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Assessing Urban Sustainability and Resilience Challenges through Existing Land-Use Patterns in Kyauktada Township, Yangon

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Abstract

Urban sustainability and resilience are increasingly important considerations in managing rapidly changing urban environments. Land use provides an important spatial basis for examining these conditions because the distribution and relationship of urban functions influence accessibility, environmental quality, resource utilization, and the capacity of urban areas to respond to future changes. This study examines the existing land-use pattern of Kyauktada Township, located within the central business district of Yangon, Myanmar, with a focus on identifying sustainability and resilience challenges and their implications for future urban development. The study uses an existing land use AutoCAD plan of the township as the primary spatial data source, supplemented by planning documents and relevant literature. Existing land uses were classified into ten categories: residential, mixed-use, school, commercial, institutional, clinic/health, religious, vacant building, under-construction/vacant land, and park/public park. The analysis focuses on the spatial distribution, concentration, relationships, and compatibility among these land-use categories. The findings indicate an intensively developed and functionally mixed urban environment, with strong relationships between residential, commercial, and supporting urban uses. However, the study also identifies several challenges, including limited open-space provision, parking demand, underutilized vacant properties, potential pressure arising from concentrated commercial activities, and the need to manage future development of vacant and under-construction areas. These conditions indicate the importance of efficient land utilization, protection of existing open spaces, appropriate reuse of vacant properties, adequate parking provision, and improved land-use compatibility. The study provides a spatial baseline for understanding existing urban conditions and supports future land-use planning strategies aimed at improving the sustainability and resilience of Kyauktada Township.

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A. Introduction

Urban sustainability refers to the long-term development and functioning of cities through the integration of environmental, social, and economic considerations. It emphasizes human well-being while maintaining environmental resources and minimizing the adverse impacts of urban development [1]. Urban resilience, in contrast, emphasizes the capacity of urban systems to maintain or restore essential functions when exposed to disturbances and to adapt to changing conditions[2]. Although sustainability and resilience are closely related, sustainability primarily emphasizes long-term urban development and outcomes, whereas resilience emphasizes the capacity of urban systems to respond and adapt to disturbances and change [3].

Land use provides an important spatial basis for examining both urban sustainability and resilience because it represents the spatial organization of different urban functions and activities. The distribution and configuration of residential, commercial, institutional, transportation, and open-space uses influence accessibility, resource use, environmental conditions, and the provision of urban services [4], [5]. Previous studies have demonstrated that land-use assessment and spatial analysis can provide useful evidence for evaluating urban sustainability [4] and examining land-use characteristics from a resilient urban perspective [6]. Therefore, analysis of existing land-use patterns can help identify spatial characteristics and conditions associated with sustainability and resilience challenges.

Yangon, as the largest urban centre of Myanmar, has experienced significant urban development and changes in land-use patterns over time. The expansion of built-up areas and increasing development intensity have contributed to changes in the spatial structure and functional organization of the city [7]. The Strategic Urban Development Plan of Greater Yangon also identifies land use, infrastructure, environmental conditions, and urban development as important components of the city's long-term planning framework [8]. These conditions highlight the importance of understanding the spatial distribution and characteristics of existing land uses when examining urban development challenges in Yangon.

Within Yangon, Kyauktada Township is located in the Central Business District (CBD) and contains a diverse mix of commercial, business, residential, institutional, administrative, and heritage-related functions. Existing building-use surveys conducted as part of the strategic urban development planning for Yangon indicate intensive commercial and business activities within the central CBD, together with mixed-use building patterns in which commercial and business activities commonly occupy lower floors while residential uses occur on upper floors [8]. Kyauktada also contains a concentration of heritage buildings and historic urban fabric around the Sule Pagoda and surrounding central urban area [8]. The concentration and coexistence of different urban functions within a relatively compact area may create spatial challenges related to accessibility, land-use compatibility, environmental conditions, urban services, and the capacity of the area to respond to changing conditions.

Although previous studies have examined urban sustainability, urban resilience, land-use assessment, and urban development in Yangon, a localized spatial assessment linking existing land-use patterns with both sustainability and

resilience challenges at the township level remains limited. Therefore, this study focuses on Kyauktada Township and uses its existing land-use pattern as the primary spatial basis for examining urban sustainability and resilience challenges.

