Analysis of Determining Service Center Systems towards the Development of The Eastern Part of Medan City

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Abstract

The issues in the research area include a high concentration of built-up residential areas with the potential for slums and warehousing activities dominating trade and service areas or residential areas, leading to congestion. This requires attention, considering that the Eastern Part of Medan City has a high built-up area, necessitating the provision of affordable infrastructure and basic services for both newcomers and existing residents in the city. Several development theories and concepts can assist in determining and conceptualizing development in the research area. The study focuses on examining the Sub-Central Service System of the City as a center serving sub-urban areas. Various methods are used in determining service centers, including the scalogram method, Marshall's centrality index, and rank-size rule, which will ultimately provide recommendations for the central service system. After issuing recommendations from these three analyses, the determination of the existing urban internal structure is conducted using a scoring method to identify the central service location. Calculations from multiple service center analysis methods are scored and summed to obtain a total score. The neighborhood with the smallest score has the highest hierarchy value, and vice versa. It is revealed that the Sub-Central Service System is present in all sub-districts in the Eastern Part of Medan City, meaning each sub-district in each neighborhood already has comprehensive facilities. Consequently, the four sub-districts in the Eastern Part of Medan City have the potential for development as they meet service needs and can be directed to become service centers serving their respective sub-districts.

Keywords: Regional Development, Sub-Central Service System, Eastern Part of Medan City

Introduction

The analysis of the central service system aims to identify issues in regional development. The analysis provides a comprehensive overview of the existing service centers in the planned area, including their placement/hierarchy, service coverage, and interactions between these service centers. The development of urban activity service centers describes the locations, hierarchies, service scales, and dominant functions of these activity service centers (Abdiyanto, 2015; Abdiyanto & Warokka, 2015). In accordance with Regional Regulation No. 1 of 2022 on the Spatial Planning of Medan City for the years 2022-2024, spatial planning strategies aim to develop a hierarchical central service system that aligns with the service area coverage and minimum supporting facilities. It designates city service centers, sub-city service centers, and

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environmental service centers to realize the development policy of Medan City's central service system as a National Activity Center (Pusat Kegiatan Nasional - PKN).

According to the Regional Spatial Plan (RTRW) of Medan City for the years 2022-2042, two Central Activity Centers (Pusat Pelayanan Kegiatan - PPK) are assigned to Medan Barat and Medan Labuhan. Internally, Medan Barat as a PPK will have a significant impact on the Eastern part of Medan, particularly Medan Timur sub-district. Meanwhile, the Central Service Center in the Eastern part of Medan is designated to be in the Medan Timur and Medan Perjuangan sub-districts. Medan Timur functions as a trading or business activity center, transportation service center, social and cultural activity center, and defense and security service center. On the other hand, Medan Perjuangan functions as a trading or business activity center and an education service center. In addition to being designated as a Central Service Center, three other sub-districts are assigned as Environmental Service Centers, namely Medan Area, Medan Perjuangan, and Medan Timur, serving as centers for economic, social, and administrative services in urban residential areas. Therefore, to realize these functions, this research aims to determine the locations that will serve as central and sub-central service centers, each hierarchically performing different functions but interconnected.

Issues in Medan City, especially in the Eastern part, such as the high concentration of built-up residential areas prone to becoming slums and warehousing activities dominating trade and service areas or residential areas, leading to congestion, need attention. In this regard, there is a need for the provision of good housing and settlements for both new and existing residents who have not yet obtained adequate housing, given that the Eastern part of Medan City is a region with high built-up areas. Additionally, the provision of affordable infrastructure and basic services is necessary for both newcomers and existing residents in the city. This study differs from previous research in terms of technical analysis and local government policies. The analysis considers variables such as population size, infrastructure, and accessibility, which determine the hierarchy of service centers in the region. Several variables from previous studies help researchers assess how to determine the suitability of developing an urban central service system and understand the theoretical concepts that align with the Eastern part of Medan City.

Literature Review

Local Regulation of Medan City No. 1 of 2022 has established the Spatial Planning of Medan City for the years 2022-2042. The objective of spatial planning in Medan City is to create a safe, comfortable, productive, and sustainable space with competitiveness and attractiveness as an investment destination. It aims to utilize land, sea, and air for economic development activities in trade, services, tourism, and environmentally conscious industries. To realize the development policy of the city's central service system supporting the role of Medan City as part of the Urban Region of Medan, Binjai, Deli Serdang, and Karo (Mebidangro) as the National Activity Center (Pusat Kegiatan Nasional - PKN), one of the strategies is the accelerated development of the Eastern part of Medan City.

The typology of the region in this study involves the categorization of the Eastern part of Medan City as an urban area, using predefined indicators. This classification is in line with Brian J.L Berry's approach, which considers the hierarchy of cities based on their functions. Budiharsono (2001:137) describes the Concept of Service Centers, which is examined and adapted from several theories proposed by Perroux about growth centers and growth in economic space, Boudeville about growth poles and growth centers in geographical dimensions, Walter Christaller and August Losch about location, distribution, and grouping of economic activities, Gunnar Myrdal about the spreadbackwash effects of economic growth in spatial planning,

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Hirschman about Trickling Down and Polarization Effects of economic growth, and Galpindan Kolb about the social anatomy of agricultural societies (Roi and Patil, 1976 in Budiharsono, 2001; Azhari, 2022), as well as Hagerstestrand and Pottier about the diffusion of innovation in spatial planning and growth axes. Spatial planning must always take into account the characteristics of the local community in the planning area. This is crucial considering that each region will have distinct features or characteristics based on their diverse backgrounds (Nuraini et al, 2023; Milanie et all, 2022).

The concept of regional development aims to reduce growth disparities and welfare imbalances between regions. Development is fundamentally an organized and coordinated effort to legally create more options for community members to fulfill their well-being. Essentially, a regional center has a hierarchy determined by factors such as the population residing in that center, the number of available public service facilities, and the type of facilities. (Budiharsono, 2001: 138; Azhari, 2017). According to Budiharsono, the larger the population and the more facilities and types of facilities in an area, the higher the hierarchy of that center. Public facilities for the community should be based on the community's needs so that people have a sense of responsibility to take care of them (Nuraini & Suprayitno,2021 and Nuraini, 2019).

