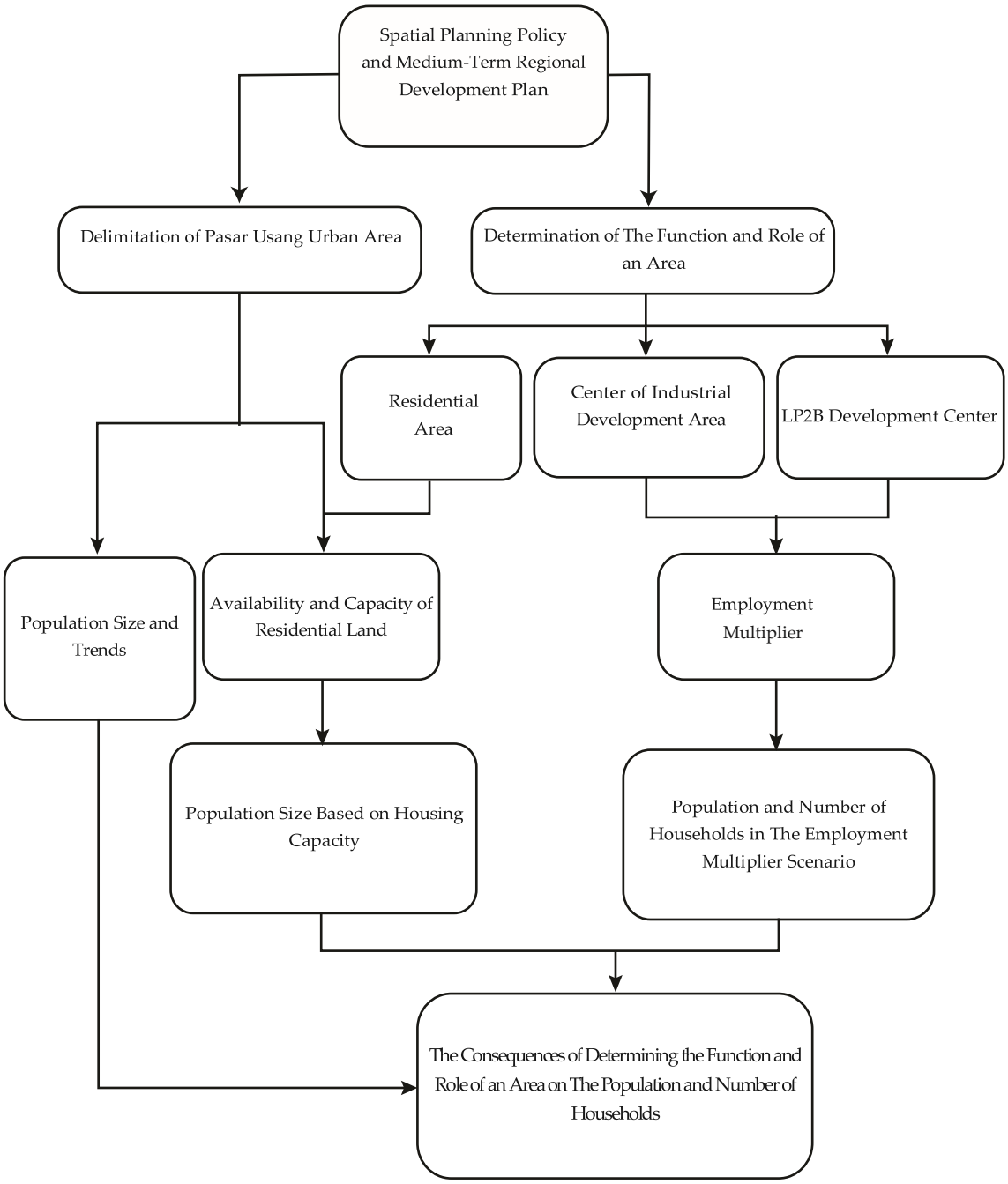

Figure 1. Research Flow

RESULTS AND DISCUSSION

Characteristics of the Region

The Delineation of the Detailed Spatial Plan for Pasar Usang Urban Area is designated with an approximate area of about ± 4,789 hectares. The area covers parts of the administrative regions of several Nagari in Batang Anai Sub-district, namely: Nagari Kasang, Nagari Sungai Buluah Selatan, Nagari Sungai Buluah, Nagari Sungai Buluah Timur, Nagari Sungai Buluah Barat, Nagari Sungai Buluah Utara, Nagari Buayan Lubuk Alung, and Nagari Katapiang.

