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Building Planning Policy Innovation: Integrated Solutions for Transforming Slum Areas into Sustainable Settlements

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Abstract: Slum areas pose a major challenge in sustainable urban development. To transform slum areas into habitable and environmentally sustainable settlements, it is imperative to implement effective building arrangements. This research proposes a policy model that can guide the arrangement of buildings in slum areas toward sustainable residential development. This policy model focuses on integrating social, economic, and environmental aspects to create comprehensive solutions. The research methods used include literature reviews, policy analysis, and case studies to identify the key factors that influence building planning in slum areas. The research results show that a participatory approach from various stakeholders, including local communities, regional governments, and the private sector, is key to designing and implementing successful building planning policies. In addition, this approach should be accompanied by efforts to strengthen the capacity of local communities, develop basic infrastructure, and provide better access to public services. The implication of this research is to provide practical guidance for policymakers, urban planners, and related practitioners to improve slum areas into socially, economically, and environmentally sustainable settlements. Implementing an appropriate policy model is hoped to lead to a positive and sustainable transformation of slum areas and improve the quality of life of their residents.

Keywords: slum areas; sustainable settlements; policy

建筑规划政策创新：将贫民窟改造成可持续居住区的综合解决方案

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摘要:
贫民窟地区是可持续城市发展面临的重大挑战。要将贫民窟地区改造成适宜居住和环境可持续的居住区，必须实施有效的建筑安排。本研究提出了一种政策模型，可以指导贫民窟地区的建筑布局，以实现可持续的住宅发展。该政策模型侧重于整合社会、经济和环境方面，以制定全面的解决方案。所采用的研究方法包括文献综述、政策分析和案例研究，以确定影响贫民窟地区建筑规划的关键因素。研究结果表明，包括当地社区、地区政府和私营部门在内的各利益相关方的参与方式是设计和实施成功的建筑规划政策的关键。此外，这种方法还应伴随着加强当地社区能力、发展基础设施和提供更好的公共服务的努力。本研究的意义在于为政策制定者、城市规划者和相关从业者提供实用指导，以将贫民窟地区改善为社会、经济和环境可持续的居住区。希望实施适当的政策模式能够带来贫民窟地区的积极和可持续的转变，并改善其居民的生活质量。

关键词：贫民窟；可持续居住区；政策

1 Introduction

贫民窟地区是一个重要的城市开发挑战，但它们在经济不发达国家尤其严峻。这些地区是基础设施匮乏、人口密度高、空间有限和对关键服务（如清洁水、卫生设施和适宜住房）的使用受限制的。这些特征反映了土地使用和资源分配的不可持续性，加剧了社会不平等。[2]

其中的一个主要问题是贫民窟的基础设施不足。[3]道路、污水系统和电力电网往往不足或不存在，阻碍了居民的基本生活设施的使用和阻碍经济的发展。这种基础设施的缺乏不仅会导致居民生活条件的恶化，而且会加剧贫困循环。[4]

此外，贫民窟地区的密集人口加剧了面临的挑战。有限的空间导致过度拥挤，增加了资源的竞争，加剧了社会紧张。家庭常常被迫生活在拥挤的住房中，缺乏隐私和个人发展的空间。[5]这种过度拥挤不仅影响了居民的生活质量，而且加剧了基础设施的负担，进一步加剧了贫困循环。[6]

另一方面，贫民窟地区的建筑设计和集成布局存在诸多社会、经济和环境问题。无序的建设以及对建筑规范的忽视使得住户面临受伤和事故的危险。没有适当的规划不仅影响结构的完整性，也导致了土地使用的低效，加剧了过度拥挤和交通拥堵。[7]这些不规划的建设往往侵犯了环境敏感区域，导致生态系统退化和加剧自然灾害的影响。

此外，不适当的建设和集成在贫民窟地区阻碍了经济发展并加深了社会排斥。缺乏正式基础设施和
property rights makes it difficult for residents to access credit or invest in their homes, trapping them in a cycle of poverty [10]. Moreover, the presence of disorderly constructions undermines the esthetic appeal of the area, stigmatizing residents and deterring investment and development initiatives.

