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Spatial Structure and Socio-Economic Linkages in Medan Denai District: A Study of Inter- Area Connectivity

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ABSTRACT

This study seeks to examine the spatial organization and socio-economic connections within Medan Denai District, with an emphasis on case studies related to inter-regional connectivity. Medan Denai District, situated in the city of Medan, North Sumatra, is characterized by a high population density and a variety of interconnected economic sectors.The spatial structure in this area includes various types of land use, ranging from settlements, trade, industry, to public facilities. Through a qualitative approach with observation methods and direct interviews to the location, this study identifies the relationship between spatial structure and the pattern of socio-economic linkages between regions in Medan Denai District. The data obtained includes information on population distribution, types of businesses, economic mobility, and accessibility between regions. This analysis also considers the role of transportation infrastructure and public facilities in shaping social and economic interactions between regions. The results of the study show that there is a significant connection between residential areas and commercial and industrial areas, which supports in creating local economic dynamics. The fragmented spatial structure affects the pattern of economic distribution, with certain regions having greater potential to increase economic activity and population welfare. However, uneven access and infrastructure inequality in some regions can hinder more inclusive economic growth. For example, in the Tegal Sari Mandala II sub-district, access to road infrastructure is small and many roads are not good, which hinders users in accessing the location, even though in this sub-district there is a local market for the community in the sub-district. Overall, this study provides an overview of the importance of more integrated and sustainable spatial planning, taking into account socio-economic aspects in an effort to create a balance between regions in Medan Denai District.

Keywords: Denai, *socio-economic, spatial structure*

1. Introdution

Medan is the capital of North Sumatra Province and ranks as the fifth-largest city in Indonesia, following Jakarta, Surabaya, and Bandung. Medan City consists of 21 sub-districts. It is geographically situated between 3º27' - 3º47' North Latitude and 98º35' - 98º44' East Longitude, with an elevation ranging from 2.5 to 37.5 meters above sea level. Medan City is surrounded by Deli Serdang Regency on all sides-north, south, east, and west. The majority of Medan City's territory consists of lowlands, where two significant rivers, the Babura River and the Deli River, converge [1].

Medan is a city experiencing rapid regional growth and development. Covering an area of 265.10 km², it has a population density of 9,186 people per km². By 2023, the population of Medan is expected to reach 2,474,166.

In comparison to the 2018 population of 2,264,145, there was an increase of 210,021 people, or 9.28% [1]. The rapid growth and development of this region inevitably lead to greater land demands. Urban development will be directly linked to population growth, where each increase in population will impact the city's expansion. As the population grows, the demand for land for housing also rises, leading to a limited availability of land that will continue to decrease each year [2]. The conversion of land for residential use can lead to shifts in the patterns and direction of regional development.

Medan Denai is one of the sub-districts in Medan City that has experienced significant growth. Located in the eastern part of Medan, North Sumatra, it is a region undergoing rapid development, with notable progress in both population growth and economic expansion. Medan Denai exhibits complex urban characteristics, showcasing social and economic diversity that mirrors the urban dynamics of Indonesia. The area is home to various communities with differing levels of well-being, shaped by factors such as access to employment, education, healthcare, and infrastructure.

The spatial structure in Medan Denai District is largely shaped by dense residential areas, the growth of trade and industrial sectors, and the presence of zones with varying functions, including residential, commercial, and industrial spaces. The connectivity between regions, in terms of economic, social, and physical accessibility, plays a significant role in influencing community interaction and the development dynamics in this area [3]. However, there are still significant challenges in achieving balanced development across regions, with notable disparities between areas that have sufficient infrastructure and those that remain underdeveloped.

Socio-economically, Medan Denai District exhibits noticeable inequality between more developed and less developed areas. Poorly integrated spatial structures can lead to disparities in the distribution of public services and infrastructure, affecting economic and social mobility between regions. Understanding the connectivity between regions is crucial, as it influences both accessibility and socio-economic interactions among residents in different areas [4].

Previous research on spatial structure reveals insights through studies of spatial planning, focusing on land use patterns, spatial functions, and regional hierarchy. The findings indicate inequality in infrastructure accessibility and public services, largely due to socio-economic disparities. Meanwhile, other studies on spatial structure and socio-economic linkages highlight the social interactions between regions, demonstrating how the connectivity patterns between regions are interrelated.