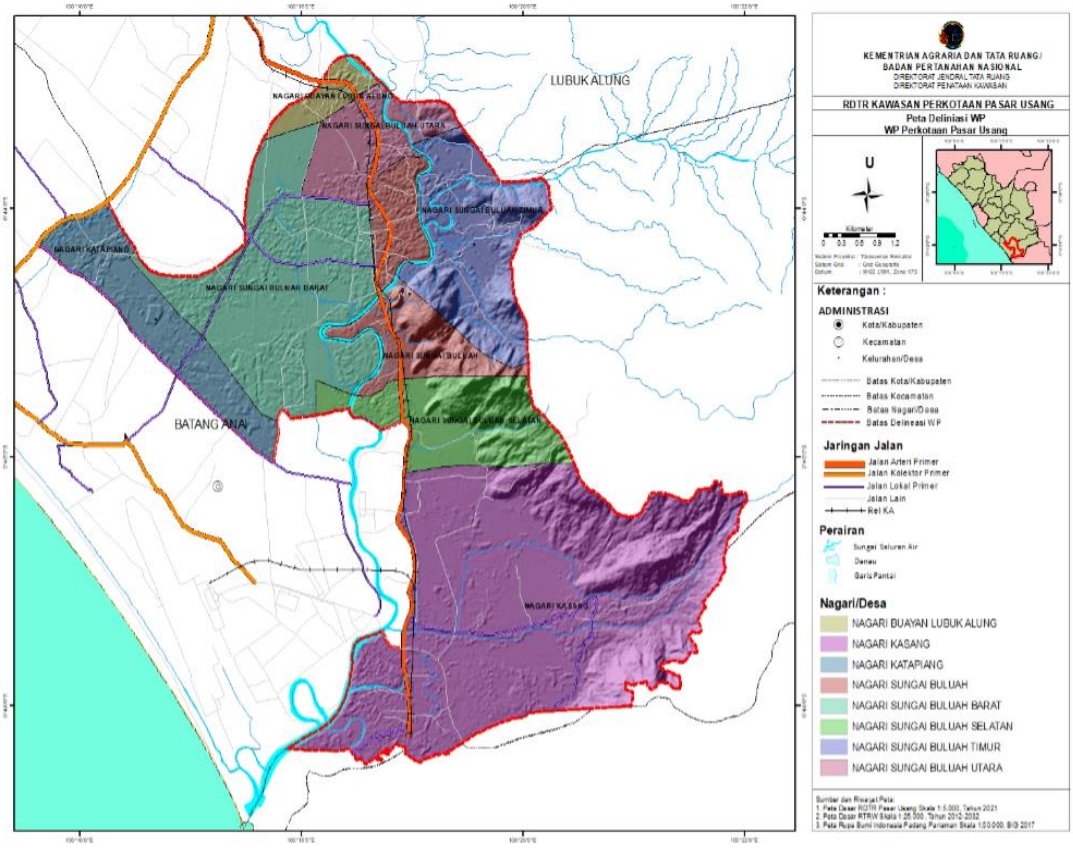

Figure 1. The delineation of the Pasar Usang Urban Area

The delineation of the Urban Market Area of Pasar Usang in Padang Pariaman Regency (Figure 1) is determined based on the following considerations:

a. In accordance with the direction of the Regional Spatial Plan (RTRW) of Padang Pariaman Regency, Pasar Usang is designated as a PPK (Zone Service Center), which functions as a center for urban settlement, trade and services, transportation, and industry;
b. areas with a high level of investment interest;
c. There is an Industrial Zoning Area covering approximately 415.80 hectares;
d. It is integrated with infrastructure networks, including primary arterial roads, railway networks, and the planned Padang Pariaman-Pekanbaru toll road network.
e. support of land conditions with a slope of about 0-2%.

For a clearer understanding, Pasar Usang Urban Area is based on Nagari can be seen in Table 1.

