

Land Use Suitability for Spatial Planning in Salatiga City

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ABSTRACT

Land use changes in urban areas are a consequence of the increasing population, economic dynamics, and the need for built-up space. Salatiga City is strategically located in the Semarang-Solo-Yogyakarta corridor, which is experiencing rapid regional development, thus driving spatial transformation in various sectors. Population growth and demand for housing development have led to the conversion of agricultural land into residential areas, while increased industrial activity has also increased the need for non-agricultural land. Land use changes have been quite significant in the last decade, with an increase in residential areas from 1,744.85 hectares in 2014 to 1,949.92 hectares in 2024. On the other hand, there has been a decrease in agricultural land area, both wet and dry land, along with the increasing need for built-up space. This study aims to analyze the suitability of land use to the spatial planning of Salatiga City. The research method uses a quantitative descriptive approach through overlay analysis between the 2024 land use map and the Geographic Information System (GIS)-based spatial pattern plan and the in-table building exchange (ITBX) matrix. The analysis results show that the most dominant non-conformities are in the Local Protection zone (39.52 ha) and the Food Crop zone (2.77 ha) which have been converted into residential and commercial areas. This study provides spatial integration with the ITBX matrix that allows for flexible suitability assessments and these findings confirm that spatial non-conformities are the result of the interaction between development pressures, accessibility and governance limitations. Broader implications show the importance of strengthening spatial data-based spatial planning control and increasing institutional capacity in dealing with urbanization pressures in developing cities.

Keywords: Land Use, Spatial Planning Suitability, Salatiga City

ABSTRAK

Perubahan penggunaan lahan di wilayah perkotaan merupakan konsekuensi dari meningkatnya jumlah penduduk, dinamika ekonomi, serta kebutuhan terhadap ruang terbangun. Kota Salatiga menjadi posisi strategis pada koridor Semarang-Solo-Yogyakarta yang mengalami perkembangan wilayah yang cukup pesat sehingga mendorong transformasi ruang pada berbagai sektor. Pertumbuhan penduduk dan permintaan pembangunan perumahan menyebabkan konversi lahan pertanian menjadi kawasan permukiman, sementara peningkatan aktivitas industri turut memperbesar kebutuhan terhadap lahan non-pertanian. Perubahan penggunaan lahan yang cukup signifikan dalam satu dekade terakhir, peningkatan kawasan permukiman dari 1.744,85 hektare pada tahun 2014 menjadi 1.949,92 hektare pada tahun 2024. Di sisi lain, terjadi penurunan luas lahan pertanian, baik tanah basah maupun tanah kering seiring meningkatnya kebutuhan ruang terbangun. Penelitian ini bertujuan untuk menganalisis kesesuaian penggunaan lahan terhadap penataan ruang Kota Salatiga. Metode penelitian menggunakan pendekatan deskriptif kuantitatif melalui analisis overlay antara peta penggunaan lahan tahun 2024 terhadap rencana pola ruang berbasis Sistem Informasi Geografis (SIG) serta matriks *in table building exchange* (ITBX). Hasil analisis menunjukkan ketidaksesuaian paling dominan terdapat pada zona Perlindungan Setempat (39,52 ha) dan zona Tanaman Pangan (2,77 ha) yang telah beralih menjadi kawasan permukiman maupun perdagangan. Penelitian ini memberikan integrasi spasial dengan matriks ITBX yang memungkinkan penilaian kesesuaian secara fleksibel serta temuan ini menegaskan bahwa ketidaksesuaian tata ruang merupakan hasil interaksi antara tekanan pembangunan, aksesibilitas dan keterbatasan tata kelola. Implikasi yang lebih luas menunjukkan pentingnya penguatan pengendalian tata ruang berbasis data spasial dan peningkatan kapasitas kelembagaan dalam menghadapi tekanan urbanisasi di kota-kota berkembang.