The foundations for determining the development of the Eastern part of Medan City's central service system are generally influenced by several factors, both internal and external. For the Eastern part of Medan City's service center system, internal factors influencing its spatial structure include the current network pattern and road function hierarchy, dominant land use patterns in that city area, the number and distribution of supporting populations, the service radius of each existing service center in that city area, and the level of completeness of facilities in the Eastern part of Medan City and its service scale. External factors affecting the urban service center system are based on the Regional Spatial Plan (RTRW) of Medan City for the years 2022-2042, which designates the Eastern part of Medan City as a strategically important service center. The sub-district designated as a Sub-Central Service System (SPPK) is Medan Timur, with functions as a center for trade/business activities, transportation services, social-cultural activities, and defense and security services. Additionally, Medan Perjuangan sub-district is designated as a center for trade/business activities and education services, serving the Eastern part of Medan City.

Previous research findings, such as those of Rona Muliana et al. (2018), Achmad Saeful Fasa & Ina Revayanti (2020), and Naltri Andre Wansaga, Linda Tondobala & Cynthia Wuisang (2020), serve as a basis for comparison in this study. Each of these studies presents different cases, showcasing inconsistencies between policy regulations and field realities and the conceptual theories used in previous research. These disparities contribute to the unique characteristics of each development region.

Methods

This study aims to analyze regional development and determine a suitable theoretical development concept for the conditions in the Eastern part of Medan City to assess whether the area qualifies as a Sub-Central Service System (SPPK) with potential for development. The research employs a descriptive-quantitative approach, collecting data directly from the field through observations and documentation, as well as gathering secondary data from books, the internet, and relevant institutions (Abdiyanto, 2020). Data analysis utilizes a Scalogram analysis to assess a region's capability to provide services to the community based on the completeness of facilities in each area. Centrality analysis is employed to identify service centers based on the quantity and types of service facility units within the urban area. Additionally, Rank Size Rule analysis is applied to determine the proportion of urban activity

distribution by examining the population size proportion and distribution. The results of these analyses are then used to determine the internal structure of the existing urban area using a scoring method to identify the central service location. To establish the existing hierarchy, scores are assigned through various service center analysis methods, and then they are summed to obtain a total score. The neighborhood with the smallest score has the highest hierarchy value, and vice versa. Connectivity testing is conducted to ascertain the interconnection between designated development region centers, aiding in determining the development theory suitable for the area. The findings are expected to help identify issues and assess whether the service centers meet the needs in the Eastern part of Medan City."

Results and Discussion

The analysis results are based on field data in the form of documentation and secondary data (sub-district BPS data and data from relevant institutions). The central service system is a crucial component of the spatial structure in the Eastern part of Medan City. The central service system is interconnected with physical, economic, transportation, population, and weighted centrality index aspects. In determining the central service, several methods are employed, including the scalogram method, Marshall centrality index, rank-size rule, and Connectivity Test for development theory.

Marshal Threshold and Scalogram Analysis

Table 1. Scalogram Analysis

No	District	Sub District	Total Population 2023	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	Total
				Education Facilities					Health Facilities						Worship Facilities						Sports Facilities						Economic Facilities					
1	Medan Timur	Gang Buntu	4.384	0	1	1	1	0	1	0	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	14
2		Sidodadi	6.288	1	1	1	1	0	0	0	0	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	12
3		Perintis	4.189	1	1	1	1	0	1	0	1	1	1	0	1	1	0	0	0	0	1	0	1	1	0	0	1	1	1	0	1	17
4		Gaharu	9.769	1	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	1	0	0	1	0	0	0	1	1	0	0	1	17
5		Durian	9.922	1	1	1	1	0	0	0	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0	0	14
6		Glugur Darat II	11.440	1	1	0	0	0	0	0	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	11
7		Glugur Darat I	13.075	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0	0	1	0	1	0	0	0	1	1	1	0	0	15
8		Pulo Brayan Darat I	20.850	1	1	1	1	1	1	0	1	1	1	0	1	1	0	1	0	0	1	0	0	0	1	0	1	1	0	0	0	16
9		Pulo Brayan Darat II	15.333	1	1	1	1	1	0	0	1	1	1	0	1	1	1	1	0	0	0	1	0	1	0	0	1	1	1	0	1	18
10		Pulo Brayan Bengkel Ba	11.536	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0	1	15
11		Pulo Brayan Bengkel	15.700	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	0	0	1	1	0	0	17
12	Medan Perjuangan	Pandau Hilir	8.251	1	1	1	1	1	0	1	0	1	0	0	1	0	1	1	0	0	0	0	0	1	1	0	1	1	1	0	0	15
13		Sei Kera Hulu	9.215	1	1	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	6
14		Pahlawan	9.424	1	1	1	1	1	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	11
15		Sei Kera Hilir I	10.925	1	1	0	0	0	0	1	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	10
16		Sei Kera Hilir II	9.241	1	1	1	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	10
17		Sidorame Timur	11.687	1	1	1	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	8
18		Sidorame Barat II	9.253	1	1	1	1	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	10
19		Sidorame Barat I	9.988	1	1	1	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	9
20		Tegal Rejo	25.829	1	1	1	1	1	1	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	11
21	Medan Tembung	Indra Kasih	25.096	1	1	1	0	1	0	1	0	1	1	1	1	1	1	0	0	0	0	1	1	1	0	0	0	1	1	0	1	17
22		Sidorejo Hilir	21.647	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0	0	0	1	0	0	0	0	1	1	1	0	0	16
23		Sidorejo	21.591	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0	0	0	1	0	1	0	0	0	1	1	0	0	16
24		Bantan Timur	17.572	1	1	1	0	1	0	0	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0	0	15
25		Bandar Selamat	21.022	1	1	1	1	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	1	17
26		Bantan	34.409	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	0	0	0	1	1	1	0	1	22
27		Tembung	12.136	1	1	1	1	0	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	0	0	1	0	1	0	0	1	18
28	Medan Area	Pasar Merah Timur	13.546	1	1	1	1	0	1	0	1	1	1	1	1	0	0	0	0	0	0	1	0	1	0	0	1	1	1	0	1	16
29		Tegal Sari II	7.980	1	1	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	1	0	0	0	0	1	1	1	0	0	13
30		Tegal Sari III	12.659	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	16
31		Tegal Sari I	10.727	1	1	1	0	1	0	1	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	13
32		Suka Ramai I	10.378	1	1	1	0	0	1	1	0	1	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	12
33		Kota Matsum II	10.275	1	1	1	1	1	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	11
34		Kota Matsum IV	11.411	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	13
35		Kota Matsum I	14.678	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	1	0	0	1	1	0	0	1	1	0	0	13
36		Sei Rengas Permata	4.121	1	1	1	1	0	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	14
37		Suka Ramai II	7.396	1	0	0	0	0	0	0	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	10
38		Sei Rengas II	6.130	1	1	1	0	1	0	0	0	1	1	1	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1	1	0	13
39		Pandau Hulu II	8.621	1	1	1	1	0	1	0	0	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	13