Table. 1. Width of the WP of Pasar Usang Based on Nagari

No.	Village / Nagari	Area of Land (ha)	Urban area	
			(ha)	(%)
1	Katapiang	4,358	350.94	8.05
2	Kasang	2,685	1,965.86	73.22
3	Sungai Buluah	235	86.19	36.68
4	Buayan Lubuak Aluang	471	369.71	78.49
5	Sungai Buluah Selatan	1,114	384.05	34.47
6	Sungai Buluah Barat	1,038	880.83	84.86
7	Sungai Buluah Timur	3,524	499.08	14.16
8	Sungai Buluah Utara	655	252.43	38.54
9	Mampang Prapatan Batang Anai	14,080	4,789.09	34.01

Source: Document of Facts Analysis of the Detailed Spatial Plan (RDTR) of Pasar Usang Urban Area (2021)

Land Use

Pasar Usang Urban Area, which is planned to become a supporting urban area for the city of Padang, is currently predominantly characterized by undeveloped lands such as forests, rice fields, farms, and plantations (Figure 2). Only 17.44% of the entire urban area consists of developed land, including residential and industrial areas (Table 2). Furthermore, if we consider the land area that is still available for conversion into developed areas, it can be obtained from agricultural land, gardens, fallow land, and shrubs, with a total area of 1,430.7 hectares (29.9%). Rice fields are not possible to be converted because they have been designated as Sustainable Food Agriculture Land (LP2B), which consists of LP2B and LCP2B (Reserve Land for Sustainable Food Agriculture), with a total area of 1,140.41 hectares.

Table 2. Land Use in the Planning Area

No.	Zone	Subzones	Code	Area (ha)
A	**Protected Zones**			
1	Cultural Heritage Zone	Cultural heritage	CB	0.22
2	Water Body Zone	Waterbody	BA	88.54
3	Local protection	Local protection	PS	104.36
4	Green Open Space Zone	City Park	RTH- 2	26.93
		District Park	RTH- 3	11.18
		Village Park	RTH- 4	10.33
		Public Cemetery	RTH- 7	25.06
		Green Line	RTH- 8	13.74

B	**Cultivation Zone**			
5	Smallholder Plantation Zone	Smallholder Plantation	KR	1165.16
6	Agricultural Zone	Food Crops	Q 1	1220.59
		Horticulture	P-2	188.18
		Plantation	P-3	27.46
		Livestock	P-4	0.14
7	Power Generation Zone	Power Plants	PTL	2.59
8	Tourism Zone	Tourism	W	8.92
9	Industrial Designation Zone	Industrial Designated Areas	KPI	363.47
10	Residential Zones	Moderate Density Residential	R-3	1133.52
		Low Density Residential	R-4	114.51
11	Public Service Facilities Zone	Urban-scale Public Service Facilities	SPU- 1	2.97
		Sub-district Scale Public Service Facility	SPU- 2	24.71
		Village Scale Public Service Facilities	SPU- 3	3.83
		Neighborhood Scale Public Service Facilities	SPU- 4	1.16
12	Non-Green Open Space Zone	Non-Green Open Space	RTNH	1.30
13	Mixed Zone	Intermediate/Moderate Mix	C-2	106.76
14	Trade and Service Zone	Trade and Services at the WP (Urban Area) Scale	K-2	3.17
15	Office Zone	Workspace area	KT	0.93
16	Waste Management Zone	Waste Management	PP	0.27
17	Transportation Zones	Transportation	TR	13.01
18	Defense and Security Zones	Defense and Security	HK	0.64
19	Other Designation Zones	Temporary Evacuation	PL- 1	0.16
		Final Evacuation	PL- 2	3.12
		Warehousing	PL -6	2.67
20	Road Body Zone	Road Body	BJ	221.54
Total				4791.25

Source: RDTR Technical Material Document for Pasar Usang Urban Areas (2021)