Kata Kunci: Penggunaan Lahan, Kesesuaian Tata Ruang, Kota Salatiga

1. INTRODUCTION

Land use change due to urbanization is a global phenomenon that occurs in various parts of the world, both in developed and developing countries (Song et al., 2021). In North America and Western Europe, there is an expansion of built areas, causing landscape fragmentation and pressure on protected areas, especially in suburban areas (Montis et al., 2017). Meanwhile, in developing countries in Asia, especially China, India, and Southeast Asia, the conversion of agricultural land to residential and industrial areas is a major issue in urban development, rapid urban expansion reduces productive agricultural land and causes mismatches between spatial planning and actual land use, as well as triggering space utilization conflicts in urban and peri-urban areas (Granda et al., 2025; Santra et al., 2025; Hu et al., 2025).

In the perspective of land economics, land use conversion generally follows a market mechanism, where land with low rental value tends to shift to uses with higher economic value, this explains the tendency to convert agricultural land to residential and industrial areas in urban and peri-urban areas (Badoa et al., 2018; Ono & Muya, 2024). The impact of such conversions not only affects the spatial structure of the city, but also threatens the sustainability of food security and is incompatible with the use of space, as shown in various cross-border studies (Syaban & Appiah-Opoku, 2024).

Spatial planning globally is positioned as the main instrument to control space utilization and reduce the gap between planning and regional development. However, various international studies show that the existence of planning documents does not necessarily guarantee the regularity of land use. Gaps between spatial planning and actual conditions are still widespread, especially in developing countries, resulting in development pressures and weak oversight (Liu et al., 2020; Li et al., 2022). Empirical studies in various developing countries, in practice the implementation of spatial planning often faces deep development pressures, weak management and high demand for land for residential and infrastructure needs (Rafieian & Kianfar, 2023). This condition leads to the emergence of a gap between planning and land use reality which ultimately reduces the effectiveness of spatial planning.

The city of Salatiga is one of the cities that experienced similar pressure, its strategic location on the main road connecting Semarang, Solo, and Yogyakarta, thus making it an important node of regional activities. This condition encourages changes in land use in the area. In 2014, the area of rice fields in Salatiga City was recorded at 2,998.23 hectares, while in 2024 the area of rice fields decreased to 2,614.35 hectares, with a land conversion rate of 6.98% during the 2014–2024 period. Data from the Salatiga City Industry and Manpower Office shows that in the last five years there has been an increase in the number of industries based on their

type. In 2024, there will be 17 large industries, 25 medium industries, and 1,618 small and medium industries. Unplanned land use can also lead to conflicts, such as overlapping between industrial and residential areas (Muslim et al., 2023). In addition, the river border area is also a sector of interest, especially for residential development. If not managed properly, this condition can cause environmental problems related to the use of river boundary space, because it interferes with protected areas (Setyabudi et al., 2024).

The concept of land use suitability in this study is understood as the level of suitability between existing land use and spatial pattern plans stipulated in the RDTR. These suitability can be classified into suitable, conditional and non-suitable, categories based on the ITBX suitability matrix used as an instrument for evaluating space utilization. This approach allows for the spatial identification of land use patterns that support or deviate from the spatial plan. Several previous studies have been conducted, including by Penggayuh et al., (2023) in Semarang City which show a shift in land use, such as from forest areas to green open spaces and built areas. The discrepancy reflects a partial or complete change in the function of the land from its original function to another function, such as the conversion of green areas into settlements. Another study by Latala et al., (2023) in the Kuningan Triangle area, South Jakarta, shows that there is pressure due to regional development for residential and commercial needs. Weak supervision and law enforcement in the implementation of spatial planning requires periodic monitoring and evaluation activities. In addition, research by Rozak, (2025) discusses the suitability of land use, especially in protected rice fields (LSD), to the Regional Spatial Plan (RTRW) of Bojonegoro Regency. However, these studies have not specifically integrated spatial analysis of land use suitability with the RDTR suitability matrix to assess the implementation of spatial planning policies at the city scale.

Based on these gaps, this study focuses on analyzing the suitability of land use to the spatial pattern of Salatiga City using a spatial analysis approach and relating it to the ITBX suitability matrix contained in the Salatiga City RDTR. Thus, this study aims to analyze the suitability of land use with the spatial arrangement of Salatiga City. Based on this background, this research was conducted to answer the research question, namely "To what extent is land use not in accordance with the plan stipulated in the Detailed Spatial Plan of Salatiga City?"