Source: Author's Analysis, 2023

Notes:

A	Pre-school/TK	H	Clinic	O	Vihara	V	Table Tennis
B	ELEMENTARY	I	Posyandu	P	Temple/Temple	W	Basketball
C	JUNIOR HIGH	J	Doctor's Practice	Q	Temple	X	Market
D	SMA	K	Midwife Practice	R	Soccer	Y	Shops
E	VOCATIONAL SCHOOL	L	Mosque	S	Futsal	Z	Supermarket/Minimarket
F	Hospital	M	Mushola	T	Volleyball	AA	Mall/Plaza
G	Puskesmas/Pustu	N	Church	U	Badminton	AB	GAS STATION

Table 2. Hierarchy Determination Based on Scalogram Analysis

District	Sub District	Total Score	Hierarchy
Medan Timur	Gang Buntu	14	3
	Sidodadi	12	3
	Perintis	17	3
	Gaharu	17	3
	Durian	14	3
	Glugur Darat II	11	4
	Glugur Darat I	15	3
	Pulo Brayan Darat I	16	3
	Pulo Brayan Darat II	18	2
	Pulo Brayan Bengkel Baru	15	3
	Pulo Brayan Bengkel	17	3
Medan Perjuangan	Pandau Hilir	15	3
	Sei Kera Hulu	6	4
	Pahlawan	11	4
	Sei Kera Hilir I	10	4
	Sei Kera Hilir II	10	4
	Sidorame Timur	8	4
	Sidorame Barat II	10	4
	Sidorame Barat I	9	4
	Tegal Rejo	11	4
Medan Tembung	Indra Kasih	17	3
	Sidorejo Hilir	16	3
	Sidorejo	16	3
	Bantan Timur	15	3
	Bandar Selamat	17	3
	Bantan	22	2
	Tembung	18	2
Medan Area	Pasar Merah Timur	16	3
	Tegal Sari II	13	3
	Tegal Sari III	16	3
	Tegal Sari I	13	3
	Suka Ramai I	12	3
	Kota Matsum II	11	4
	Kota Matsum IV	13	3
	Kota Matsum I	13	3
	Sei Rengas Permata	14	3
	Suka Ramai II	10	4
	Sei Rengas II	13	3
	Pandau Hulu II	13	3

Source: Author's Analysis, 2023

Based on the table above, it can be observed that the Eastern part of Medan City does not have a Hierarchy 1; therefore, it only has Hierarchy 2 with a moderate total score, Hierarchy 3 with a low total score, and Hierarchy 4 with a very low total score in the Eastern part of Medan City.

Hierarchy 2 is present in the Sub-district of Medan Timur, specifically in the Pulo Brayan Darat II Village, and the Sub-district of Medan Tembung, specifically in the Bantan and Tembung Villages. Meanwhile, Hierarchy 3 is distributed in each village of the four sub-districts, and Hierarchy 4 is scattered in the Sub-districts of Medan Timur, Medan Area, and Medan Perjuangan, in each of their respective villages.

The Scalogram Analysis technique is a tool used to assess a region's capability to provide services to the community. The determination of the central service using scalogram analysis is based on the completeness of facilities in each area. In this analysis, if facilities are available in a particular area, it is assigned a code of 1; otherwise, it is assigned a code of 0. The assumption is that the area with the highest score will be selected as the central service. After scoring, the next step is to determine the central service based on hierarchy. Before determining the hierarchy range, the number of orders needs to be determined using the following formula:

Number of Orders = 1 + 3.3 log n
Number of Orders = 1 + 3.3 log 4
Number of Orders = 1 + 3.3 (0.602) = 2.98

From the calculation results, the number of orders for scalogram analysis is 2.98, which can be rounded up to 3. Next, determine the range using the following formula:

Range = (Highest Value - Lowest Value) / Number of Orders

The final step is to determine the hierarchy from the scoring results as follows.