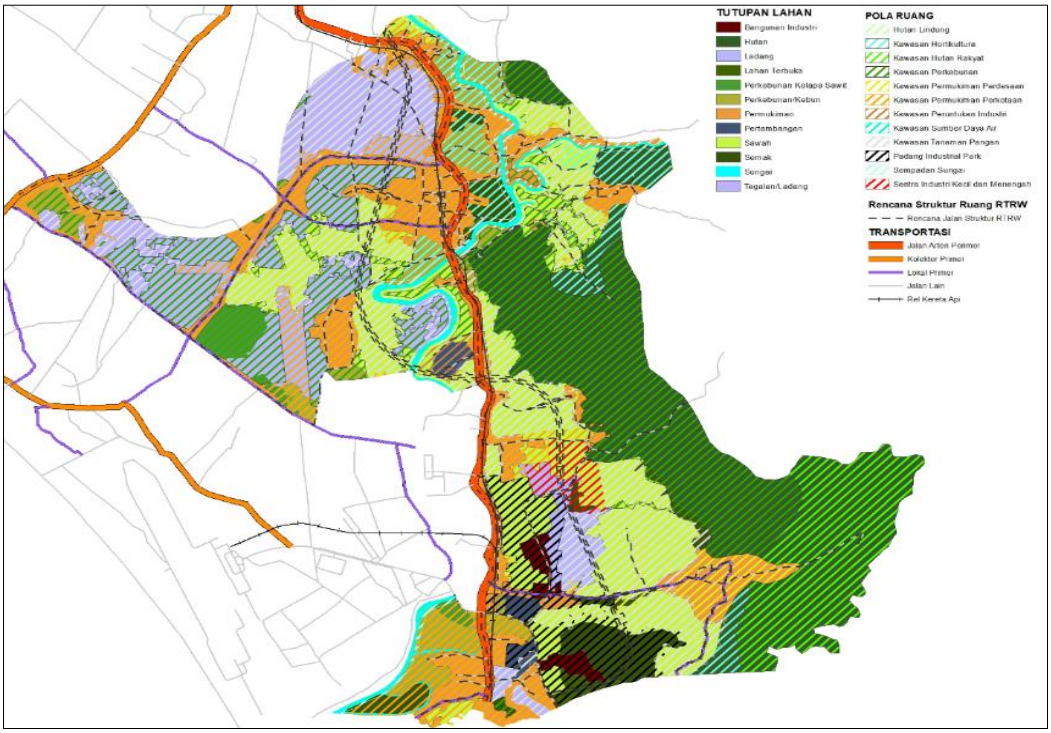

Figure 2. Map of Cover and Spatial Pattern Plans in Pasar Usang

Population Profile

An overview of this population profile is based on the development of the number of residents in Batang Anai District. In Table 4, population projections are carried out over the next 20 years. In Sungai Buluah village there was an expansion into five villages/Nagari, so there was a change in population data after the expansion.

Table 4. Projected Population of Batang Anai District in 2022-2042

NO	VILLAGE	Area (ha)	2010	2020	r(%)	NUMBER OF INHABITANTS (POPULATION) 2022	2027	2032	2037	2042
1	Katapiang	64.25	12.211	14966	0.78	15,202	15,808	16,438	17,094	17,775
2	Kasang	37.76	12,723	15,529	0.87	15,800	16,499	17,229	17,991	18,787
3	Buayan Lubuk Alung	10.3	3,767	2,909	0.89	2,961	3,096	3,238	3,385	3,540
4	Sungai Buluh	68.08	15,758	3,984	0.72	4,042	4,189	4,342	4,501	4,666
5	Sungai Buluah Selatan			5,446	0.72	5,525	5,727	5,936	6,153	6,378
6	Sungai Buluah Barat			5,863	0.72	5,948	6,165	6,391	6,624	6,866
7	Sungai Buluah Timur			2,381	0.72	2,415	2,504	2,595	2,690	2,788
8	Sungai Buluah Utara			1,766	0.72	1,792	1,857	1,925	1,995	2,068
	TOTAL					55,707	57,872	60,126	62,470	64,910

Source: Analysis of Population Projection Calculations Using Exponential Methods in Pasar Usang Urban Areas (2021)

Analysis of Population Development Based on Tendencies

As mentioned in the methodology section, it is crucial to take into account the function and role of an urban area when making population growth projections. Specifically, the analysis will delve into the functions and roles, and their implications will be examined using specific analytical tools and assumptions outlined below.

As mentioned earlier, due to the unavailability of precise population data for this area, the population projection of the Batang Anai Subdistrict is utilized as a foundation for estimating population growth. The population projections are determined by utilizing the population count in the base year of 2020 and the growth rates calculated from the periods 2011-2020 and 2015-2020. The exponential projection method predicts that the population in the Pasar Usang Urban Area will reach approximately 79,264 and 96,189 individuals by the year 2042, aligning with the timeline specified in the Urban Area Spatial Planning (RDTR). In comparison to the population in 2020, the population in 2042 is expected to experience a growth of around 30-50%.