The aim of this study is to assess urban sustainability and resilience challenges in Kyauktada Township through the analysis of its existing land-use pattern. The specific objectives are: (1) to analyze the existing land-use pattern of Kyauktada Township; (2) to examine the spatial characteristics and distribution of existing land uses; (3) to identify urban sustainability and resilience challenges associated with the existing land-use pattern; and (4) to discuss planning implications for improving urban sustainability and resilience in Kyauktada Township.

B. Research Method

Study Area

This study focuses on the entire Kyauktada Township, which is located within the Central Business District of Yangon. The township is characterized by a mixture of commercial, business, residential, institutional, administrative, and heritage-related functions. Its intensive development and diverse land-use pattern provide an appropriate context for examining spatial conditions associated with urban sustainability and resilience.

The study adopts a spatial analysis approach based on existing land-use information. The research process consists of four main stages: (1) preparation of existing spatial data; (2) classification and mapping of land uses; (3) analysis of the spatial characteristics of existing land uses; and (4) interpretation of identified spatial conditions in relation to urban sustainability and resilience challenges.

Data Collection and Preparation

The primary spatial data source is an existing land use AutoCAD plan of Kyauktada Township. The plan provides the spatial layout of buildings, streets, and other relevant physical features within the study area. The existing plan is reviewed and prepared for land-use classification and spatial mapping.

Secondary information is obtained from relevant planning documents, academic literature, and published studies related to urban land use, sustainability, resilience, and urban development in Yangon. These sources are used to support the interpretation of the spatial characteristics identified from the land-use analysis.

Land-use Classification and Spatial Analysis

The existing AutoCAD plan is classified according to the major land-use functions identified within Kyauktada Township. The land-use categories include residential, commercial, business, institutional/administrative, transportation, open space, heritage-related uses, and other relevant uses where applicable.

The classified land uses are represented spatially through a land-use map. The analysis focuses on the distribution, concentration, mixture, and spatial relationships among different land uses. Particular attention is given to intensive development, mixed land uses, limited open-space conditions, concentration of particular urban functions, and potential spatial conflicts.

The resulting land-use map provides the primary spatial evidence for identifying the existing spatial characteristics of Kyauktada Township.cropping patterns of the region.

Assessment and Interpretation

The identified spatial characteristics are interpreted in relation to urban sustainability and resilience. Sustainability-related considerations include accessibility, efficient use of urban space, environmental conditions, and the distribution of urban functions. Resilience-related considerations focus on the capacity of the urban area to maintain essential functions, respond to disturbances, and adapt to changing conditions.

The study does not develop a separate quantitative resilience index. Instead, sustainability and resilience challenges are identified through interpretation of the spatial evidence obtained from the existing land-use pattern. Based on these findings, relevant planning implications for land-use management, spatial organization, accessibility, open-space provision, mixed-use development, and heritage-sensitive development are discussed.

C. Results and Discussion

Existing Land-use Distribution and Spatial Characteristics

The existing land-use map of Kyauktada Township indicates a highly developed and functionally mixed urban environment. Ten major land-use categories were identified from the existing spatial plan: residential, mixed-use, school, commercial, institutional, clinic/health, religious, vacant building, under construction/vacant land, and park/public park. The distribution of these land uses demonstrates the coexistence of residential, commercial, institutional, and community-related functions within a relatively compact urban area.

Commercial and mixed-use areas constitute prominent components of the existing land-use pattern. These uses are distributed across a large proportion of the developed urban blocks, indicating the importance of commercial and mixed-use activities within the township. Residential uses are also distributed throughout the study area and are frequently located in proximity to commercial and mixed-use areas. This spatial coexistence indicates a mixed urban structure in which different urban functions are closely integrated.

Institutional, school, clinic/health, and religious uses are distributed among the predominantly developed urban blocks. Although these uses occupy smaller areas compared with the major residential, mixed-use, and commercial functions, they provide important supporting functions for the urban population. Their spatial distribution is therefore relevant to the accessibility and provision of essential urban and community services.

Vacant buildings and under-construction/vacant land are also identified within the existing land-use pattern. These areas represent spaces that are either temporarily underutilized or undergoing changes in use and development. Their presence indicates that the land-use structure of the township is not completely static and includes locations associated with redevelopment or changes in urban use.