Understanding the spatial structure and socio-economic linkages in Medan Denai District is crucial to gaining a more comprehensive view of how urban space influences socio-economic relations between regions. Therefore, this study aims to analyze the interconnectivity between regions in Medan Denai District, focusing on how spatial structure shapes social and economic patterns, and how the relationships between these regions can either support or impede the overall development of the area.

This research will also examine how factors such as transportation infrastructure, the distribution of economic sectors, and land use contribute to forming relationships between interdependent regions. The goal is for the findings to offer policy recommendations that enhance regional connectivity more effectively, as well as assist in developing more inclusive and sustainable spatial planning for Medan City, particularly in the Medan Denai District.

2. Method

Research Location

Medan Denai District is a sub-district located in the area of Medan City, North Sumatra, this sub-district borders the following areas:

North : Medan Tembung, South : Medan Amplas, East : Deli Serdang, West : Medan Area

Medan Denai District covers an area of 29.87 km² and is made up of 6 villages. The location of the research is illustrated in figure 1.

Figure 1 map of medan denai district

(Source : Google EART [5])

2. Methods

In this study, the researcher employs a descriptive approach with spatial and socio-economic analysis methods, which are commonly used to obtain real results. The study period spans three months, from October to December. The data used in this research includes secondary data (regional maps, demographic data, economic data, infrastructure data) and primary data collected through interviews and field observations to identify patterns of economic activities and social interactions between regions. The approach used in studying inter-regional connectivity offers in-depth insights into how spatial structure and socio-economic linkages influence one another. By focusing on narrative and context, this approach reveals dynamics that cannot be measured quantitatively, providing a strong foundation for evidence-based policy development. This method thoroughly describes the phenomenon within the context of spatial relations and socio-economic interactions in the studied area. The research is essential for understanding how space, social activities, and economic activities interact across different regions. In analyzing the spatial structure, direct observation is crucial, utilizing detailed spatial planning (RDTR) data to identify residential areas, trade, industry, and transportation networks. Additionally, they gathered information on land use patterns and infrastructure. In analyzing socio-economic linkages, interviews were held with various stakeholders, including local residents, business actors, and government officials. Furthermore, narratives were collected regarding inter-regional relationships, such as the workforce in industrial areas, trade patterns, and cultural interactions within commercial zones.

3. Results and Discussion

3.1 Theoretical Review

Space Structure

Urban development, according to its hierarchy, reflects the growth of the activities within the city's community. As time progresses, the city undergoes numerous changes, leading to continuous development. This urban growth has always aligned with population increases and the rising demands for basic needs in areas such as

the economy, politics, society, culture, and technology, which in turn leads to a rise in population activities [6].

Based on the Law of the Republic of Indonesia No. 26 of 2007, the spatial structure is defined as "the arrangement of residential centers and a network of infrastructure and facilities that support the social and economic activities of the community, with a hierarchical functional relationship." The internal structure of a city comprises areas with distinct functions, and there are specific groups and spatial distribution patterns between these areas [7].

The spatial structure is shaped by historical factors, activities, and geographical conditions. Geographical elements are associated with natural physical factors, such as topography, rainfall, soil types, geology, and land use [8]. The components that form the city's spatial structure include various services like trade, government, and finance, which are typically organized in clusters within service centers. Additionally, it encompasses secondary industries (manufacturing), warehousing, and wholesale trade, which tend to be concentrated in specific areas. Moreover, the urban spatial structure includes residential areas for human habitation and green open spaces. Lastly, the transportation network plays a crucial role in linking key locations such as residential areas, industrial zones, and service centers[9].

The most prominent theories related to spatial structure include[10]:

Constitutional theory suggests that the central business district (CBD) is the heart of the city, positioned at its center, and typically circular in shape. It serves as the hub for social, economic, cultural, and political activities, with a high level of accessibility.Sectoral theory asserts that the central business district (CBD) holds the same meaning as described in concentric theory.The theory of multiple centers proposes that the central business district (CBD) is located near the center of other distinct areas and acts as one of several growing focal points within the city.

Types of Areas

According to Wikipedia, an area (derived from Old Javanese: kawaśan, meaning "waśa area," and Sanskrit: "to rule") refers to a region that possesses specific characteristics or is organized based on a functional grouping of particular activities, such as industrial zones, commercial areas (trade and services), and residential zones.

According to the Great Dictionary of Indonesian Language (KBBI), the term "commercial" refers to anything related to commerce or trade, intended for exchange, and possessing a high commercial value, often to the extent of sacrificing other values such as social or cultural aspects. Trade and services, as defined by Law No. 7 of 2014 on Trade, refer to activities involving the transaction of goods and/or services both within the country and across its borders, with the goal of transferring rights to goods and/or services in exchange for payment or compensation. Services are defined as any form of work or service provided by one party to another, which can be utilized by consumers or business actors. The aim of trade and services is to drive economic growth, generate employment, enhance competitiveness, and achieve other related goals[11].

