IMPACT OF ROAD ACCESSIBILITY ON URBAN SPRAWL IN SRI LANKA

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ABSTRACT - Rapid urbanization is fueling urban sprawl, which is a growing concern in many parts of the world, including Sri Lanka. The impact of road accessibility on urban sprawl is a topic that has received increasing attention in recent years, but the relationship between the two is still unclear. This study investigated the relationship between road accessibility and urban sprawl in ten towns in Sri Lanka, both within and outside of city limits, using remote sensing and GIS methods. The study discovered a positive link between road accessibility and urban sprawl as measured by betweenness and closeness centrality values. The study also discovered that road infrastructure plays an important role in driving urban growth in Sri Lanka and that investment in road infrastructure can have a significant impact on the spatial distribution of urban sprawl. The findings of this study have important implications for policymakers and urban planners working to promote sustainable and balanced urban development in Sri Lanka and other rapidly urbanizing countries.

Keywords: Urban Sprawl; Accessibility; Urban core; Urban fringe

1. INTRODUCTION

Urbanization has become a global phenomenon, and more than half of the world's population currently lives in urban areas. Rapid urbanization causes cities to expand into surrounding rural areas, leading to the phenomenon known as urban sprawl [1]. The impact of road accessibility on urban sprawl is a topic that has received increasing attention in recent years [2]. However, the relationship between road accessibility and urban sprawl is complex and not well understood. Most studies have shown that road accessibility can lead to more compact and sustainable urban development [3] [4], while others have found a positive relationship between road accessibility and urban sprawl. As a result, more research is required to investigate the impact of road accessibility on urban sprawl in greater depth.

In recent years Sri Lanka has experienced rapid urban expansion, leading to major changes in its land use patterns. At the same time, there is growing concern about the impact of road accessibility on the country's urban sprawl. Consequently, the main objective of this study is to investigate the impact of road accessibility on urban sprawl in Sri Lanka. Gaining insights into how road infrastructure impacts urban sprawl will play a vital role in assisting policymakers and urban planners in fostering well-balanced and sustainable urban development not only in Sri Lanka but also in other rapidly urbanizing nations.

2. MATERIALS AND METHODS

This research utilized Landsat 07 ETM satellite images (2012) obtained from United States Geology Survey, employing supervised classification through ArcGIS to examine urban expansion and non-urban expansion. The study analyzed urban sprawl in 10 Sri Lankan towns (Kurunegala, Negombo, Badulla, Galle, Kandy, Trincomalee, Kalutara, Kegalle, Rathnapura, Anuradhapura) using intensity index, landscape metrics, and Shannon's entropy model. Each town was given a 1 km buffer around its city center, and the land use within that buffer was designated as the core urban area, while areas beyond the buffer (6km) were designated as the urban fringe. Betweenness and closeness centrality

values from road network data were obtained to analyze the relationship between accessibility and urban sprawl. These values were calculated using QGIS software for each road segment in the road network. This relationship was quantified using statistical analysis techniques, specifically regression analysis.

3. RESULTS AND DISCUSSION

The results of this study confirmed the positive relationship between road accessibility (as measured by betweenness and closeness centrality) and urban sprawl in Sri Lanka. This suggests that towns with higher values for these measures have experienced more significant levels of urban sprawl than towns with lower values for these measures. According to the analysis Below figure 1 revealed the positive relationship for Closeness centrality values of the Urban core ($r = .682$, $p < .05$) and urban fringe ($r = .729$, $p < .05$), against the urban sprawl values. In addition, figure 2 indicated that the Closeness centrality values of Urban fringe ($r = .642$, $p < .05$), reveal a positive relationship with urban sprawl. In addition, Figure 3 illustrates the spatial representation of the urban expansion and

Figure 1. Urban Sprawl and Closeness Centrality

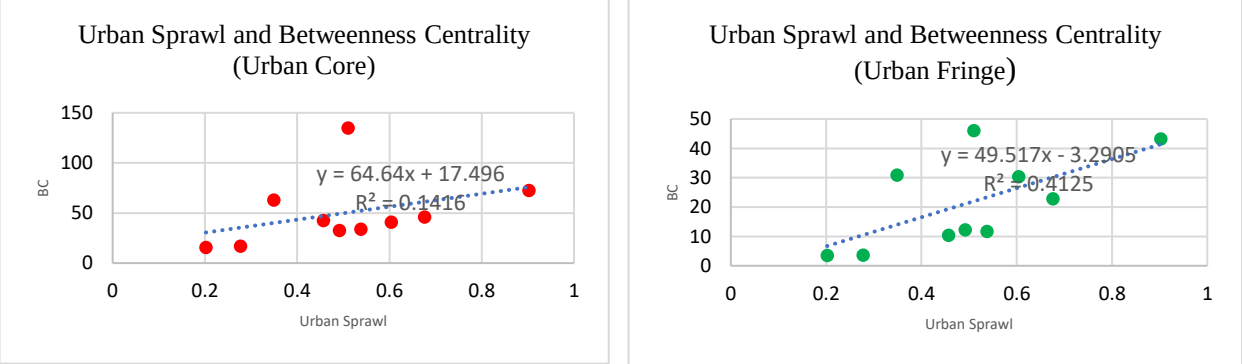

Figure 2. Urban Sprawl and Betweenness Centrality

road networks in the selected towns.