The Utilization of Labor in the Industrial Sector

Serving as a hub for industrial activities, a total area of 435 hectares is designated for industrial purposes in the Pasar Usang Urban Area. According to the Technical Guidelines for Industrial Area Planning, the employment capacity of an industrial area is estimated to

be 100 workers per hectare. Additionally, it is assumed that 70% of industrial workers will form households, with an average of 4 individuals per household in terms of population count.

Table 5. Estimating the Future Population Based on The Industrial Area

Illustration of how to estimate the future population in an industrial area:	
Industrial Projection: 500 ha	
For example (20% for RTH): 500-100 remaining 400 ha	
Assumption: industrial development per hectare: 50 manpower per hectare	
Total Labor: 50 x 400 = 20,000	
Assumption of the base sector: industry (60%)	
Base sector (60%)	20,000
Non-base sector (40%)	15,000
Total Workforce	35,000
2/3 Head of family	21,000
The overall number of individuals that need to be housed or accommodated from the industrial sector.	84,000
Total projected natural population	57,306
Total population	141,306
Resettlement space needs	
Pessimistic scenario assumptions (in 20 yrs)	10,000 individuals
Assuming that each hectare can accommodate 25 houses, a minimum of 1,000 hectares of land would be necessary.	
Assumption:	
In the beginning, the percentage of supporting workers is 20%, and it increases by 5% every 5 years. As a result, by the year 2038, supporting workers will constitute 40% of the total industrial workforce.	
The local population of the core area comprises individuals living in the Bahodopi and Bungku Timur sub-districts, as indicated by statistical data.	

The estimation of labor absorption in the industrial sector is based on assumptions outlined in the Technical Guidelines for Industrial Area Planning. Considering the industrial area's expansive size of 435 hectares, it is expected to generate employment opportunities for approximately 43,500 workers. Assuming that this industry serves as the primary sector, it will have a positive impact on the growth of the non-primary sector, with a ratio of 60% for the primary sector and 40% for the non-primary sector. Consequently, the non-primary sector is projected to employ around 30,000 workers, resulting in a total

workforce of approximately 70,000 workers. Considering the equivalent number of households, which is estimated to be 29,000 households or approximately 116,000 residents. This implies that 29,000 housing units are required to meet the housing needs of these workers. Certainly, these calculations can be even higher when considering the growth in other sectors (Zenda, 2017).

The utilization of labor in the food agriculture and plantation sector

Its role is to serve as an agropolitan area, with significant sub-sectors including food crop agriculture (LP2B paddy fields) and smallholder plantations. Taking into account various studies (Isbah & Iyan, 2016; Sudalmi, 2009), this analysis assumes that the absorption capacity for agricultural land, specifically paddy fields for food crops, is estimated at one farming family per hectare. Regarding this matter, it should be noted that the average number of individuals per household in the Batang Anai District is 3.8, which can be rounded up to 4 individuals per household. Additionally, in the smallholder plantation sub-sector, the labor absorption follows a similar pattern to that used in transmigration areas, where one transmigration household is capable of cultivating 2 hectares of land. Considering its role as an agropolitan area, the projected population will be determined based on the number of households, with an assumption of an average of 4 individuals per household.

In the food crop agriculture sector, particularly in the management of LP2B (rice fields), the assumption is that one farming household is responsible for one hectare of paddy field. Therefore, with a land allocation of 1,024 hectares, it will accommodate 1,024 farming households. Moving on to the plantation sector, the assumption is made that each transmigration household requires 2 hectares of land per farmer. The allocation of 1,167 hectares of land for smallholder plantations will provide space for 584 farming households. The combined agricultural sub-sectors will provide employment for 1,608 farming households, which corresponds to a population of 6,430 individuals.

Labour Multiplier Analysis

Serving as an urban service center, this area will witness the construction of diverse infrastructure and facilities to support urban life as part of the urban development policy. To address employment absorption in this context, the labor multiplier approach will be employed, which strongly correlates with the development of base sectors such as industry, agriculture, and housing (specifically dormitory). Given the urban-rural theme of the area's development, it is expected that the base sectors will continue to have a higher employment absorption compared to the service sector. In this study, a ratio of 60:40 will be used, indicating that for every 3 workers in the base sectors, 2 workers will be generated in the service sector. Additionally, the estimation of population and households will take into account assumptions related to other functions and roles.