2. METHOD

The data used in this study is in the form of data shapefile Land Use Map 2024 and a map of the spatial pattern of the Salatiga City RDTR obtained from the Salatiga City Public Works and Spatial Planning Office. This study uses a quantitative descriptive approach with

an analysis method in the form of an overlay analysis technique using the Geographic Information System (GIS) by overlapping the land use map with the spatial pattern plan map of the Salatiga City RDTR. In addition, descriptive analysis is performed to correlate the matrix In Table Building Exchange (ITBX) Salatiga City RDTR by examining the results of the overlay in the form of incompatibility between existing land use and the planned spatial pattern. Matrix usage In Table Building Exchange (ITBX) in this study offers analytical advances compared to the spatial overlay approach which generally only classifies land use in binary terms and conditions. Through ITBX, it is able to reflect regulatory flexibility in spatial planning and distinguish between real violations and the use of space that is still accommodated in a regulatory manner (Sigit et al., 2024). Thus, the level of conformity not only shows the harmony of land use techniques, but also as governance dynamics and development pressures.

The ITBX matrix as stipulated in the Regulation of the Mayor of Salatiga Number 43 of 2024 concerning the Detailed Spatial Plan of the City of Salatiga for 2024–2044 serves as a guideline in assessing the suitability of space use to spatial zoning. This matrix is compiled in the form of a table that contains the types of activities that are allowed in each space utilization zone, so that it can be used as a reference in the space utilization evaluation process. The classification in the ITBX matrix consists of:

1. Permitted (I), classification for activities that are permitted because they are included in a classification that has characteristics in accordance with the planned designation.
2. Limited Permission (T), classification for limited activities. Limited means activities subject to applicable provisions such as restrictions on operation, restrictions on area, and restrictions on number of users.
3. Conditionally Permitted (B), classification for activities with certain conditions. This is necessary because the use of the space has a significant impact on the surrounding environment.
4. Not Permitted (X), classification for activities that are not permitted or allowed because they are not in accordance with the planned designation.

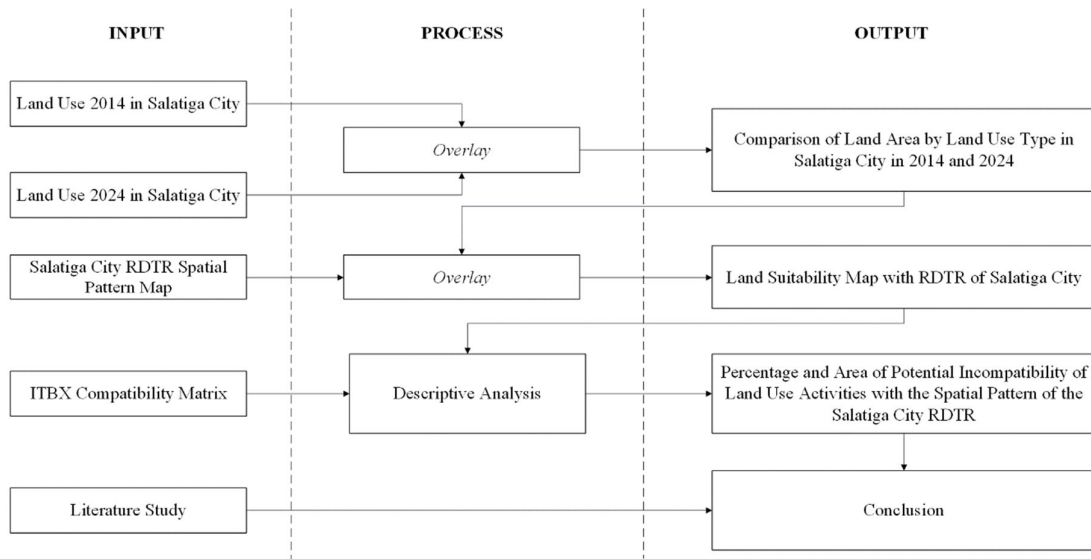


Figure 1. Stages of Land Use Suitability for Spatial Planning in Salatiga City
Sumber: Authors, 2025