Well-planned and sustainable construction arrangements hold immense significance in impoverished communities, particularly with regard to sustainable development goals [11]. When discussing sustainable urban development, it is essential to recognize the transformative potential of properly managed slum areas. These areas, when managed effectively, have the capacity to evolve into sustainable settlements. Such settlements not only offer residents dignified living conditions but also mitigate environmental impacts and elevate the overall quality of life for all inhabitants [12].

A pivotal aspect of achieving sustainable urban development in slum areas is the formulation of a comprehensive policy model for building layout [13]. This model must encompass various elements to ensure holistic development. First, it should prioritize the provision of fundamental necessities such as clean water, sanitation facilities, and adequate housing. By addressing these basic needs, communities can experience significant improvements in health, well-being, and overall quality of life [14].

Empowering communities is another crucial component of the policy model [15]. Engaging residents in the decision-making process regarding urban development fosters a sense of ownership and accountability. Community involvement ensures that development initiatives align with the needs and aspirations of the people they serve, promoting inclusivity and social cohesion [16].

Furthermore, effective management of the environment is essential for sustainable urban development. Policies should incorporate measures to minimize environmental degradation and promote resource conservation [17]. This may include initiatives such as green spaces, waste management systems, and sustainable building practices to mitigate the ecological footprint of urban areas.

Finally, the development of high-quality infrastructure is indispensable for fostering sustainable urban communities. Investments in infrastructure such as roads, transportation networks, energy systems, and public amenities are essential for enhancing accessibility, connectivity, and overall livability [18]. By prioritizing infrastructure development, policymakers can create environments that support economic growth, social well-being, and environmental sustainability [19].

The complexity of the issues at hand and the variety of local circumstances present the biggest obstacles to developing a policy model for construction arrangements in slum regions [20]. To create pertinent and long-lasting policies, a comprehensive strategy focused on community involvement and cooperation amongst many stakeholders is required. Previous studies have found that a number of important variables, such as government policy, community capacity, public service accessibility, and infrastructure development investment, affect how buildings are arranged in slum regions [21]. Nevertheless, more work is required to include these elements in a thorough and useful policy model.

By creating a policy model for building arrangements in slum regions that can direct the establishment of sustainable settlements, this research closes this knowledge gap. The suggested policy model involves active participation from stakeholders and is based on a thorough investigation of the major variables that affect how buildings are arranged in slum regions.

2 Materials and Methods

This research aims to explore and analyze policy models for building arrangements in slum areas with a focus on sustainable residential development. The method used in this research was structural equation modeling (SEM), a statistical technique that allows researchers to examine the relationships between complex variables in a model [22]. Using SEM, we can understand how various policy factors influence sustainable settlement development in slum areas. The first step in this research is to develop a conceptual model that reflects the relationship between various variables relevant to building planning policies in slum areas [23]. This conceptual model covers social, economic, environmental, and sustainability aspects. Variables that may be included in this model include access to basic services, community participation, economic growth, environmental quality, and others [24].

After developing a conceptual model, the next step is to identify and collect the data needed to test the model [25]. Data can be obtained through various means, including surveys, interviews, field observations, or the use of available secondary data. It is important to ensure that the collected data include all variables in the conceptual model. Once the data are collected,
SEM analysis can be performed using appropriate statistical software such as AMOS. This analysis involves several stages, including estimating model parameters, testing hypotheses, and assessing the fit of the model to empirical data [28]. Using SEM, we can test the causal relationship between building planning policy variables and sustainable residential development.

Furthermore, the results of the SEM analysis were used to interpret the impact of building arrangement policies in slum areas on sustainable residential development. These results help understand the critical factors that influence the success of policy implementation and find opportunities for policy improvement in the future [27]. In addition, this research considers the involvement of stakeholders, such as the government, local communities, and the private sector, in policy formulation and implementation. The use of SEM will make it possible to evaluate the effectiveness of collaboration between parties in achieving the goal of sustainable residential development in slum areas [29].