The map also identifies park/public park space within the township. Compared with the extensive built-up areas, the distribution of park space appears limited. This spatial characteristic is particularly relevant to the assessment of urban sustainability because public open spaces provide opportunities for recreation, environmental functions, and improvement of the urban living environment.

Overall, the existing land-use pattern of Kyauktada Township is characterized by intensive development, a strong presence of commercial and mixed-use activities, widespread residential uses, and the coexistence of several specialized urban functions. The presence of vacant and developing areas, together with the limited distribution of park space, further indicates spatial conditions that require consideration in relation to sustainable urban development and urban resilience.

Spatial Characteristics of Existing Land Use

The spatial characteristics of existing land use in the study area are examined based on the existing land use map. The analysis focuses on the distribution, concentration, and spatial relationships among different land use types. The existing land uses include residential, commercial, institutional and public uses, open spaces and parks, vacant buildings, and vacant or under-construction land. The spatial distribution of these land uses provides an understanding of the existing development pattern and the degree of land utilization within the study area.

Figure 3.1 illustrates the existing land use pattern and the spatial distribution of different land use types within the study area.

Figure 1. Existing Land Use Map of the Study Area

As shown in Figure 1, residential land use forms a major component of the existing built-up area. Residential areas are distributed throughout the developed parts of the study area and are closely associated with the existing road network. The distribution indicates that residential development has generally followed areas with better accessibility and connections to surrounding streets. In some locations, residential uses are mixed with other urban activities, particularly commercial uses, creating areas of mixed land use.

Commercial land use is mainly associated with accessible locations and active road corridors. Commercial activities are spatially related to residential areas and transportation routes, as these locations provide better access to customers and surrounding communities. This pattern indicates that commercial development tends to occur where accessibility and movement are relatively convenient.

Institutional and public land uses are distributed within the existing urban fabric and are generally located in relation to surrounding residential areas. These uses serve the local population and contribute to the functional structure of the study area. Their spatial distribution also influences accessibility to public and community services.

Open spaces and parks are identified as important elements within the existing land-use pattern. The green areas shown on the land use map represent parks and open spaces. These areas provide relief from the built-up environment and contribute to the environmental and recreational functions of the study area. However, their distribution appears to be relatively limited compared with the extent of developed land.

Vacant buildings represent underutilized existing structures within the study area. Their presence indicates that some developed sites are not currently being fully utilized. These vacant buildings may occur within otherwise active areas and therefore represent potential opportunities for future reuse or redevelopment.

Vacant land and under-construction areas indicate locations where development has not yet been completed or where land remains unused. These areas are important in understanding the ongoing transformation of the study area. Their locations may indicate potential areas for future development and changes in the existing land-use pattern.

Overall, the existing land-use pattern shows a predominantly developed urban environment in which residential uses form an important component, while commercial, institutional, open-space, vacant-building, and vacant or under-construction uses are distributed in relation to the existing road network and built-up areas. The spatial characteristics identified from the land use map provide a basis for further analysis of accessibility, development conditions, land-use conflicts, and potential areas for future planning.

Spatial Relationship and Land Use Compatibility

The spatial relationship among existing land uses is examined to understand how different activities are located in relation to one another within the study area. The relationship between residential, commercial, institutional, open space, vacant, and under-construction areas influences the overall functional pattern and development characteristics of the study area.

Residential areas are closely related to commercial activities, particularly along accessible roads and active areas. This relationship provides convenience for residents by allowing daily commercial activities and services to be located within or near residential areas. However, where commercial activities become concentrated along major roads, increased movement and activity may create pressure on the surrounding residential environment.

Institutional and public uses are generally associated with residential areas because they provide services to the local community. Their accessibility from surrounding residential areas is therefore an important factor in the functional organization of the study area. The location of these facilities in relation to the road network also affects the ease of access for residents.

Parks and open spaces have a complementary relationship with the surrounding built-up areas. They provide recreational and environmental functions within areas dominated by buildings and other urban activities. Their spatial relationship with residential areas is particularly important because accessible open spaces can serve nearby residents and contribute to the quality of the living environment.