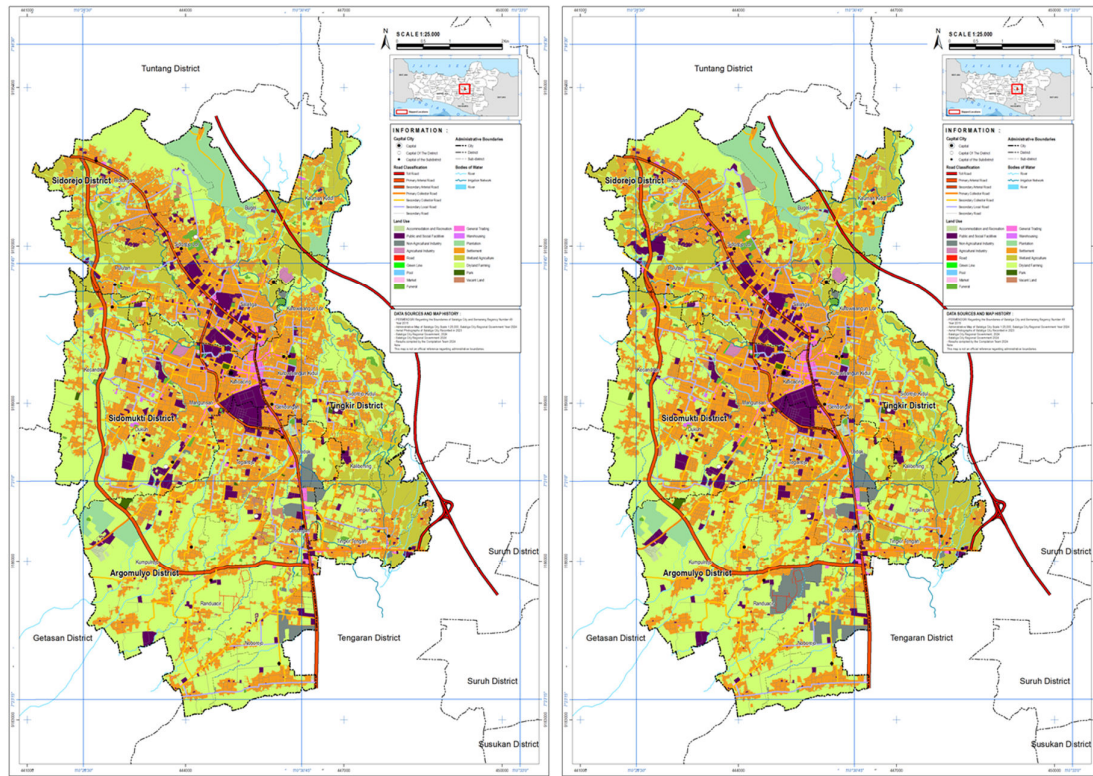
3. RESULTS AND DISCUSSION

Study Area

The research was conducted in the city of Salatiga, Central Java Province, which has an area of 5,498.32 hectares with a population density of 18,022 people/km². The city of Salatiga is strategically located and has relatively good infrastructure to support population mobility and economic activities. The development of Salatiga City is due to the construction of the Salatiga Ring Road and the toll road exit on Jalan Tingkir Raya. This growth is triggered by high demand to meet the needs of the population and surrounding areas. This has led to an increase in land value and accelerated the conversion of land from agriculture and low-density settlements to high-density settlements, commercial areas, and logistics centers.

Land Use Change

The development of a region is always accompanied by various changes, not only related to economic growth and population increase but also affecting land use patterns (Sefiw et al., 2024). The area, which was previously green and agricultural, has now been transformed into an urban environment filled with shop houses, residential areas, and various supporting facilities (J. Li et al., 2024). Residential land in Salatiga City in 2024 will reach 1,949.92 ha, while the available rice field area is recorded at 516.30 ha. The analysis of land use changes in Salatiga City was conducted by examining the changes in the land use map of Salatiga City from 2014 to 2024. The following are images and tables comparing land in Salatiga City in 2014 and 2024.