Centrality Analysis

Table 3. Centrality Analysis

District	Sub District	Area Km2	Population 2023	Education Facilities					Health Facilities						Worship Facilities						Sports Facilities						Economic Facilities				
				A	B	C	D	E	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E
Medan Timur	Gang Buntu	0,42	0,88	0	0,6	2,6	2,2	0	14,3	0	0	0,3	4,5	0	0,4	0	1	10,6	0	0	0	0	0	0	12,5	0	5,9	5,4	3	33,3	0
	Sidodadi	0,46	1,26	1,5	0,6	1,3	2,2	0	0	0	0	0,9	7,1	0	1,3	0,7	3,1	2,1	0	0	0	0	0	0	0	0	0	0	3	0	9,1
	Perintis	0,49	0,84	1,5	2,3	1,3	2,2	0	7,1	0	5,6	1,2	1,5	0	2,1	1,4	0	0	0	0	25	0	20	7,1	12,5	0	0	1,1	3	0	9,1
	Gaharu	0,52	1,96	4,4	4,7	6,5	8,9	10,5	7,1	0	2,8	3	1	0	2,1	6,5	0	2,1	33,3	33,3	0	0	20	0	0	0	0	0	5	0	9,1
	Durian	0,54	1,99	2,2	1,2	1,3	2,2	0	0	0	2,8	2,7	2	0	1,7	1,4	1	4,3	0	0	0	0	0	0	0	0	5,9	1,1	3	0	0
	Glugur Darat II	0,76	2,3	0,7	1,2	0	0	0	0	0	5,6	3	3	0	2,6	2,2	4,1	4,3	0	0	0	0	0	0	0	0	0	1,1	4	0	0
	Glugur Darat I	0,79	2,63	1,5	3,5	1,3	0	0	0	9,1	8,3	2,4	3,5	2,1	3	2,2	1	0	0	0	0	9,1	0	0	0	0	5,9	2,2	2	0	0
	Pulo Brayan Darat I	0,75	4,19	3	2,9	2,6	4,4	13,2	7,1	0	2,8	3	8,6	0	3,8	2,2	0	2,1	0	0	25	0	0	0	12,5	0	0	1,1	5	0	0
	Pulo Brayan Darat II	0,88	3,08	2,2	2,9	2,6	2,2	2,6	0	0	2,8	2,1	3,5	0	3	3,6	2,1	2,1	0	0	0	9,1	0	7,1	0	0	5,9	1,1	3	0	9,1
	Pulo Brayan Bengkel Baru	1,17	2,32	2,2	2,9	3,9	2,2	5,3	0	0	8,3	2,4	1	6,4	2,1	2,9	9,3	0	0	0	0	9,1	0	0	0	0	0	0	1	0	9,1
	Pulo Brayan Bengkel	1,06	3,15	2,2	3,5	3,9	4,4	2,6	0	9,1	2,8	3,4	0,5	2,1	2,6	2,2	2,1	2,1	0	0	25	0	0	0	12,5	0	0	0	1	0	0
Medan Perjuangan	Pandau Hilir	0,39	24,61	21,5	26,2	27,3	31,1	34,2	35,7	18,2	41,7	24,7	36,4	10,6	24,7	25,4	23,7	29,8	33,3	33,3	75	27,3	40	14,3	50	0	23,5	13	32,7	33,3	45,5
	Sei Kera Hulu	0,31	1,66	3	1,2	2,6	4,4	13,2	0	9,1	0	0,6	0	0	1,3	0	4,1	6,4	0	0	0	0	0	7,1	12,5	0	5,9	6,5	1	0	0
	Pahlawan	0,36	1,85	2,2	0,6	0	0	0	0	0	0	2,1	0	0	3	2,9	0	0	0	0	0	0	0	0	0	0	0	2,2	0	0	0
	Sei Kera Hilir I	0,45	1,89	3	2,9	3,9	4,4	2,6	0	0	0	1,8	0	0	2,6	2,9	4,1	0	0	0	0	0	0	0	0	0	0	4,3	1	0	0
	Sei Kera Hilir II	0,44	2,2	4,4	2,9	0	0	0	0	9,1	0	2,1	0	0	5,1	2,9	2,1	0	0	0	0	0	0	0	0	0	5,9	3,3	2	0	0
	Sidorame Timur	0,5	1,86	3	2,9	2,6	0	0	0	0	0	1,8	0	0	2,6	2,2	3,1	0	0	0	0	0	0	7,1	0	0	3,3	0	0	0	9,1
	Sidorame Barat II	0,43	2,35	3	2,3	1,3	0	0	0	0	0	2,7	0	0	2,1	0	6,2	0	0	0	0	0	0	0	0	0	5,9	0	5,9	0	0
	Sidorame Barat I	0,33	1,86	1,5	3,5	3,9	4,4	0	0	0	0	1,8	0	0	1,7	1,4	10,3	0	0	0	0	0	0	7,1	12,5	0	0	0	0	0	0
	Tegal Rejo	1,1	2,01	3	1,2	1,3	0	0	0	0	0	1,5	0	0	3	1,4	1	0	0	0	0	0	0	0	12,5	0	0	0	1	0	0
Medan Tembung	Indra Kasih	1,79	5,19	7,4	3,5	3,9	4,4	5,3	7,1	0	0	4	0	0	3,4	2,2	8,2	0	0	0	0	0	0	0	0	0	0	0	2	0	0
	Sidorejo Hilir	0,76	20,86	30,4	20,9	19,5	17,8	21,1	7,1	9,1	0	18,6	0	0	24,7	15,9	39,2	6,4	33,3	0	0	0	0	14,3	37,5	0	17,6	19,6	12,9	0	9,1
	Sidorejo	1,48	5,04	3,7	4,7	1,3	0	5,3	0	9,1	0	4,3	5,1	8,5	5,1	6,5	9,3	0	0	0	0	18,2	40	14,3	0	0	0	4,3	4	0	9,1
	Bantan Timur	0,63	4,35	1,5	2,9	2,6	4,4	0	0	9,1	5,6	3,4	3	10,6	4,3	1,4	3,1	0	0	0	0	9,1	0	0	0	0	5,9	2,2	1	0	0
	Bandar Selamat	0,77	4,34	1,5	6,4	10,4	4,4	0	0	9,1	5,6	2,7	4	6,4	4,3	1,4	7,2	0	0	0	0	9,1	0	7,1	0	0	0	13	4	0	0
	Bantan	1,39	3,53	1,5	4,1	1,3	0	2,6	0	0	5,6	3,4	8,1	6,4	2,1	0	3,1	2,1	33,3	0	0	0	0	0	0	0	5,9	6,5	4	0	0
	Tembung	1,03	4,22	1,5	3,5	7,8	6,7	5,3	7,1	0	5,6	4,3	4,5	8,5	3,4	0,7	0	0	0	0	0	0	0	7,1	0	0	5,9	6,5	3	0	9,1
Medan Area	Pasar Merah Timur	0,61	6,91	8,1	5,8	10,4	13,3	10,5	7,1	9,1	5,6	4	5,1	8,5	7,2	0,7	7,2	4,3	0	66,7	0	9,1	0	7,1	0	0	5,9	4,3	2	0	9,1
	Tegal Sari II	0,27	2,44	2,2	2,3	3,9	2,2	5,3	0	9,1	5,6	2,1	3,5	6,4	2,1	2,2	0	0	0	0	0	9,1	20	14,3	0	0	5,9	0	4	0	9,1
	Tegal Sari III	0,37	30,84	20	29,7	33,8	31,1	28,9	14,3	45,5	33,3	23,5	33,3	55,3	28,5	13	29,9	6,4	33,3	66,7	0	54,5	60	50	0	0	29,4	37	21,8	0	36,4
	Tegal Sari I	0,26	2,72	4,4	4,1	3,9	4,4	0	7,1	0	2,8	3,4	2	2,1	3,8	0,7	0	0	0	0	0	9,1	0	7,1	0	0	0	1,1	6,9	0	9,1
	Suka Ramai I	0,39	1,6	3	1,7	0	0	0	0	0	5,6	1,8	1,5	6,4	1,7	4,3	2,1	0	0	0	0	9,1	0	0	0	0	5,9	1,1	2	0	0
	Kota Matsum II	0,31	2,54	2,2	4,7	1,3	2,2	5,3	7,1	0	2,8	3	0,5	14,9	3	1,4	3,1	2,1	0	0	0	0	0	0	0	0	0	1,1	2	0	0
	Kota Matsum IV	0,32	2,16	1,5	0,6	1,3	0	5,3	0	9,1	0	2,4	1,5	0	2,1	0,7	1	6,4	0	0	0	0	0	0	0	0	0	3,3	1	0	0
	Kota Matsum I	0,41	2,09	2,2	4,1	1,3	0	0	7,1	9,1	0	4	1,5	0	1,3	4,3	0	0	0	0	0	0	0	7,1	0	0	0	2,2	4	0	0
	Sei Rengas Permata	0,25	2,06	2,2	2,9	2,2	2,6	0	0	0	2,8	2,4	3,5	0	1,7	10,1	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0
	Suka Ramai II	0,3	2,29	3,7	0,6	1,3	2,2	0	0	9,1	2,8	2,7	1,5	2,1	2,6	8	0	0	0	0	0	0	0	0	0	0	0	1,1	3	0	0
	Sei Rengas II	0,35	2,95	3,7	1,2	0	0	0	0	0	0	4,6	5,1	4,3	3	11,6	0	2,1	0	0	25	0	0	7,1	12,5	0	0	1,1	2	0	0
	Pandau Hulu II	0,4	0,83	1,5	1,2	2,6	2,2	0	14,3	0	0	1,5	2	4,3	0,9	1,4	1	10,6	0	0	0	0	0	0	0	0	0	3,3	5	0	0
	Grand Total	24,24	171,86	168,1	174,4	179,2	173,3	181,6	150	181,8	166,7	160,1	158,6	166	175,7	151,4	192,8	106,4	166,7	200	175	181,8	200	185,7	187,5	0	147,1	153,3	160,4	66,7	190,9

