Leveraging Prefabricated Construction for Mini City Development on Lagos Island as Path to a Sustainable and Livable City.

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Abstract- ***Rapid urbanization on Lagos Island has exacerbated housing deficits, infrastructure challenges, and environmental stress. This study examines prefabricated construction as a sustainable alternative for mini-city development. Using a qualitative methodology rooted in literature analysis, the research evaluates the feasibility, benefits, and barriers to prefabrication adoption in Nigeria. Findings highlight time and cost efficiency, reduced environmental impact, and improved housing quality, while also identifying cultural, regulatory, and technical constraints. The study concludes that with proper policy reform, infrastructure, and public-private partnerships, prefabrication can drive sustainable urban growth on Lagos Island.***

Indexed Terms- ***Prefabricated Construction, Mini City Development, Sustainability, Livable city, Urban Development***

I. INTRODUCTION

Lagos Island, a critical center of commerce and culture in Lagos State, faces severe urban challenges, including housing shortages, infrastructure strain, and environmental degradation (Aluko, 2010). The population growth has surpassed the capacity of conventional housing systems, making innovative construction approaches necessary (Olowu & Adeoye, 2021).

Globally, prefabrication has demonstrated its potential in reducing construction time, costs, and environmental impact, as seen in projects in China, Sweden, and Singapore (Bertram et al., 2019). Adopting prefabrication on Lagos Island could revolutionize urban housing by addressing the island's unique constraints, reduces building time by up to 50%, minimizes on-site labor requirements, decreases construction waste and also promotes the use of eco-friendly materials and energy- efficient designs, which align with the goals of sustainability and environmental protection (Oladiran & Akomolafe, 2021).

The aim of this study is to explore the potential of prefabricated construction in developing mini-cities on Lagos Island as a strategy for achieving a sustainable and livable urban environment.

The specific objectives are to:

1. Assess the current urban challenges and housing deficits on Lagos Island.
2. Examine the principles and benefits of prefabricated construction.
3. Evaluate the feasibility of applying prefabricated techniques to mini-city development.
4. Identify barriers and enablers for adopting prefabrication in Lagos' construction sector.

II. PREFABRICATION, RELATED STUDIES AND RESEARCH GAP

Prefabricated construction, a building technique which involves manufacturing building components off-site and assembling them on-site, reducing construction time, waste, and environmental impact (Adelusola, 2024).

Prefabricated construction involves producing building components in off-site factories for later on-site assembly (Magar, 2020). It improves quality control, reduces waste, and shortens project duration (Rocha et al., 2023).

Several studies demonstrate its benefits. For instance, Liu (2024) explores cost factors in prefabrication, while Lakhani (2025) highlights its role in reducing on-site accidents. Despite these advantages, Nigeria faces low adoption due to regulatory gaps, high setup costs, and lack of awareness (Ajayi et al., 2021).

There is limited empirical research addressing prefabrication in the context of mini-city development in Lagos Island. While localized innovations like the Makoko Floating School suggest the viability of alternative construction methods, comprehensive evaluations of scalability and sustainability are missing (Yawas et al., 2024).

III. RESEARCH METHODOLOGY

This study adopts a constructivist research philosophy, emphasizing interpretation and synthesis of existing knowledge. A qualitative approach was used, focusing on literature and document analysis. The research examined 30 academic articles, government reports, and case studies on prefabricated construction and urban development.

Document analysis allowed for in-depth examination of global and local practices. This methodology facilitated the identification of trends, barriers, and enablers in prefabricated construction, enabling a contextual evaluation for mini-city development on Lagos Island.

IV. FINDINGS AND REVIEWS

A total of 30 studies were reviewed, covering global and local perspectives on prefabricated construction. These studies provide insights into how prefabrication has been applied in various contexts and its potential impact on sustainable urban development in Lagos.

The 9 articles deduced from the reviewed 30 journal articles are seen in Table 1. The table showcases the research objectives, providing a structured overview of the selected literature, summarizing key details such as the author(s), year, country, title, and study focus which helps to categorize the research sources based on their relevance to this study.