a) Land Use in 2014

b) Land Use in 2024

Figure 2. Comparison Map of Land in Salatiga City in 2014 and 2024

Table 1. Comparison of Land Area by Land Use Type in Salatiga City in 2014 and 2024

No	Land Use	Area 2014 (Ha)	Area 2024 (Ha)
1	Accommodation and Recreation	23,82	29,99
2	Public and Social Facilities	276,00	306,19
3	Non-Agricultural Industry	59,75	125,99
4	Agricultural Industry	11,63	11,63
5	Road	90,66	101,15
6	Green Line	1,10	1,10
7	Pool	0,16	0,20
8	Market	4,19	4,32
9	Funeral	41,95	42,30
10	General Trading	89,18	92,51
11	Warehousing	3,50	3,69
12	Plantation	175,70	178,90
13	Settlement	1.744,85	1.949,92
14	Wetland Agriculture	557,96	516,30
15	Dryland Farming	2.324,36	2.098,05
16	Park	8,69	8,71
17	Vacant Land	84,81	26,90

Sumber: Authors, 2025

Based on a comparison of the area of each type of land use, there has been an increase in area, particularly in the categories of housing, non-agricultural industry, and public and social

facilities. The area of residential areas increased from 1,744.85 ha in 2014 to 1,949.92 ha in 2024. There have also been reductions in the area of certain land use types, such as wet agriculture (557.96 ha to 516.30 ha) and dry agriculture (2,324.36 ha to 2,098.05 ha). The dynamics of land use change show that population growth and the need for space are the main factors driving land conversion. The increase in residential areas, as seen from the spatial analysis results, shows that this development tends to convert various other types of land use. One of the most notable changes is the decline in wet and dry agriculture, which has been converted into residential areas, where agricultural land can help absorb rainwater into the soil (S. Li et al., 2021). This phenomenon is also consistent with the concept of land use change and urbanization pressure as proposed by Lambin, E., & Geist (2006) which explains that population growth, economic development, and changing spatial needs are the main drivers of land use change, particularly in urban areas.

Land Use Suitability Based on the Salatiga City RDTR

Changes in land use characteristics cannot be separated from the aspect of compatibility between actual land use conditions in the field and the provisions stipulated in the RDTR (Suprayogi & Richani, 2021). The disharmony between actual land use and spatial planning has the potential to cause various implications in spatial planning, including disruption of spatial functions.

The spatial pattern after overlaying with land use has the potential to be inappropriate in several subdistricts, namely in locations that should be allocated for food crops, but in fact have been used for other functions that are not in line with the regional spatial plan, thus potentially causing conflicts in land use and reducing the optimization of agricultural production in the area. Meanwhile, in the horticultural subzone, zoning regulations in the RDTR still allow residential, public service, and commercial activities with the designation “T2, B1, B3,” which limits the area and intensity of activities, both in terms of the maximum area of an activity within the subzone, with the aim of not reducing the dominance of land use in the surrounding area, Conditional activities must have environmental documents, and conditional activities must have relevant sectoral approvals.