Figure 2. Existing Park and Open Space within the Study Area

Vacant buildings and vacant or under-construction land are spatially related to the existing developed areas. Their presence within or around established built-up areas indicates opportunities for reuse, redevelopment, or future development. At the same time, development in vacant or under-construction areas may gradually change the existing land-use pattern and increase the intensity of development.

Overall, the existing land uses show both complementary relationships and potential areas of conflict. Residential, commercial, institutional, and open-space uses can support one another when appropriately located, while incompatible activities or excessive concentration of particular uses may place pressure on surrounding areas. Understanding these spatial relationships is important for

identifying existing land-use issues and opportunities for future development planning.

Sustainability and Resilience Challenges

Table 1. Sustainability and Resilience Challenges and Planning Implications

Existing Land-use Condition	Sustainability / Resilience Challenge	Planning Implication
Limited distribution of parks and open spaces	Limited opportunities for recreation, environmental improvement, and urban relief in the intensively built-up area	Protect existing parks and consider additional green/open spaces where appropriate
Concentration of commercial activities	Increased movement, activity, and pressure on surrounding urban areas	Improve land-use compatibility and manage the concentration of high-intensity activities
Vacant buildings	Underutilization of existing urban resources and buildings	Promote adaptive reuse or redevelopment for appropriate community, commercial, or public functions
Under-construction/ vacant land	Potential for inefficient land use or uncontrolled future development	Guide redevelopment according to appropriate land-use and urban design principles
Parking demand in commercial and institutional areas	On-street parking and vehicle activity may create pressure on pedestrian movement and accessibility	Provide or manage designated parking spaces and improve pedestrian–vehicle relationships
Close relationship between residential and commercial uses	Provides accessibility and convenience but may create disturbance or pressure on residential areas	Maintain compatible mixed-use relationships and manage activities that may negatively affect residential environments
Intensive built-up development	Limited opportunities for open-space provision and reduced flexibility for future urban adaptation	Balance built-up development with green spaces, parking, and other supporting urban facilities

The existing land-use pattern indicates several sustainability and resilience challenges within the study area. These challenges are mainly associated with the distribution and utilization of built-up areas, vacant properties, open spaces, parking demand, and the spatial relationships among different land-use activities. The findings from the existing land-use distribution and spatial compatibility analysis provide a basis for identifying areas that may require attention in future urban development.

One of the main challenges is the presence of vacant buildings and vacant or under-construction land within the existing urban area. These areas represent underutilized land resources and may interrupt the continuity of existing development. At the same time, they provide opportunities for future redevelopment and more efficient land utilization. Appropriate reuse and

development of these areas can help accommodate future growth without unnecessary expansion into undeveloped areas.

The distribution of parks and open spaces is also important for urban sustainability and resilience. Open spaces provide recreational and environmental functions within the built-up area and contribute to the quality of the urban environment. Therefore, maintaining existing parks and open spaces and ensuring their accessibility to surrounding residential areas are important considerations for improving the sustainability and adaptive capacity of the study area.

Another challenge is the spatial relationship between residential and commercial land uses. Although the proximity of commercial activities to residential areas provides convenience for daily needs, the concentration of commercial activities in certain locations may increase movement and activity around surrounding residential areas. Appropriate spatial organization and compatibility between different land uses are therefore necessary to maintain a functional and comfortable urban environment.

Figure 3. Spatial Relationship between Residential and Commercial Uses

Parking demand is also an important consideration in areas with commercial, institutional, and public activities. Insufficient or poorly managed parking may increase on-street vehicle activity and create conflicts with pedestrian movement and accessibility. Appropriate provision and management of parking spaces should therefore be considered as part of future land-use and urban management strategies.

Figure 4. Parking Conditions and Vehicle–Pedestrian Interaction

The existing pattern also indicates that future development should be carefully managed to maintain a balance between built-up areas, open spaces, and available vacant land. Unplanned development of vacant or under-construction areas may gradually increase development intensity and reduce opportunities for maintaining open spaces. Future land-use planning should therefore consider the efficient reuse of existing vacant areas while protecting important open spaces and maintaining compatible relationships among different land uses.

Overall, the identified sustainability and resilience challenges highlight the need for more efficient land utilization, appropriate redevelopment of vacant areas, protection of open spaces, adequate parking provision, and improved compatibility among different land uses. These findings provide a basis for developing appropriate planning implications and strategies for the future development of the study area.