According to Government Regulation No. 2 of 2017, an industrial estate is a designated area where industrial processing activities are concentrated. It is equipped with infrastructure, facilities, and other supporting amenities provided and managed by the industrial estate company (either government or private). This setup encourages investors or entrepreneurs to invest their capital in the industrial sector within the area. With adequate land, facilities, infrastructure, and other resources available, industrial zones can promote economic efficiency in investment (such as setting up factories and industries). This is in contrast to situations where investors are required to provide these facilities independently. Furthermore, the planned development of industrial estates aids in regional development and contributes to more effective spatial planning[12].

According to Law Number 1 of 2011 on Housing and Residential Areas, settlements are part of a residential environment that consists of multiple housing units, which are equipped with infrastructure, facilities, public utilities, and support other functional activities in both urban and rural areas. Housing, on the other hand, refers to a group of houses within settlements, whether in urban or rural settings, that are also equipped with

infrastructure, facilities, and public utilities, aiming to provide livable homes. Hadi Sabari Yunus (1987), as cited in Wesnawa (2015:2), describes settlements as areas formed both naturally and by human intervention, encompassing all necessary components where individuals or groups reside, either temporarily or permanently, to manage their lives. Meanwhile, housing refers to a cluster of houses that serve as a residential environment, equipped with infrastructure and essential facilities[13].

Connectivity between regions

The Inter-Regional Connectivity Study is an analysis conducted to examine the relationships between different regions within an area, focusing on social, economic, and physical aspects[14]. In regional or urban planning, connectivity between areas is crucial in influencing growth patterns, population movement, the distribution of goods and services, and the use of resources. This study is typically conducted to analyze the interactions between different types of areas, such as residential, industrial, commercial, and green spaces. On a broader scale, the study also examines how inter-regional connectivity affects community quality of life, infrastructure efficiency, and promotes equitable development[15] .

Here are some important aspects of the study of inter-regional connectivity:

Economic Linkages Between Regions examines how goods, services, and capital flow between different regions within an area. This includes the relationship between industrial and residential areas, where industrial zones typically rely on labor from nearby residential areas, while residential areas depend on industries to provide jobs and income. Similarly, the connection between commercial and residential areas sees commercial zones acting as trade centers, while residential areas provide consumers and workforce for the trade and service sectors. Additionally, the distribution patterns of goods and services are influenced by inter-regional connectivity, particularly in how consumer goods are moved from industrial estates to markets or shops in commercial areas.

Social Linkages Between Regions focuses on the interactions and social relationships between residents of different areas. This includes social mobility, where people from residential areas move to other regions for work, education, or healthcare, with this mobility being heavily reliant on the availability of transportation infrastructure and regional accessibility. Additionally, education and health services may be more advanced in developed areas, making inter-regional access to these services crucial for ensuring equal opportunities for all social groups. Cultural connectivity and social life also play a role, as different regions often have distinct social and cultural characteristics. The connectivity between these areas is fostered through various social and cultural activities, such as festivals, markets, and public spaces, which bring together diverse community groups.

Infrastructure and Accessibility are crucial factors in the study of inter-regional connectivity, with a focus on transportation and communication networks. Adequate infrastructure facilitates the efficient movement of people, goods, and services between regions, supporting the smooth operation of economic and social activities. Key elements to analyze include transportation networks, such as highways and public transit (e.g., buses, trains), which influence the efficiency of regional connectivity. Inadequate or poor connectivity can lead to congestion, delays, and high economic costs. Furthermore, inter-regional connectivity requires infrastructure that supports sustainability, such as eco-friendly transportation systems (e.g., electric or bicycle-based transport) and the management of interconnected green open spaces. Beyond socio-economic factors, it also involves the broader management of natural resources and the environment, including water and sanitation management. Ecologically connected areas benefit from better access to clean water distribution, waste management, and environmental restoration. Green open spaces and ecosystems, such as urban forests or parks, provide vital ecological benefits, improving air quality and reducing noise pollution, while ensuring that ecosystems function effectively across the region.