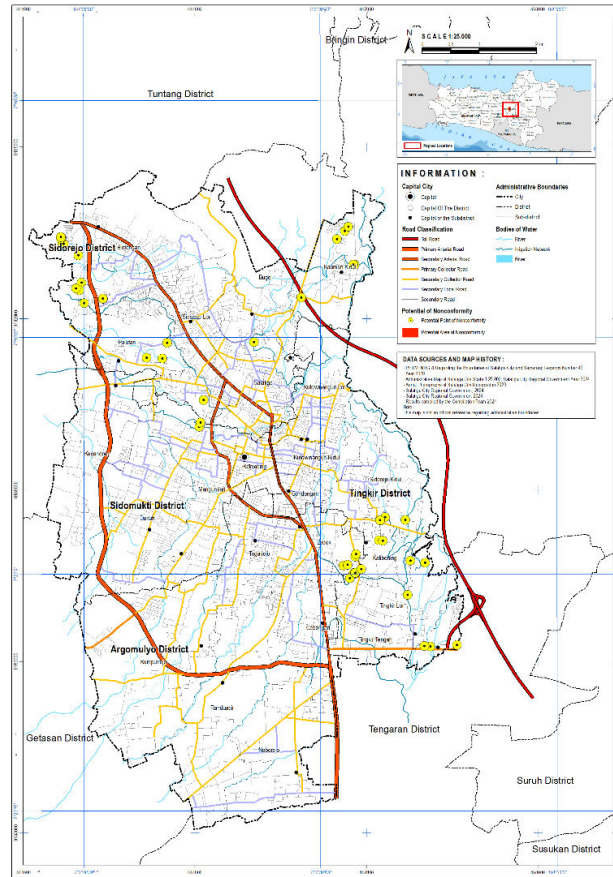


Figure 3. Land Suitability Map with RDTR of Salatiga City

Several forms of inconsistency between existing land use and the provisions of the Salatiga City RDTR in spatial patterns that need attention include the existence of buildings in a 2.77 ha food crop area. This inconsistency occurred due to the conversion of land into a trade and service area. In addition, in the local protection area in Salatiga City, there is also identified misuse of space, with a total area of 39.52 ha. Based on Minister of Agrarian Affairs and Spatial Planning Regulation No. 16 of 2018 concerning Guidelines for the Preparation of RDTR, riverbanks are zones where buildings are prohibited. A similar provision is emphasized in Regulation of the Minister of Agrarian Affairs and Spatial Planning/National Land Agency Number 14 of 2020 concerning Guidelines for the Preparation of RDTR Map Databases for Regencies/Cities, which states that riverbanks are protected areas designated to prevent human activities that have the potential to reduce river water quality, damage the physical condition of riverbanks and riverbeds, and disrupt the smooth flow of rivers (Iqbal et al., 2025). The following tables showing land suitability according to the Salatiga City RDTR.

Table 2. Land Suitability Data with RDTR of Salatiga City

Categories	Area of Space Pattern (Ha)	Land Area Not Compliant (Ha)	Percentage(%)
Water Agency	31,77	0	
Road Authority	200,90	0	
Horticulture	616,00	6,45	1%
Green Line	10,79	0	
Industrial Zone	234,58	22,92	10%
Tourism	85,70	0	
Funeral	50,85	0	
Electric Power Generation	0,82	0	
Waste Management	22,61	0	
City-Scale Trade and Services	480,20	0	
Trade and Services on a WP Scale	145,99	0	
Aquaculture	3,60	0	
Office buildings	31,37	0	
Plantation	136,34	0	
Local Protection	73,32	39,52	54%
Defense and Security	52,86	0	
Medium Density Housing	590,24	0	
High Density Housing	1.909,03	0	
Urban Jungle	31,50	0	
Non-Green Open Space	0,30	0	
Sub-district Scale SPU	13,36	0	
Neighborhood Level Scale SPU	29,92	0	
City Scale SPU	188,28	0	
Subdistrict Park	6,00	0	
Neighborhood Park	17,74	0	
City Park	24,08	0	
Food Crops	508,75	2,77	1%
Transportation	1,39	0	0%
Total	5.498,29	71,66	

Sumber: Authors, 2025

These compatibility results are based on the use of the ITBX compatibility matrix. The ITBX compatibility matrix is used as a guideline for compatibility between land use and spatial planning. Based on the compatibility results against the ITBX matrix, there are four classifications, namely permitted/allowed (I), limitedly permitted (T), conditionally permitted (B), and not permitted (X). The following is a table of land use compatibility with the Salatiga City RDTR.

Table 3. Area and Percentage of Land Use Suitability in Relation to the Spatial Pattern of Salatiga City

	I	T	B	X	Total
Area (Ha)		9,22	22,92	39,52	71,66
Percentage (%)		13%	32%	55%	100%

Sumber: Authors, 2025

The results of the ITBX matrix test on land use in relation to the spatial pattern of the Salatiga City RDTR are 71.66 ha. When compared to the total area of the spatial pattern of 5,498.29 ha, the

conformity rate is 98.70%. This figure is calculated from the ratio of suitability area, which is 5,426.63 ha to the total spatial pattern. With this achievement, the condition of spatial utilization in Salatiga City is categorized as having a high level of conformity with the results of policy evaluation in the form of strategies and policies to improve and maintain the suitability of spatial utilization in Salatiga City.