Source: Author's Analysis, 2023

Notes:

A	Pre-school/TK	H	Clinic	O	Vihara	V	Table Tennis
B	ELEMENTARY	I	Posyandu	P	Temple/Temple	W	Basketball
C	JUNIOR HIGH	J	Doctor's Practice	Q	Temple	X	Market
D	SMA	K	Midwife Practice	R	Soccer	Y	Shops
E	VOCATIONAL SCHOOL	L	Mosque	S	Futsal	Z	Supermarket/Minimarket
F	Hospital	M	Mushola	T	Volleyball	AA	Mall/Plaza
G	Puskesmas/Pustu	N	Church	U	Badminton	AB	GAS STATION

The Centrality method is conducted to determine service centers based on the quantity and types of service facility units within the urban area. The number of units of each type of facility is compared, resulting in a level of concentration. This concentration level is an indicator showing the city facility service capability. This method employs weighting to all types of facilities, forming a Combined Centrality Value, with the assumed centrality value being 100.

From the analysis results based on the above table, the scoring results and hierarchy can be determined as follows:

Table 4. Hierarchy Determination Based on Centrality Analysis

District	Sub District	Total Population 2023	Total	Hierarchy
Medan Timur	Gang Buntu	0,88	97,63	4
	Sidodadi	1,26	34,12	4
	Perintis	0,84	104,97	4
	Gaharu	1,96	162,43	4
	Durian	1,99	34,82	4
	Glugur Darat II	2,3	33,99	4
	Glugur Darat I	2,63	59,73	4
	Pulo Brayan Darat I	4,19	103,48	4
	Pulo Brayan Darat	3,08	70,16	4
	Pulo Brayan Bengkel Baru	2,32	70,47	4
	Pulo Brayan	3,15	85,1	4
Medan Perjuangan	Pandau Hilir	24,61	856,91	2
	Sei Kera Hulu	1,66	80,5	4
	Pahlawan	1,85	14,84	4
	Sei Kera Hilir I	1,89	35,48	4
	Sei Kera Hilir II	2,2	41,96	4
	Sidorame Timur	1,86	39,47	4
	Sidorame Barat II	2,35	31,82	4
	Sidorame Barat I	1,86	50,1	4
	Tegal Rejo	2,01	27,9	4
Medan Tembung	Indra Kasih	5,19	56,6	4
	Sidorejo Hilir	20,86	395,78	3
	Sidorejo	5,04	157,65	4
	Bantan Timur	4,35	74,38	4
	Bandar Selamat	4,34	101,02	4
	Bantan	3,53	93,43	4
	Tembung	4,22	94,68	4
Medan Area	Pasar Merah Timur	6,91	218,07	4
	Tegal Sari II	2,44	111,68	4
	Tegal Sari III	30,84	846,41	2
	Tegal Sari I	2,72	74,9	4
	Suka Ramai I	1,6	47,75	4
	Kota Matsum II	2,54	59,28	4
	Kota Matsum IV	2,16	38,34	4
	Kota Matsum I	2,09	50,29	4
	Sei Rengas Permata	2,06	37,22	4
	Suka Ramai II	2,29	42,94	4
	Sei Rengas II	2,95	86,11	4
	Pandau Hulu II	0,83	50,58	4

Source: Author's Analysis, 2023

The assumption used is that the area with the highest ranking is the location that can be designated as the service center. The results of the analysis of the Marshall centrality index for the Eastern part of Medan City can be seen in the following table.

Looking at the table above, it can be observed that Hierarchy 2 with a moderate total score is present in the Sub-district of Medan Perjuangan, specifically in the Pandau Hilir Village, and the Sub-district of Medan Area, specifically in the Tegal Sari III Village. Hierarchy 3 with a low total score is present in the Sub-district of Medan Tembung, specifically in the Sidorejo Hilir Village, and the majority of villages in each sub-district in the Eastern part of Medan City are Hierarchy 4, scattered across each sub-district.