Taking into account the labor multiplier approach and assuming a 60:40 ratio between the base sectors and the service sector, the urban service sector is estimated to absorb approximately 21,426 workers. This is derived from the assumption that the base sectors will employ around 30,608 workers, with the remaining proportion being allocated to the service sector. Assuming that the ratio of workers to households in the service sector is similar to that in the industrial sector, we can expect the creation of approximately 14,284 households from the service sector workforce.

The analysis of each sector, which serves as the foundation for the functions and roles of the Pasar Usang urban area, indicates that a significant number of job opportunities, totaling 52,034, will be available. Consequently, this employment growth is expected to lead to the formation of around 44,892 households, accommodating a population of approximately 179,568 individuals.

Housing Area Capacity Analysis

Function as a residential area. Considering the urban-rural concept that will be implemented in this region, the allocation of space for the residential zone encompasses two subcategories: medium-density housing and low-density housing. In order to calculate the density of medium-density and low-density housing, an analysis is conducted to assess the size of residential plots that serve as the basis in this region. As per the decree issued by the Regent regarding the minimum plot size in this urban region, it is determined to be 87 square meters per plot, which is rounded up to 90 square meters per plot. Additionally, for low-density housing, a plot size of 200 square meters per plot will be utilized as the foundation for calculating the capacity of the allocated space.

In order to assess the housing capacity, considering the housing density that will be provided, we utilize the assumption of a minimum plot size ($90m^2$) and a standard plot size ($200m^2$). Based on the calculation, where 60% of the residential land area will be allocated for house plots, it is estimated that medium-density housing will be able to accommodate around 75,533 houses, while low-density housing will have a capacity for approximately 3,450 housing units. The overall housing capacity within the designated residential area is estimated to be 78,983 housing units or households. The ability to accommodate housing units plays a crucial role in achieving compact housing, which is further supported by the provision of adequate and efficient infrastructure (Abdullahi, Pradhan, & Mojaddadi, 2018; Purnomo & Kurniawan, 2016).

Implications of Determining the Function and Role of Pasar Usang Urban

Areas Comparison of Population Projections Based on Trends with Potential Population Increase Due to Functions and Roles

The analysis of population growth based on existing trends reveals a substantial gap between the projected population to be accommodated through the development of Pasar Usang's urban functions and the current population growth rate. The implications of this development indicate that the population is expected to almost double compared to the existing growth trend. This indicates the importance of carefully considering the establishment of functions and roles for an area. This also has an impact on the demand for supporting infrastructure, such as clean water supply (Lebel et al., 2007).

The estimation of the population for a developing area with specific functions and roles can no longer rely on the existing population growth trends alone. Therefore, it is essential to enhance the information and refine the assumptions used to calculate the workforce implications that will arise from the development of a specific function in an area. When developing an area based on development themes, it is crucial to take into account the workforce implications that will be generated. Additionally, this will contribute to the planning and development of essential infrastructure and amenities to enhance the quality of life for future residents in the designated area.

Comparison of Population Development with Housing Capacity

The inaccuracies in calculating the carrying capacity of an environment have resulted in unfavorable outcomes, with many developed areas exceeding their carrying capacity and capacity limits (Duh et al, 2008; Henry, Yongsheng, & Jun, 2006). The approach of considering the housing capacity for an area can be used to establish the threshold for development activities in a particular region. In this study, the housing capacity derived from the allocated space for housing as defined in the Spatial Planning Document for Pasar Usang Urban Area will be used to assess whether the designation of the area's functions and roles will exceed the environmental carrying capacity or not. Based on the calculation of housing needs derived from the employment absorption of the area's functions and roles, which amounts to 44,892 houses, it can be concluded that the designation of the area's functions and roles is still below the housing capacity of 78,983 units. This allows for the opportunity to develop the functions and roles of the Pasar Usang urban area as a *dormitory town,* which will be part of the Padang metropolitan area.

The above discussion indicates that there are several important factors to consider in determining the functions and roles of a city, including the absorption of labor according to the city's functions and roles, which can generate population growth even beyond the projected population calculations using standard methods such as arithmetic, geometric, or

exponential projections. This aspect is often overlooked in the preparation of a planning product.