According to that, a positive relationship between road accessibility and urban sprawl was observed both within and outside the city limits. This suggests that road infrastructure plays a key role in driving urban growth in Sri Lanka and that investment in road infrastructure can have a significant impact on the spatial distribution of urban sprawl across the country.

The findings of this study highlight the need for strategic planning and investment in road infrastructure, especially in rapidly urbanizing areas, to promote balanced and sustainable urban growth. The findings highlight the importance of considering the potential benefits and risks associated with urban sprawl when making road infrastructure investment decisions.

Overall, this study provides valuable insights into the relationship between road accessibility and urban sprawl in Sri Lanka and could inform policymakers and urban planners as they work to promote sustainable and balance urban development in the country.

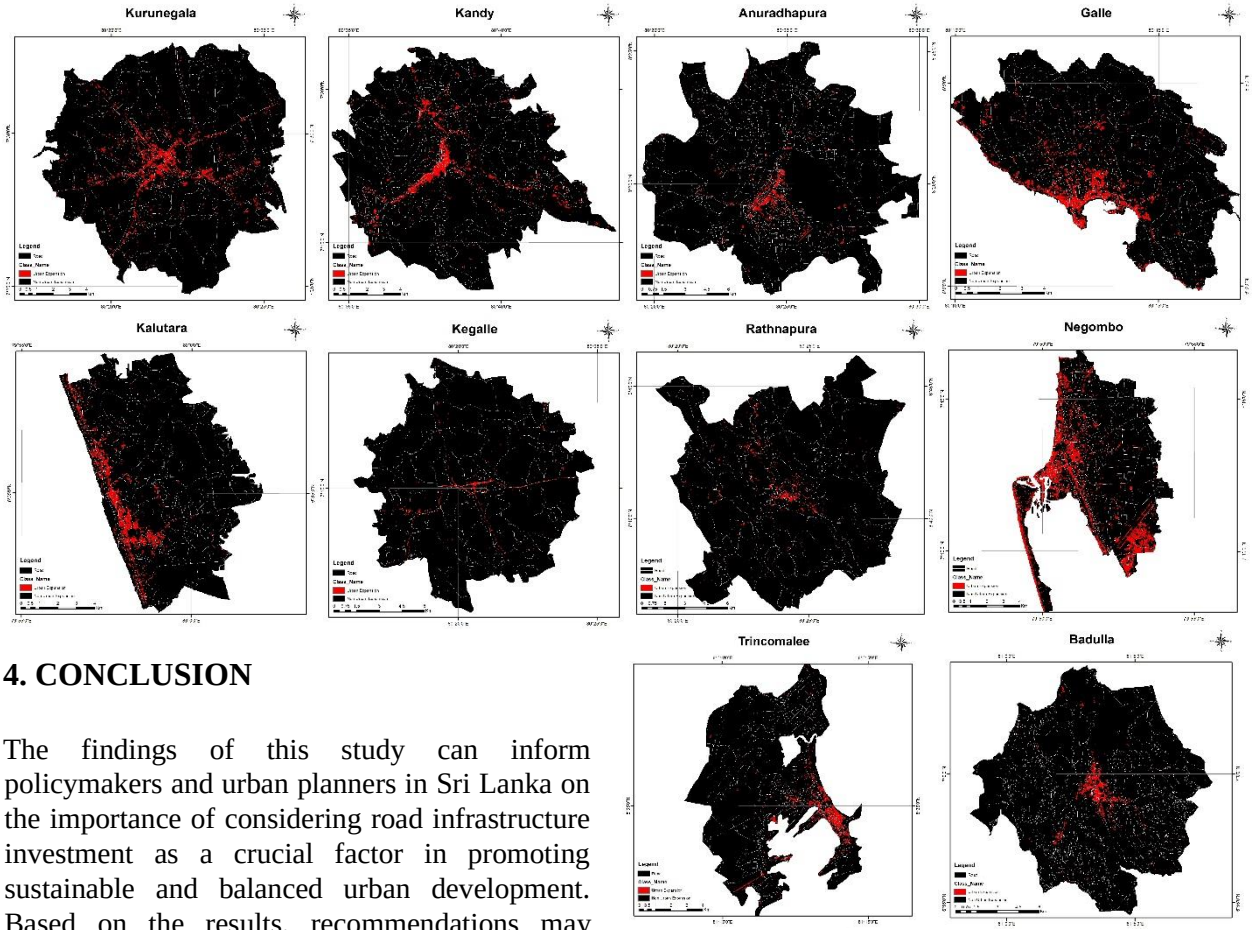

Figure 3. Maps of urban sprawl and accessibility

4. CONCLUSION

The findings of this study can inform policymakers and urban planners in Sri Lanka on the importance of considering road infrastructure investment as a crucial factor in promoting sustainable and balanced urban development. Based on the results, recommendations may include strategic planning for road development in rapidly urbanizing areas to manage and control urban sprawl effectively. Additionally, policymakers can use this information to prioritize infrastructure projects and make informed decisions about where to invest in road networks to achieve more compact and sustainable urban growth.

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