Rank Size Rule Analysis

This method is conducted by comparing the population between cities of higher hierarchy with cities of at least three times lower hierarchy. The method categorizes the villages in the Eastern part of Medan City into four (4) order groups 1 – 4, based on population. Where order 1 has the highest population and so on. In determining the urban order, this method uses the formula:

With: Pn = Population of Village/Sub-district of n Orde

$$Pn = P1 \ X \ Rn^{-1}$$

Rn-1 = Village/Sub-district orde with the exponent -1 or 1/Rn"Rn

Table 5. Analysis of the Central Service System Based on Rank Size Rule

District	Sub District	Population 2023	Population Rank	1/Rank	Population Estimate	Hierarchy
Medan Timur	Gang Buntu	4.384	37	0,03	118,5	4
	Sidodadi	6.288	35	0,03	179,7	4
	Perintis	4.189	38	0,03	110,2	4
	Gaharu	9.769	26	0,04	375,7	4
	Durian	9.922	25	0,04	396,9	4
	Glugur Darat II	11.440	18	0,06	635,6	4
	Glugur Darat I	13.075	13	0,08	1.005,80	4
	Pulo Brayan Darat I	20.850	7	0,14	2.978,60	4
	Pulo Brayan Darat II	15.333	10	0,1	1.533,30	4
	Pulo Brayan Bengkel Baru	11.536	17	0,06	678,6	4
	Pulo Brayan Bengkel	15.700	9	0,11	1.744,40	4
Medan Perjuangan	Pandau Hilir	8.251	32	0,03	257,8	4
	Sei Kera Hulu	9.215	30	0,03	307,2	4
	Pahlawan	9.424	27	0,04	349	4
	Sei Kera Hilir I	10.925	20	0,05	546,3	4
	Sei Kera Hilir II	9.241	29	0,03	318,7	4
	Sidorame Timur	11.687	16	0,06	730,4	4
	Sidorame Barat II	9.253	28	0,04	330,5	4
	Sidorame Barat I	9.988	24	0,04	416,2	4
	Tegal Rejo	25.829	2	0,5	12.914,50	4
Medan Tembung	Indra Kasih	25.096	3	0,33	8.365,30	4
	Sidorejo Hilir	21.647	4	0,25	5.411,80	4
	Sidorejo	21.591	5	0,2	4.318,20	4
	Bantan Timur	17.572	8	0,13	2.196,50	4
	Bandar Selamat	21.022	6	0,17	3.503,70	4
	Bantan	34.409	1	1	34.409,00	3
	Tembung	12.136	15	0,07	809,1	4
Medan Area	Pasar Merah Timur	13.546	12	0,08	1.128,80	4
	Tegal Sari II	7.980	33	0,03	241,8	4
	Tegal Sari III	12.659	14	0,07	904,2	4
	Tegal Sari I	10.727	21	0,05	510,8	4
	Suka Ramai I	10.378	22	0,05	471,7	4
	Kota Matsum II	10.275	23	0,04	446,7	4
	Kota Matsum IV	11.411	19	0,05	600,6	4
	Kota Matsum I	14.678	11	0,09	1.334,40	4
	Sei Rengas Permata	4.121	39	0,03	105,7	4
	Suka Ramai II	7.396	34	0,03	217,5	4
	Sei Rengas II	6.130	36	0,03	170,3	4
	Pandau Hulu II	8.621	31	0,03	278,1	4

Source: Author's Analysis, 2023

Based on the table above, it can be observed that the Eastern part of Medan City only has Hierarchy 3, which is located in the Sub-district of Medan Tembung, specifically in the Bantan Village, and all villages in the other four sub-districts are in Hierarchy 4.

**Recommendation for the Central Service System**

Table 6. Analysis of Determining the Hierarchy of Residential Centers

District	Sub District	Scalogram Hierarchy	Centrality Hierarchy	Zip Rank Hierarchy	Total	Order of Analysis Results	Hierarchy
Medan Timur	Gang Buntu	3	4	4	11	Hierarchy 2	SPPK
	Sidodadi	3	4	4	11	Hierarchy 2	SPPK
	Perintis	3	4	4	11	Hierarchy 2	SPPK
	Gaharu	3	4	4	11	Hierarchy 2	SPPK
	Durian	3	4	4	11	Hierarchy 2	SPPK
	Glugur Darat II	4	4	4	12	Hierarchy 2	SPPK
	Glugur Darat I	3	4	4	11	Hierarchy 2	SPPK
	Pulo Brayan Darat I	3	4	4	11	Hierarchy 2	SPPK
	Pulo Brayan Darat II	2	4	4	10	Hierarchy 3	PPL Kecamatan
	Pulo Brayan Bengkel Baru	3	4	4	11	Hierarchy 2	SPPK
	Pulo Brayan Bengkel	3	4	4	11	Hierarchy 2	SPPK
Medan Perjuangan	Pandau Hilir	3	2	4	9	Hierarchy 3	PPL Kecamatan
	Sei Kera Hulu	4	4	4	12	Hierarchy 2	SPPK
	Pahlawan	4	4	4	12	Hierarchy 2	SPPK
	Sei Kera Hilir I	4	4	4	12	Hierarchy 2	SPPK
	Sei Kera Hilir II	4	4	4	12	Hierarchy 2	SPPK
	Sidorame Timur	4	4	4	12	Hierarchy 2	SPPK
	Sidorame Barat II	4	4	4	12	Hierarchy 2	SPPK
	Sidorame Barat I	4	4	4	12	Hierarchy 2	SPPK
	Tegal Rejo	4	4	4	12	Hierarchy 2	SPPK
Medan Tembung	Indra Kasih	3	4	4	11	Hierarchy 2	SPPK
	Sidorejo Hilir	3	3	4	10	Hierarchy 3	PPL Kecamatan
	Sidorejo	3	4	4	11	Hierarchy 2	SPPK
	Bantan Timur	3	4	4	11	Hierarchy 2	SPPK
	Bandar Selamat	3	4	4	11	Hierarchy 2	SPPK
	Bantan	2	4	3	9	Hierarchy 3	PPL Kecamatan
	Tembung	2	4	4	10	Hierarchy 3	PPL Kecamatan
Medan Area	Pasar Merah Timur	3	4	4	11	Hierarchy 2	SPPK
	Tegal Sari II	3	4	4	11	Hierarchy 2	SPPK
	Tegal Sari III	3	2	4	9	Hierarchy 3	PPL Kecamatan
	Tegal Sari I	3	4	4	11	Hierarchy 2	SPPK
	Suka Ramai I	3	4	4	11	Hierarchy 2	SPPK
	Kota Matsum II	4	4	4	12	Hierarchy 2	SPPK
	Kota Matsum IV	3	4	4	11	Hierarchy 2	SPPK
	Kota Matsum I	3	4	4	11	Hierarchy 2	SPPK
	Sei Rengas Permata	3	4	4	11	Hierarchy 2	SPPK
	Suka Ramai II	4	4	4	12	Hierarchy 2	SPPK
	Sei Rengas II	3	4	4	11	Hierarchy 2	SPPK
	Pandau Hulu II	3	4	4	11	Hierarchy 2	SPPK