It is hoped that the results of this research can significantly contribute to the development of better and result-oriented building planning policies to improve residential conditions in slum areas. By understanding the factors that influence sustainable settlement development, the government and related institutions can design more effective and sustainable policies to improve the quality of life of slum residents and the environment in which they live [29]. This study has several limitations, including limitations in data access and statistical analysis skills. However, by taking these limitations into account and paying attention to the quality of the analysis, it is hoped that this research can provide valuable and relevant insights for practitioners, researchers, and decision-makers in the field of urban policy and sustainable residential development [30].

3 Results and Discussion

Following an analysis utilizing SEM on the policy model for building arrangements in slum areas, aimed at promoting sustainable residential development, several noteworthy results were uncovered. First, the analysis results show a strong relationship between policy factors related to social, economic, environmental, and sustainability aspects. This indicates the complexity of the relationship between variables in the context of building arrangements in slum areas. The results of the analysis also highlight the importance of access to basic services as a factor influencing sustainable settlement development in slum areas. It was found that increasing access to basic services, such as clean water, sanitation, and adequate housing, significantly contributed to improving the quality of life of slum residents and creating more sustainable conditions. This research agrees with that by Sutthichaimethee and Dockthaisong [31] which explains that to strive for great policies, there must be the right tools to support the planning process. One such tool is to construct a model based on the relationships among causal factors related to economic, social, and environmental aspects, as these affect the future implementation of sustainable policy in Thailand.

In addition, community participation also emerged as a key factor influencing the successful implementation of building planning policies in slum areas. The results of the analysis show that communities who are actively involved in the planning and decision-making process tend to have a higher level of satisfaction with the policies implemented and have greater involvement in maintaining and maintaining the infrastructure that has been built. The following SEM model obtained on the basis of the research variables is shown in Fig. 1.

![SEM model results](Developed by the authors)

**Notes:** X1.1 – communication; X1.2 – resource; X1.3 - bureaucratic structure; X1.4 - executor’s disposition; X2.1 - non-governmental organizations; X2.2 - business stakeholders; X2.3 - community stakeholders; X2.4 - expert stakeholders; Y1.1 – planning; Y1.2 – implementation; Y1.3 - post-implementation; Y2.1 - building order; Y2.2 - neighborhood road; Y2.3 - environmental drainage; Y2.4 - provision of clean drinking water; Y2.5 - waste management; Y2.6 - waste water/sanitation management; Y2.7 - fire protection; Z.1 - environmental sustainability; Z.2 - social sustainability; Z.3 - economic sustainability

From an economic perspective, the SEM analysis shows that local economic empowerment has a positive impact on sustainable settlement development in slum areas. Research finds that small and medium
businesses supported by economic empowerment policies can create local jobs, increase people’s incomes, and reduce poverty levels. In an environmental context, the analysis results highlight the importance of efficient waste management and the use of green technology in promoting sustainable residential development in slum areas. It was found that implementing environmentally friendly waste management practices and using green technology in infrastructure development can reduce negative impacts on the environment and improve the quality of the living environment for slum residents. In addition, the analysis results reveal the existence of a complex relationship between different policy factors. For example, it was found that increasing access to basic services can increase community participation in the development process, which contributes to local economic empowerment and better environmental management.

However, although there are many factors involved in the policy model for building arrangements in slum areas, the results of the analysis also highlight several challenges and obstacles that need to be overcome. For example, there are still obstacles to achieving optimal levels of community participation, especially among vulnerable and marginalized groups in slum areas. Based on the results of this analysis, it is recommended that the government and related institutions pay more attention to the key aspects that have been identified in efforts to design and implement building planning policies in slum areas. Concrete steps could include increasing access to basic services, increasing community participation, empowering the local economy, more efficient waste management, and implementing green technology in infrastructure development. Based on the research model built, it can be seen from the results of the structural model estimation in Tab. 1.