By examining other studies conducted in various countries to analyze urban development, several other factors can also be taken into consideration in determining the function and role of this area. These factors include interregional interaction, accessibility, and mobility analysis, land use distribution and development, density structure, urban activities and planning, and relationships with surrounding areas (Shen & Karimi, 2016; Willemen, Verburg, Hein, & van Mensvoort, 2008). As a result, the *Urban Function Connectivity* (UFC) method has been developed to further study the functions of this area in-depth (Shen & Karimi, 2016). This can also be further examined in future studies. With the acceleration of the spatial planning document (RDTR) preparation in Indonesia in the next five years, there are many aspects that still need to be thoroughly studied, especially in strengthening the substance of this RDTR.

CONCLUSION

Based on the discussions and findings of this research, several conclusions can be drawn as follows: First, based on the natural conditions, geographical location, and existing development policies, the Pasar Usang Urban Area has been designated with the following functions and roles: an industrial activity center, an agribusiness activity center, an urban services center, and a *dormitory town* that is part of the Padang metropolitan area.

Second, there is a significant difference in population growth in this area between calculations using exponential projections and calculations based on the scenarios of the functions and roles of the area, which in this case are industry, agriculture, and housing. This illustrates that it is not appropriate to rely solely on projections based on existing trends as a basis for estimating the population in new development areas for spatial planning purposes.

Third, the implications of these calculation differences emphasize the importance of assessing the carrying capacity and capacity of an area when considering any development interventions. Among these is the need to project the necessary infrastructure and facilities required in the area. This includes anticipating the required provisions for infrastructure in the region.

Some limitations of this study include the use of assumptions that need further investigation, particularly in the context of other cities. This also acts as feedback for future research to enhance the development of stronger assumptions that are employed. Nevertheless, this study is crucial for the formulation of spatial planning, especially in the current era of accelerated RDTR.

REFERENCES

Abdullahi, S., Pradhan, B., & Mojaddadi, H. (2018). City compactness: Assessing the Influence of the Growth of Residential Land Use. *Journal of Urban Technology, 25*(1), 21-46. doi:10.1080/10630732.2017.1390299

Carmona, M. (2019). Principles for public space design, planning to do better. *URBAN DESIGN International, 24*(1), 47-59. doi:10.1057/s41289-018-0070-3

Chen, Y., Yao, M., Zhao, Q., Chen, Z., Jiang, P., Li, M., & Chen, D. (2021). Delineation of a basic farmland protection zone based on spatial connectivity and comprehensive quality evaluation: A case study of Changsha City, China. *Land Use Policy, 101*, 105145. doi:https://doi.org/10.1016/j.landusepol.2020.105145

Davis, H.C. (1995). *Demographic projection techniques for regions and smaller areas: A Primer*: UBC Press.

Duh, J.D., Shandas, V., Chang, H., & George, L. A. (2008). Rates of urbanisation and the resiliency of air and water quality. *Science of The Total Environment, 400*(1), 238-256. doi:https://doi.org/10.1016/j.scitotenv.2008.05.002

Faludi, A. (2000). The performance of spatial planning. *Planning practice Research, 15*(4), 299-318.

Faludi, A. (2013). *A Reader in Planning Theory*. Kent: Elsevier Science.

Feltynowski, M., Kronenberg, J., Bergier, T., Kabisch, N., Łaszkiewicz, E., & Strohbach, M. W. (2018). Challenges of urban green space management in the face of using inadequate data. *Urban Forestry & Urban Greening, 31*, 56-66. doi:https://doi.org/10.1016/j.ufug.2017.12.003

Gulseven, O. (2016). Forecasting population and demographic composition of Kuwait until 2030. *International Journal of Economics Financial Issues, 6*(4), 1429-1435.