Figure 4. Potential Incompatibility of Trade and Service Activities in the Food Crop Zone Subchapter



Figure 5. Potential Incompatibility of Residential Activities in the Food Crop Zone Subchapter

The findings in this study show that the incompatibility of spatial use in Salatiga City is concentrated in the local protection area of 39.52 ha or around 54% of the total area of the area. This pattern indicates that the deviations that occur are not random, but are influenced by the dynamics of urban development that encourage the conversion of space to built functions. These findings are in line with research Ono & Muya, (2024) which states that changes in land use in urban areas are influenced by the pressure of housing needs and limited access to formal land, thus encouraging unplanned use of space.

Nevertheless, not all driving factors have the same influence on spatial mismatches. In this study, accessibility factors such as the existence of road infrastructure and the strategic location of Salatiga City on the Semarang-Solo-Yogyakarta corridor were proven to contribute to increasing development pressure. This is in line with studies Li et al., (2024) which shows

that increasing the accessibility of the area plays a role in accelerating the change in land use towards the built function. However, in contrast to metropolitan areas that have a high level of urbanization, the relatively small scale of Salatiga City causes conversion patterns to tend to be more concentrated in certain locations, especially protected areas that have high accessibility but low supervision.

From a governance perspective, the findings of the study confirm that the mismatch in space utilization is not only influenced by development pressures, but also by the limitations of institutional capacity in space control. As shown in research Sutanto et al., (2025) The effectiveness of spatial control is highly dependent on the consistency of regulations, coordination between institutions and optimal supervision mechanisms. In the context of Salatiga City, there is still a gap between planning and implementation so that the area that should be protected is experiencing increasing development pressure.

This spatial mismatch has implications for regional sustainability, especially on food security. The declining conversion of agricultural land has the potential to reduce local food production capacity. This is in line with research S. Li et al., (2021) which confirms that the conflict between the ecological function and the economic function of the land can lead to the degradation of the carrying capacity of environmental land and reduce agricultural productivity. Although the area of mismatch in the food crop zone is relatively small (2.27 ha), its existence still shows pressure on the food system. The control of space utilization through instruments such as RDTR and conformity matrix (ITBX) has provided a fairly clear normative framework. However, the success of land protection depends not only on formal regulations but also on consistent implementation, continuous oversight, and synergy between stakeholders.

5. CONCLUSION

The development of Salatiga City has driven significant changes in land use, as analyzed in the 2014 and 2024 land use analyses, particularly in the increase in residential and non-agricultural industrial areas, which has resulted in a reduction in agricultural land area and disruption to the function of protected areas. A spatial analysis of existing land use and RDTR spatial patterns identified 71.66 ha of land use inconsistencies, with the largest inconsistencies occurring in local protection zones (39.52 ha) and food crops (2.77 ha). Therefore, it is necessary to strengthen planning and regulation of agricultural land use in accordance with RDTR provisions and to be able to overcome population growth pressures.

This study confirms that spatial incompatibility cannot be reduced as a deviation of individual behavior alone, but rather a manifestation of a structural interaction between

economic pressures, spatial accessibility and governance limitations. In this context, weak inter-agency coordination, insynchronization between spatial and land regimes, and low supervisory capacity indicate that control failures are systemic rather than incidental. This condition indicates that the existing regulatory approach is still administrative and does not have adequate critical power in controlling the dynamics of space utilization. Therefore, a policy repositioning is needed that not only emphasizes on strengthening formal instruments such as zoning, licensing and sanctions but also on the development of intensive and disincentive-based adaptive mechanisms as well as the integration of spatial and land information systems.

Failure to control the conversion of space, especially in protected areas and productive land, has direct implications for the reduction of environmental carrying capacity and vulnerability of regional food security systems. Thus, it is necessary to be directed to the development of a more integrative and evidence-based spatial control model, including evaluation of the effectiveness of policy instruments and simulation of spatial scenarios to anticipate the long-term impact on the sustainability of the region in the future.

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