Connectivity and Urban Planning require careful attention to the integration of different regions to prevent segregation and ensure balanced growth. Key elements in spatial planning include proper zoning, where the grouping of adjacent residential, commercial, and industrial areas promotes the efficient integration of

economic activities and enhances residents' quality of life. Additionally, sustainable land use is crucial, as ecologically connected areas with responsible land management support population mobility and contribute to the creation of greener, environmentally friendly spaces. By addressing these factors, urban planning can foster a more cohesive and sustainable urban environment.

3.2 Connectivity Studies

Study of the structure of the existing space in Medan Denai District

The Study of Service Facility Centers in Medan Denai District reveals the distribution of various facilities across its sub-districts, which include Tegal Sari Madala I, Tegal Sari Mandala II, Tegal Sari Mandala III, Denai, Binjai, and Medan Tenggara research is illustrated in Figure 2. The educational facilities in Medan Denai, ranging from kindergartens to universities, are adequately provided, with a detailed distribution shown in Table 1. For health facilities, the sub-district offers sufficient services, including hospitals, health centers, posyandu, health posts, and medical practices, with their distribution detailed in Table 2. In terms of worship facilities, Medan Denai District has a significant number, including 127 mosques and prayer rooms and 64 churches, as shown in Table 3. Office facilities, primarily government offices such as sub-district and village offices, are also available, with their distribution shown in Table 4. Lastly, trade facilities, including modern markets and traditional markets, are fairly widespread across the district, although there is still room for further development in the service sector, as shown in Table 5 [1].

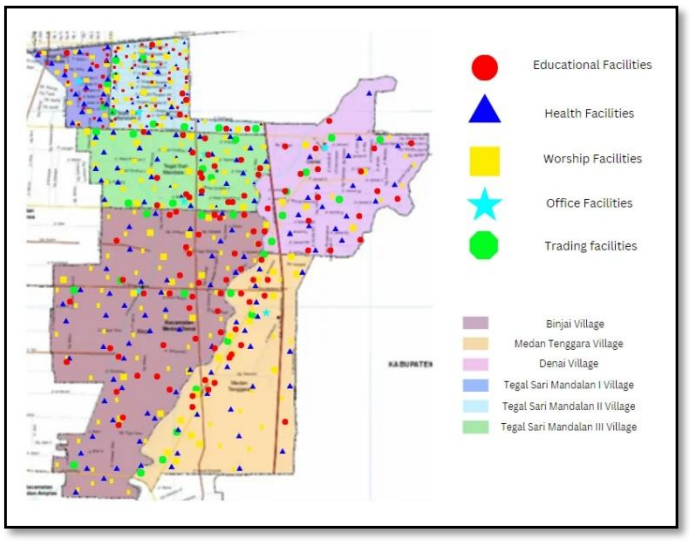

Figure 2 Map of the Distribution of Medan Denai Facilities
(Source: Personal Analysis)

Table 1 Data on the Distribution of Educational Facilities in Medan Denai District

Neighborhoods	Kindergarten	primary school	Junior High School	High School	Vocational High School	College
BINJAI	6	21	5	3	-	4
MEDAN TENGGARA	3	6	1	3	2	1
DENAI	5	6	3	1	2	-
TEGAL SARI MANDALA I	7	6	5	2	1	-
TEGAL SARI MANDALA II	6	28	4	2	-	2
TEGAL SARI MANDALA III	4	10	4	1	-	-
MEDAN DENAI	31	77	22	12	5	7

(Source: Medan City Statistics Center Agency[1])

Table 2 Data on the Distribution of Health Facilities in Medan Denai District

Neighborhoods	hospital	Community Health Center	Village Health Center	integrated health service post	Doctor's Practice	Midwifery Practice
BINJAI	-	2	2	19	12	10
MEDAN TENGGARA	1	-	3	10	4	4
DENAI	-	-	1	13	-	5
TEGAL SARI MANDALA I	1	-	1	12	2	-
TEGAL SARI MANDALA II	-	-	1	19	7	4
TEGAL SARI MANDALA III	-	1	1	15	5	11
MEDAN DENAI	2	3	9	12	30	34

(Source: Medan City Statistics Center Agency[1])

Table 3 Distribution Data of Worship Facilities in Medan Denai District

Neighborhoods	mosque	prayer room	church
BINJAI	31	11	18
MEDAN TENGGARA	9	8	11
DENAI	9	3	3
TEGAL SARI MANDALA I	6	3	6
TEGAL SARI MANDALA II	11	6	20
TEGAL SARI MANDALA III	18	12	6
MEDAN DENAI	84	43	64

(Source: Medan City Statistics Center Agency[1])