Planning Implications

The findings from the existing land-use analysis indicate several planning implications for the future development of the study area. The planning approach should focus on improving land-use efficiency, providing adequate supporting facilities, maintaining green and open spaces, and ensuring compatibility among different land-use activities.

First, the provision and protection of green and open spaces should be considered in future land-use planning. Existing parks and open spaces should be maintained, while opportunities for additional green spaces should be identified where appropriate, particularly in areas with a high concentration of built-up and residential uses. The distribution of green spaces should also consider accessibility for surrounding communities so that they can function effectively as recreational and environmental spaces.

Second, adequate car parking areas should be planned in locations associated with commercial, institutional, and public activities. Designated parking spaces can help reduce the pressure of on-street parking and minimize conflicts between

vehicles, pedestrians, and surrounding land uses. Parking provision should therefore be considered together with the location and intensity of commercial and public activities.

Third, vacant buildings and vacant or under-construction land should be considered as potential resources for future development. Depending on their location and surrounding land uses, these areas may be reused or redeveloped for appropriate community facilities, parking areas, green spaces, or other necessary urban functions. Prioritizing the appropriate reuse of existing vacant areas can also improve land-use efficiency and reduce unnecessary expansion of developed areas.

Fourth, land-use compatibility should be incorporated into future development decisions. Residential areas should be protected from activities that may create excessive disturbance, while commercial and public activities should be appropriately located to maintain accessibility and convenience. The spatial relationship between different land uses should therefore be considered when determining future development areas and land-use changes.

Finally, future planning should maintain a balanced relationship between development and supporting urban spaces and facilities. The integration of residential, commercial, institutional, green-space, parking, and other necessary land uses can contribute to a more functional and sustainable urban environment. These planning implications provide a basis for guiding future land-use management and development within the study area.

D. Conclusion and Recommendations

This study examined the existing land-use pattern and spatial characteristics of the study area to understand the distribution, spatial relationships, and compatibility of different land uses. The analysis identified residential, commercial, institutional and public uses, parks and open spaces, vacant buildings, and vacant or under-construction land as the major existing land-use categories.

The findings indicate that the existing land uses have both complementary relationships and potential conflicts. Residential areas are closely associated with commercial and public activities, providing accessibility and convenience for local communities. However, the concentration of commercial and other activities may create pressure on surrounding residential areas. The existing parks and open spaces provide important recreational and environmental functions, while vacant buildings and vacant or under-construction land represent opportunities for future reuse and redevelopment.

The study also identified several planning needs related to green and open spaces, car parking, vacant properties, and land-use compatibility. Maintaining an appropriate balance between built-up areas and supporting urban spaces is important for improving the functionality, sustainability, and resilience of the study area. Therefore, future development should consider not only the expansion of built-up areas but also the provision of necessary urban facilities and open spaces.

Recommendations

Based on the findings of the study, the following recommendations are proposed:

1. Maintain and improve green and open spaces

Existing parks and open spaces should be protected and maintained. Opportunities for additional or better-distributed green spaces should also be considered, particularly in areas with concentrated residential and built-up development.

2. Provide adequate car parking areas
   Designated parking areas should be provided near major commercial, institutional, and public activity areas. Parking provision should be considered together with pedestrian movement and surrounding land uses to reduce conflicts and improve accessibility.
3. Promote appropriate reuse of vacant buildings and land
   Vacant buildings and vacant or under-construction land should be assessed for suitable reuse or redevelopment. Depending on their location and surrounding land uses, they may be utilized for community facilities, parking, green spaces, or other necessary urban functions.
4. Improve land-use compatibility
   Future development should consider the compatibility of adjacent land uses. Residential areas should be appropriately protected from incompatible activities, while commercial and public uses should be located and managed to maintain accessibility without creating excessive pressure on surrounding residential areas.
5. Support balanced future development
   Future land-use planning should maintain a balance among residential, commercial, institutional and public uses, green spaces, parking areas, and other supporting facilities. The reuse of existing vacant areas should be considered before unnecessary expansion of developed areas.
6. Use the existing land-use analysis as a basis for future planning
   The existing land-use map and spatial analysis developed in this study can be used as a baseline for monitoring future land-use changes and guiding subsequent planning and development decisions within the study area.

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