Source: Author's Analysis, 2023

Based on the results of all the analyses conducted earlier regarding the selection of service centers, including service indices, scalograms, and rank-size rules, the next step is to determine the internal structure of the existing urban area using the scoring method to identify the location

that will become the service center. To determine the existing hierarchy, the results of calculations using several methods of service center analysis were scored and then summed to obtain the total score. Villages with the smallest score have the highest hierarchy value, and vice versa. Based on the analysis results, it is found that the Eastern part of Medan City does not have Hierarchy 1 or a Sub-center of the City (PPK), thus aligning with Regional Regulation No. 1 of 2021 concerning the Spatial Plan for Medan City, which states that PPKs are only located in the Sub-districts of Medan Barat and Medan Labuhan. The determination of the hierarchy of service centers in the Eastern part of Medan City can be seen in the following table.
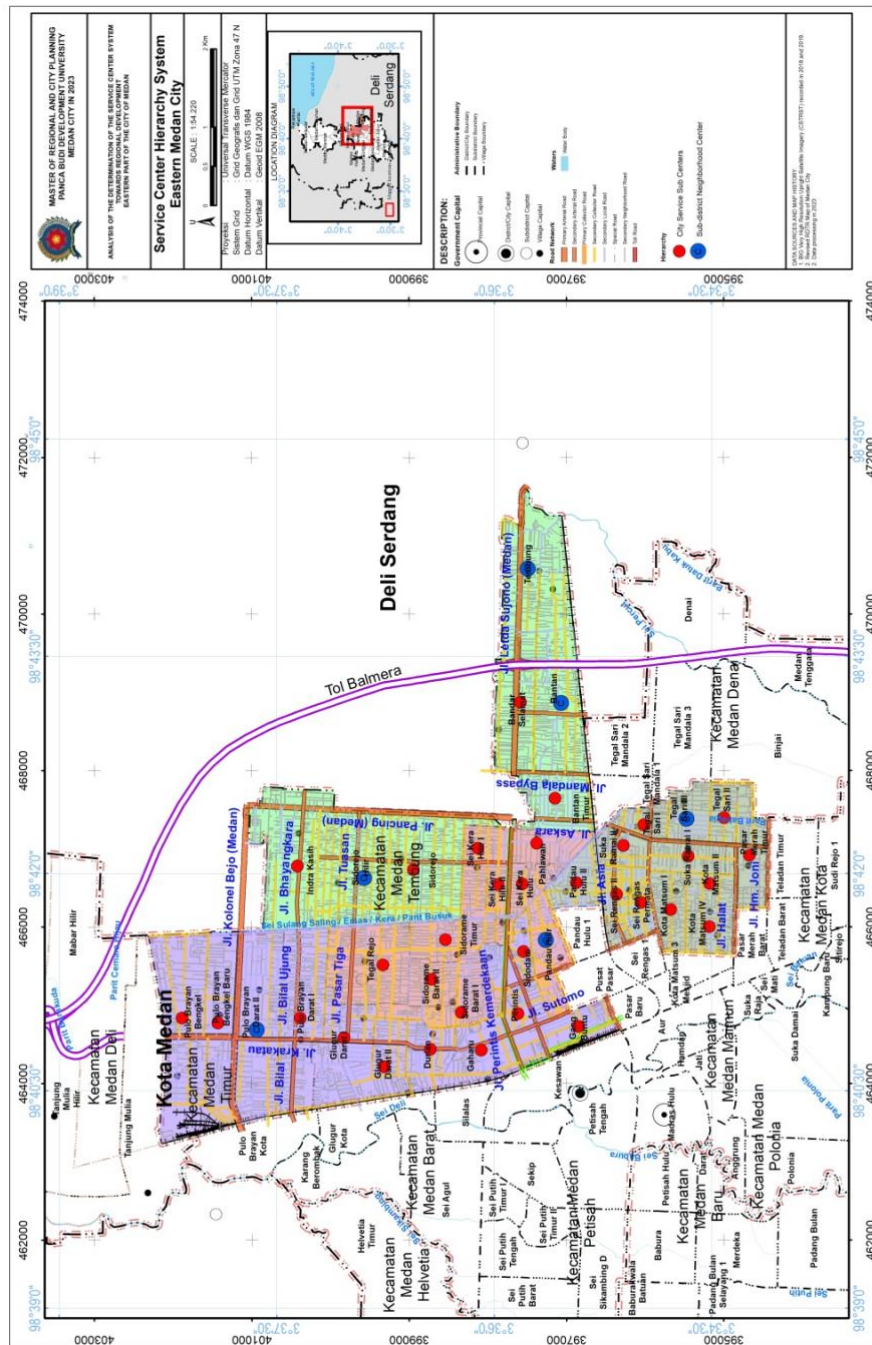
Concept of Development Theory for the Eastern Part of Medan City

From the analysis results above, it can be observed that Sub-Centers of the City (SPPK) are present in all Sub-districts in the Eastern part of Medan City. Therefore, each sub-district in each village already has the most complete facilities, allowing the four sub-districts in the Eastern part of Medan City to have the potential for development. For a clearer view, refer to the Hierarchy Map in the following figure. Figure 1 Hierarchy Map of Service Centers in the Planning Region of the Eastern Part of Medan City.

The development plan for the center of urban activities describes the location of urban activity service centers, their hierarchy, service scale, and the dominance of activity functions directed towards these service centers. The fundamentals for determining the development of the service center system in the Eastern Part of Medan City are generally influenced by several factors, both internal and external. For the service center system in the Eastern Part of Medan City, internal factors influencing the spatial structure include:

a. The current pattern of road networks and functions;
b. The dominant land use in that part of the city;
c. The number and distribution of supporting populations;
d. The level of facility completeness and its service scale.