Tab. 1 Testing the direct effect hypothesis (Primary data processed in 2024)

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Independent Variable</th>
<th>Dependent Variable</th>
<th>Std’ize</th>
<th>C.R.</th>
<th>P-value</th>
<th>Path Coefficient</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Government Policy (X1)</td>
<td>Community Participation (Y1)</td>
<td>0.248</td>
<td>5.055</td>
<td>***</td>
<td>0.619</td>
<td>Significant</td>
</tr>
<tr>
<td>H2</td>
<td>Non-Government Stakeholders (X2)</td>
<td>Community Participation (Y1)</td>
<td>0.118</td>
<td>4.441</td>
<td>***</td>
<td>0.448</td>
<td>Significant</td>
</tr>
<tr>
<td>H3</td>
<td>Government Policy (X1)</td>
<td>Slum Reduction (Y2)</td>
<td>0.248</td>
<td>4.441</td>
<td>***</td>
<td>0.448</td>
<td>Significant</td>
</tr>
<tr>
<td>H4</td>
<td>Non-Government Stakeholders (X2)</td>
<td>Sustainable Residential Buildings (Z)</td>
<td>0.091</td>
<td>1.075</td>
<td>0.282</td>
<td>0.091</td>
<td>Non-significant</td>
</tr>
<tr>
<td>H5</td>
<td>Community Participation (Y1)</td>
<td>Slum Reduction (Y2)</td>
<td>0.118</td>
<td>4.441</td>
<td>***</td>
<td>0.448</td>
<td>Significant</td>
</tr>
<tr>
<td>H6</td>
<td>Community Participation (Y1)</td>
<td>Sustainable Residential Buildings (Z)</td>
<td>0.118</td>
<td>4.441</td>
<td>***</td>
<td>0.448</td>
<td>Significant</td>
</tr>
<tr>
<td>H7</td>
<td>Slum Reduction (Y2)</td>
<td>Sustainable Residential Buildings (Z)</td>
<td>0.118</td>
<td>4.441</td>
<td>***</td>
<td>0.448</td>
<td>Significant</td>
</tr>
</tbody>
</table>

The findings from the SEM analysis demonstrate a notable and favorable correlation between government policies and community engagement in sustainable settlement development. Proactive government policies in the arrangement of buildings in slum areas had a strong impact on increasing the level of community participation. This shows that policy measures supported by the government, such as increasing access to basic services and infrastructure, can motivate the community to be more actively involved in the slum area development process. In addition, the results of the analysis also reveal that there is a significant and positive influence between non-government stakeholders on community participation in sustainable settlement development. These findings show that the role and contribution of non-government stakeholders, such as civil society organizations, non-governmental organizations, and the private sector, have an important impact in mobilizing the community to participate in the development of slum areas. The results of this research are strengthened by those by Surya et al. [32], who reported the influence of community participation, improving the quality of infrastructure and the environment, and changing the sociocultural community on the sustainability of city development.

The presence and active involvement of non-government stakeholders in supporting slum area development initiatives can increase community awareness, expand participation networks, and provide additional resources needed to achieve sustainable development goals. This reflects the importance of collaboration and cooperation among the government, society, and private sector in promoting community participation in the development of slum areas. The results of this analysis provide strong evidence that both government policies and the involvement of non-government stakeholders play a crucial role in
stimulating community participation in sustainable settlement development in slum areas. By recognizing and strengthening the role of both, we can create more inclusive, empowering, and sustainable environments in slum areas, which will result in significant positive change for the people who live there.

The results of the analysis using SEM also reveal interesting findings related to the relationship between non-government stakeholders, community participation, reduction of slum areas, and the construction of environmentally friendly and sustainable buildings in slum areas. First, the analysis results indicate no significant influence of non-government stakeholders on the construction of environmentally friendly and sustainable buildings. This suggests that the contribution of non-government stakeholders to creating such buildings in slum areas was not proven to be significant in this analysis.