Table 4 Data on the Distribution of Office Facilities in Medan Denai District

Neighborhoods	address
BINJAI	Jl. Raya menteng No. 276
MEDAN TENGGARA	Jl. Menteng VII / Jl. Rahmad No. 1
DENAI	Jl. Jermal I NO. 1
TEGAL SARI MANDALA I	Jl. Jendral Ahmad Taher No. 4
TEGAL SARI MANDALA II	Jl. Tangguk Bongkar x No. 20
TEGAL SARI MANDALA III	Jl. Tuba IV No 25

(Source: Medan City Statistics Center Agency[1])

Table 5 Data on the Distribution of Trade Facilities in Medan Denai District

Neighborhoods	market	Shophouse	Grocery store
BINJAI	-	3	3
MEDAN TENGGARA	-	-	4
DENAI	-	-	4
TEGAL SARI MANDALA I	-	-	2
TEGAL SARI MANDALA II	1	2	5
TEGAL SARI MANDALA III	-	5	4
MEDAN DENAI	1	10	22

(Source: Medan City Statistics Center Agency[1])

The shape and model of the spatial structure of Medan Denai sub-district, based on spatial structure theory, can be identified as resembling a double center pattern, with service centers located in two key areas: the central government area (Medan Denai sub-district office) and the trade and service center in the Southeast Medan sub-district. The spatial structure of Medan Denai sub-district is further classified as multi-nodal, as it consists of Urban Service Centers (PPK), Urban Service Sub-Centers (SPPK), and Other Service Centers (PPL). For more detailed information on the shape and model of the spatial structure of Medan Denai sub-district, refer to Figure 3.

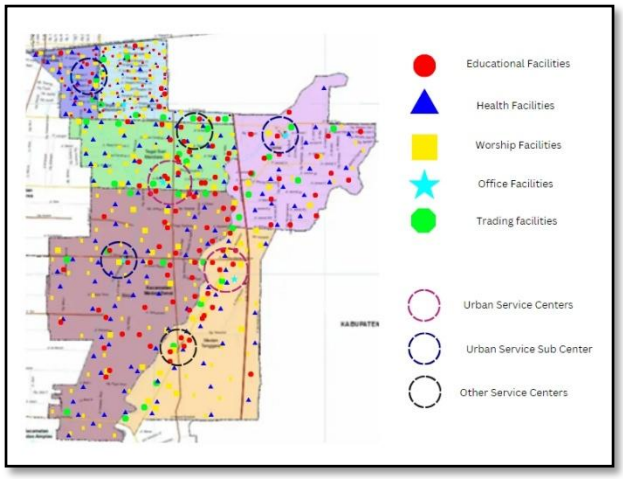

Figure 3 Map of the Shape and Model of the Spatial Structure of Medan Denai District
(Source : Personal Analysis)

Study of the Medan Denai sub-district area

Medan Denai District is composed of several key areas that define its spatial structure. Residential areas in the district are primarily made up of densely populated housing, most of which are informal settlements. These areas often face unplanned development, leading to limited access to basic facilities such as sanitation, clean water, and proper roads. The commercial areas consist of various trading centers and traditional markets located along the main roads, serving as the economic hubs that connect residents with essential goods and services. In addition, industrial estates around Medan Denai, which focus on small and medium industries catering mainly to the local market, are significant contributors to the region's economic income. Finally, the infrastructure and transportation areas are crucial to the district's connectivity, with main transportation routes linking residential, commercial, and industrial zones while also connecting Medan Denai with other sub-districts in Medan.