External factors affecting the urban service center system include:

a. The designation of types and locations of urban-scale land use activities in the neighboring areas;
b. The pattern and function of urban-scale road networks passing through that part of the city; and
c. Vital objects in the bordering area of the city.

Based on the criteria influencing the service center system mentioned above, the service level system in each part of the Eastern Part of Medan City is divided into 2 hierarchies:

Sub-Center of the City (SPPK)

a. Transportation nodes serving several areas and connected;
b. City-scale trade and service activities and sub-services; and
c. Housing and settlement activities.

District and Village Environmental Centers

The environmental service center is a service center for one district and one village environment with several neighborhood blocks. This service center is identical to neighborhood-scale service facilities. The service facilities consist of village-scale service facilities. The rapid urban population growth is accompanied by the development of types and intensities of activities with all their facilities, which also influence the rapid transformation of the city's physical form. The current intensity of space utilization in the Eastern Part of Medan City consists of various developing activities, one of which is the need for housing. The main activities in the Eastern Part of Medan City are trade and services, and public service facilities. Therefore, the demand for housing as a supporter of the existence of trade and service areas is very high.

The current intensity of built-up space development is more towards residential areas scattered in the Eastern Part of Medan City. The role of the Eastern Part of Medan City as a Sub-Center of the City (SPPK) is one of the crucial roles for the economic growth of the region, with the development of several socio-economic facilities being a support for the high population growth in the Eastern Part of Medan City. To determine the connectivity between the designated development centers, a regional connectivity test is conducted. The intended

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connectivity is related to the road network connecting the designated development centers. The more positive the structural test value, the better the connectivity between the regions in the Eastern Part of Medan City.

The formulation based on the above formulation is as follows: Structure value = number of lines - number of points + network

Structural testing uses the center of the development area as points. Primary arterial roads, primary collectors, and primary local roads are used as lines. Meanwhile, the network is a unified network. In this case, Kota Medan Bagian Timur has 3 (three) networks, namely (road network, toll road network, and railway network).
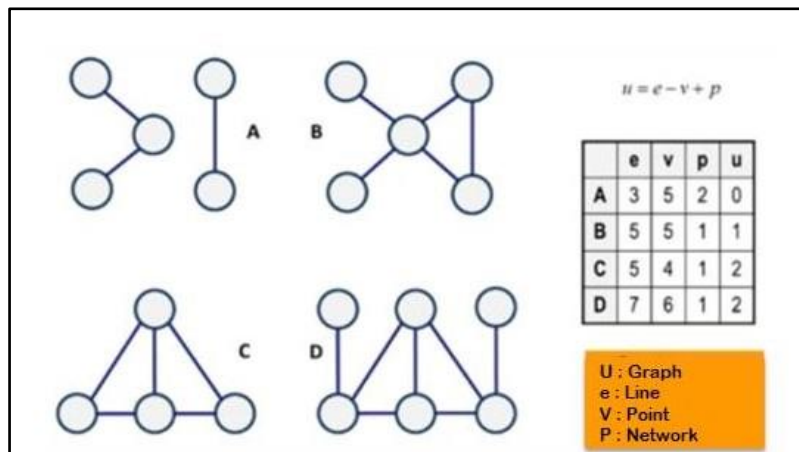
Figure 2 Movement Test Formulation

The value of the existing structure of Kota Medan Bagian Timur is: = 10 - 7 + 3 = 0

The existing structure is already good because it is balanced or positive. This is because the current road network has connected the centers of neighborhoods in Kota Medan Bagian Timur. According to the theories of Walter Christaller and August Losch, based on spatial aspects, the hexagonal network is the most effective. The advantage of a hexagonal network is that it has a high level of community participation in economic activities, allowing it to serve the needs of the community to the maximum. According to the existing condition, the structure in Kota Medan Bagian Timur is good because most of the area is connected by a road network. However, further development is still needed to enhance the connectivity between these centers.

Figure 3. Intensity of Spatial Development

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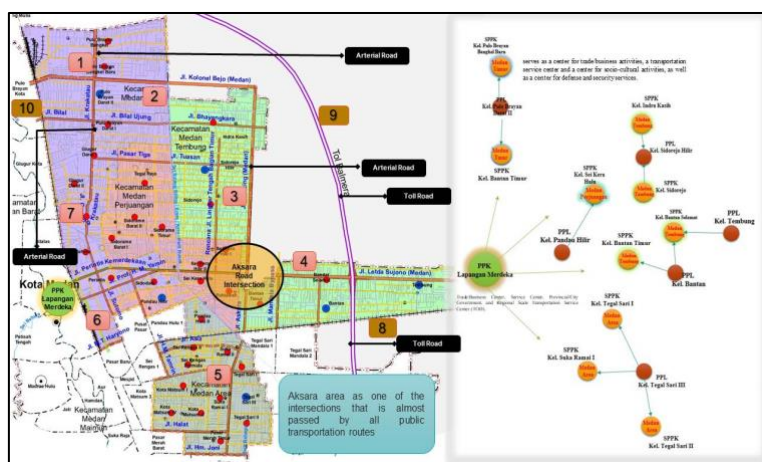
Conclusion

In this research, after conducting Scalogram, Centrality, and Rank Size Rule analyses, recommendations have been made indicating that the determination of Sub-City Service Centers (SPPK) in the 4 districts has a very strategic position in the region. Medan Timur District, Medan Perjuangan District, Medan Tembung District, and Medan Area District have already fulfilled their service needs and can be directed to become service centers that can serve their respective districts. Based on these results, recommendations have been made, where the service level system in each part of the Kota Medan Bagian Timur region, especially SPPK, includes transportation hubs serving several areas and interconnected, trade and service activities on a city scale and sub-services, as well as housing and settlement activities, so that the development of these 4 districts has the potential to thrive. The results of development theory using connectivity testing, which is the interconnection between development centers, show positive/balanced values because the current road network has connected neighborhood centers in Kota Medan Bagian Timur. Based on spatial aspects and development theory according to Walter Christaller and August Losch, it is recommended to form a hexagonal spatial structure to maximize serving the needs of the community.

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