Furthermore, the analysis results reveal no significant correlation between community participation and the construction of environmentally friendly and sustainable buildings. While community involvement is crucial for sustainable settlement development, its impact on the construction of such buildings is not substantial. However, a notable and positive relationship was found between the reduction of slum areas and the construction of environmentally friendly and sustainable buildings. These findings suggest that efforts to decrease slum areas have a beneficial effect on the creation of more environmentally friendly and sustainable buildings in these regions. This underscores the importance of addressing slum issues as a starting point for sustainable residential development.

Research on sustainable development, as demonstrated by Yuliani and Setyaningsih [33], has contributed to the advancement of ecological architecture concepts. Their work emphasizes the significance of community engagement in implementing green design models that are suitable for humid tropical climates.

Apart from that, the analysis results demonstrate a significant and positive correlation between community participation and the reduction of slum areas. These findings underscore the crucial role of communities in supporting initiatives to alleviate slum conditions. By actively engaging in the planning and development of slum areas, communities can substantially impact addressing slum issues and promoting the development of improved settlements. Overall, the results of this analysis show that although non-government stakeholders and community participation do not significantly influence the construction of environmentally friendly and sustainable buildings in slum areas, the reduction of slum areas and community participation in the process have a positive and significant impact. This emphasizes the importance of focusing on slum reduction efforts and actively involving communities in slum development to achieve more sustainable settlement development.

4 Implications
Progressive and inclusive government policies play a crucial role in guiding the development of sustainable settlements in slum areas, supporting enhanced access to infrastructure and basic services. This enhancement creates a strong foundation for community participation in the development process, which is essential for the sustainability and effectiveness of redevelopment initiatives. Although there is no substantial correlation between community involvement and the development of sustainable and eco-friendly buildings, such involvement significantly impacts the reduction of slum areas. Therefore, it is crucial to proactively involve the community in slum reduction initiatives as a first step toward achieving broader sustainable development goals.

5 Conclusions
Several key conclusions have been drawn from the analysis of policy models for slum area building arrangements that lead to sustainable settlement development. For example, the results indicate that government policy is a major factor in guiding the development of sustainable settlements in slum areas. The government can inspire community participation in development through progressive and inclusive policy measures like expanding access to infrastructure and basic services. Additionally, the analysis emphasizes how crucial community involvement is to the creation of sustainable settlements in slum areas. Although there is no significant correlation between community involvement and the development of sustainable and eco-friendly buildings, community engagement plays a crucial role in reducing the prevalence of slum areas. This underlines how crucial it is to involve the community in slum reduction initiatives on a proactive basis as a first step toward more sustainable development. An intriguing discovery, nevertheless, is that non-governmental stakeholders have no appreciable impact on the development of sustainable and eco-friendly structures. Non-governmental players can
contribute significantly to development projects; however, this investigation does not show that they have a major impact on the construction of sustainable and eco-friendly structures in slum regions. In general, the analysis findings offer insightful information to practitioners and policymakers who aim to improve the efficiency of building codes in impoverished neighborhoods to promote more environmentally friendly residential development. By enhancing the government’s role, fostering community engagement, and recognizing the contributions of non-governmental stakeholders, we can create a more inclusive, empowering, and sustainable living environment for residents in slum areas.

Future studies should focus on evaluating the long-term impacts of specific policies on slum redevelopment and sustainability, which is essential for understanding the durability and adaptability of policy-driven changes. Comparing the effectiveness of similar policies in different regions or countries can reveal cultural and contextual factors that influence redevelopment success, guiding more tailored and effective policy formulations. Investigating the role of innovative technologies, such as GIS mapping and mobile data collection, could enhance planning and implementation effectiveness in slum redevelopment projects. Further research into different models of community involvement could determine the most effective methods for fostering sustainable community-driven redevelopment, focusing on community leadership and participatory planning. Additionally, assessing the environmental impacts of slum redevelopment projects, especially in developing eco-friendly buildings and infrastructure, would support the promotion of sustainability in all aspects of slum redevelopment.

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