Hamidah, N., Garib, T.W., & Santoso, M. (2019). Potential of Ecotourism in Open Space of Kahayan Riverside of Palangka Raya City. *IOP Conference Series: Earth and Environmental Science, 363*, 012003. doi:10.1088/1755-1315/363/1/012003

Havel, M.B. (2014). Delineation of property rights as institutional foundations for urban land markets in transition. *Land Use Policy, 38*, 615-626. doi:https://doi.org/10.1016/j.landusepol.2014.01.004

Henry, R.K., Yongsheng, Z., & Jun, D. (2006). Municipal solid waste management challenges in developing countries – Kenyan case study. *Waste Management, 26*(1), 92-100. doi:https://doi.org/10.1016/j.wasman.2005.03.007

Hersperger, A.M., Oliveira, E., Pagliarin, S., Palka, G., Verburg, P., Bolliger, J., & Grădinaru, S. (2018). Urban land-use change: The role of strategic spatial planning. *Global Environmental Change, 51*, 32-42. doi:https://doi.org/10.1016/j.gloenvcha.2018.05.001

Isbah, U., & Iyan, R. Y. (2016). Analisis peran sektor pertanian dalam perekonomian dan kesempatan kerja di Provinsi Riau. *Jurnal Sosial Ekonomi Pembangunan, 7*(19), 45-54.

Lebel, L., Garden, P., Banaticla, M.R.N., Lasco, R.D., Contreras, A., Mitra, A.P., Sari, A. (2007). Management into the Development Strategies of Urbanizing Regions in Asia: Implications of Urban Function, Form, and Role. *11*(2), 61-81. doi:https://doi.org/10.1162/jie.2007.1185

Longato, D., Cortinovis, C., Albert, C., & Geneletti, D. (2021). Practical applications of ecosystem services in spatial planning: Lessons learned from a systematic literature review. *Environmental Science & Policy, 119*, 72-84. doi:https://doi.org/10.1016/j.envsci.2021.02.001

Moseley, M.J. (2013). *Growth centres in spatial planning: Pergamon urban and regional planning*: Elsevier.

Mundia, C.N., & Aniya, M. (2005). Analysis of land use/cover changes and urban expansion of Nairobi city using remote sensing and GIS. *International Journal of Remote Sensing, 26*(13), 2831-2849. doi:10.1080/01431160500117865

Pangastuti, Y. (2015). Analisis Faktor-Faktor yang Mempengaruhi Penyerapan Tenaga Kerja di Provinsi Jawa Tengah. *Economics Development Analysis Journal, 4*(2), 203-211.

Purnomo, R.A., & Kurniawan, A. (2016). Kajian Perkembangan dan Kesesuaian Lokasi Perumahan dengan Rencana Detail Tata Ruang (Rdtr) Kecamatan Depok dan Gamping Kabupaten Sleman. *Jurnal Bumi Indonesia, 5*(2).

Shen, Y., & Karimi, K. (2016). Urban function connectivity: Characterisation of functional urban streets with social media check-in data. *Cities, 55*, 9-21. doi:https://doi.org/10.1016/j.cities.2016.03.013

Sitányiová, D., & Masarovičová, S. (2021). *Feasibility analysis for revitalisation of unused rail infrastructure.* Paper presented at the IOP Conference Series: Materials Science and Engineering.

Sudalmi, E. S. J. I. J. I. P. (2009). Analisis penggunaan tenaga kerja pertanian pada usahatani padi sawah (study kasus di Desa Karang Duren). *8*(1).

Sutaryono, S., & Dewi, A.R. (2022). Peluang dan tantangan penerapan kebijakan insentif dan disinsentif dalam pengendalian pemanfaatan ruang di Kabupaten Sleman.

Tulumello, S., Cotella, G., & Othengrafen, F. (2020). Spatial planning and territorial governance in Southern Europe between economic crisis and austerity policies. *International Planning Studies, 25*(1), 72-87. doi:10.1080/13563475.2019.1701422

Wang, H., Pan, Y., & Luo, X. (2019). Integration of BIM and GIS in sustainable built environment: A review and bibliometric analysis. *Automation in Construction, 103*, 41-52. doi:https://doi.org/10.1016/j.autcon.2019.03.005

Willemen, L., Verburg, P.H., Hein, L., & van Mensvoort, M.E.F. (2008). Spatial characterization of landscape functions. *Landscape and Urban Planning, 88*(1), 34-43. doi:https://doi.org/10.1016/j.landurbplan.2008.08.004

Zenda, R.H. (2017). Peranan Sektor Industri Terhadap Penyerapan Tenaga Kerja Di Kota Surabaya. *Jurnal Ekonomi dan Bisnis, 2*(01).