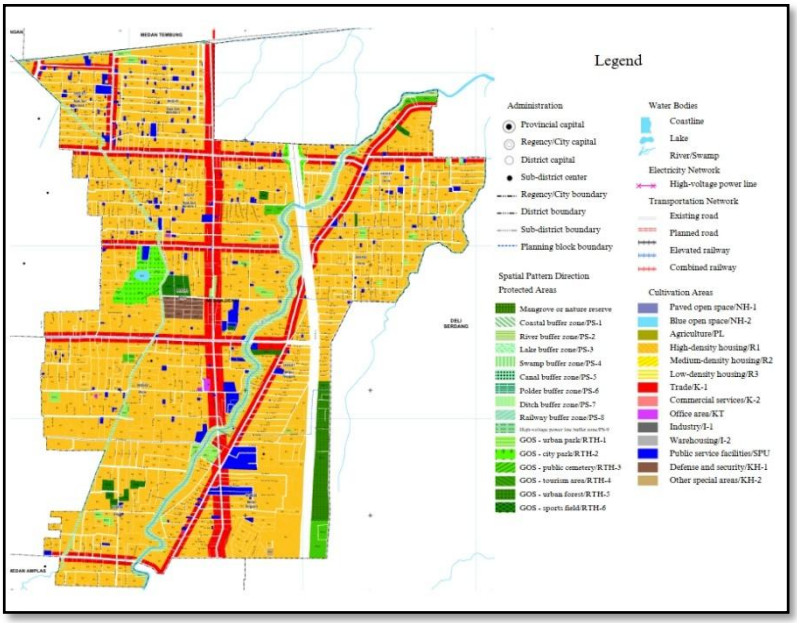

Figure 4 Map of the Spatial Pattern Map of Medan Denai District
(Source :RDTR[16])

Study on socio-economic linkages between Medan Denai sub-district areas

Some aspects of socio-economic connectivity between regions in Medan Denai include economic linkages, particularly between the trade centers and industrial sectors. The commercial area in Medan Denai is closely tied to surrounding industrial zones, as traditional markets and shopping malls serve as key points for marketing local industrial products, such as processed foods and household goods. Additionally, labor mobility plays a significant role, with many residents from residential areas working in industrial and commercial sectors. This linkage highlights the flow of labor between regions, influencing economic growth. However, transportation accessibility poses challenges that hinder smooth mobility, affecting the efficiency of this socio-economic connectivity. Social linkages also play a crucial role, especially regarding access to education and healthcare. Residential areas with lower income levels often face limited access to quality education and healthcare, while commercial and industrial areas offer better facilities, further impacting social dynamics. Moreover, improved quality of life in economically developed areas, such as commercial zones, provides better opportunities for residents in terms of employment, income, and access to essential services, enhancing social connectivity. Transportation and infrastructure are vital for ensuring accessibility between regions, with most residents in Medan Denai relying on public transport. However, the current transportation system faces challenges like congestion and poorly maintained roads. Local governments should prioritize infrastructure development, focusing on transportation networks connecting key areas like industrial, residential, and commercial zones. By improving the transportation system, the flow of goods and services can be streamlined, and labor mobility can be accelerated, ultimately fostering greater connectivity between regions.

The inter-regional connectivity study highlights the important relationships between various areas in Medan Denai. Connectivity between residential areas and industrial zones is particularly significant, as residential areas provide labor for industrial estates, while the industrial zones offer employment opportunities. However, this connection is heavily reliant on adequate transportation infrastructure, which, if lacking, can disrupt the flow of people between these areas. Similarly, the relationship between commercial areas and residential areas is vital, with developed commercial zones such as shopping centers and markets acting as distribution centers for goods and services that fuel the local economy. Easy access between residential areas and commercial centers is essential for residents to meet their daily needs. Furthermore, the connectivity between public and private areas is crucial, as public spaces like parks and green open areas must be easily accessible from residential neighborhoods. This accessibility not only enhances the quality of life for residents but also ensures that social facilities are utilized to their full potential.

4. Conclusion

The study of interregional connectivity examines how different areas within a region interact and impact one another across social, economic, and environmental dimensions. By understanding and improving the interconnectedness of these regions, we can develop a more integrated, efficient, and sustainable city or area, ultimately enhancing the quality of life for its residents and fostering economic growth. Effective planning and management of these connections are crucial to ensuring that interregional relationships operate smoothly and support sustainable development. In Medan Denai District, connectivity is essential for driving socio-economic progress, but fragmented spatial structures and inadequate infrastructure present significant challenges that must be addressed to improve regional connections.

The study of interregional connectivity looks at how different areas within a region interact and affect each other across social, economic, and environmental aspects. By understanding and improving these connections, we can create a more integrated, efficient, and sustainable city or region, which in turn enhances the quality of life for its residents and stimulates economic growth. Effective planning and management of these linkages are key to ensuring smooth interregional relationships and supporting sustainable development. In Medan Denai District, connectivity plays a vital role in advancing socio-economic progress, but fragmented spatial structures and insufficient infrastructure pose major challenges that need to be addressed to improve regional connections.

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the development of this journal. While acknowledging the limitations of this paper, the author welcomes any feedback and suggestions for further improvement.

6. Conflict of Interest

The authors listed below confirm that there are no conflicts of interest associated with this manuscript.

By signing this statement, all authors affirm that the provided information is accurate and correct. (If there are more than 10 authors, a photocopy of this form may be used):

Author's name (typed) Author's signature

Tika Nurannisa 

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