Table 1: Research Findings

S/ N	Author (s)	Yea r	Country	Paper Title	Study Area
1	Aluko O.E	2010	Nigeria	The Impact of Urbanization on Housing Development: The Lagos Experience, Nigeria.	Urbanization impact on housing development in Lagos
2	Mayowa Fasona , Ajibade Ariori, Akinlabi Akintuyi	2020	Nigeria	The Challenge of Urban Evolution and Land Management in Developin`g Countries: Some Lessons from the City of Lagos	Urban evolution and land management challenges in Lagos
3	Jayesh Shankar Magar	2020	India	Effective & Sustainable Construction by Prefabrication Method	Sustainable construction through prefabrication

4	Bhavin bhai G. Lakhani	2024	USA	The Role of Prefabrication and Modular Construction in Reducing Construction Time and Costs	Reducing construction time and costs using prefabrication and modular methods
5	Patrícia F. Rocha, Nuno O.	2023	Portugal	Impacts of Prefabrication in the	Impacts of prefabrication on sustainability, productivity, and quality
	Ferreira, Fernan do Pimenta, Nelson B. Pereira			Building Construction Industry	
6	Amr Ibrahim, Khaled Hamdy, Moha med Badaw y	20 23	Egypt	Overall, Barriers to The Prefabricated Construction Industry: A Fuzzy- SEM	Barriers to prefabricated construction in developing countries
7	Hui Liu, Nazira h Zainul Abidin	20 24	Malaysia, China	A Review on Research of Prefabricated Building Costs: Exploring Collaborations, Intellectual Basis, and Research Trends	Cost management and financial aspects of prefabricated construction
8	Tran Duong Nguye n, Pardis Pishdad -Bozorgi	20 23	USA	Overcoming the Barriers Toward Widespread Adoption of Prefabrication: An Approach Involving Emerging Technologies	Barriers to prefabrication adoption and emerging technologies
9	Michae l W. Robey, Raja R.A. Issa	20 15	USA	Implementation of Prefabrication and Modular Offsite Construction using BIM and Lean	BIM and Lean Construction for prefabrication and modular construction

development. However, this rapid urbanization has not been matched by proportional growth in housing supply, leading to a severe housing deficit. Studies by Aluko (2010) and Fasona et al. (2020) reveal that the uncontrolled expansion of Lagos has resulted in overcrowded slums, high property prices, inadequate infrastructure, and worsening living conditions. Many residents are forced into informal settlements with substandard housing, poor sanitation, and inadequate access to essential services such as potable water, electricity, and proper waste management.

Table 2: Analysis of Prefabrication Research

S/N	Methods Used	Advantages Highlighted	Limitations Identified	Key Findings

1	Survey, statistical analysis	Examines the effects of urbanization on housing supply	Data limitations due to outdated housing records	Rapid urbanization in Lagos leads to housing deficits. Prefabrication is a potential solution.
2	GIS, remote sensing, historical data analysis	Maps the evolution of urban land use in Lagos	Uncontrolled urban sprawl and lack of planning	Lagos Island suffers from unplanned urban growth and infrastructural stress
3	Experimental study, literature review	Highlights environmental benefits of prefabrication	Challenges in large-scale adoption	Prefabrication is environmentally sustainable and reduces waste.
4	Comparative analysis, case studies	Demonstrates cost and time savings of modular construction	Limited applicability to highly customized projects	Modular construction reduces time & labor costs, especially in repetitive projects.
5	Review of existing projects, sustainability assessment	Shows prefabrication's impact on sustainability and productivity	Lack of standardization across different regions	Prefabrication increases efficiency & supports
6	Questionnaire survey, Structural Equation Modeling (SEM)	Identifies key barriers to prefabrication in developing countries	Limited industry expertise in prefabricated construction	Major barriers to prefab adoption include lack of expertise and industry resistance.
7	Bibliometric analysis, cost analysis	Provides insights into cost factors influencing prefabrication	High capital investment and policy limitations	Cost & investments factors heavily influence prefabrication adoption.
8	Literature review, case studies	Identifies technological solutions to prefabrication barriers	High initial cost of implementation	Prefabrication improves productivity & coordination when combined with digital tools.
9	Interviews, case study analysis	Demonstrates benefits of BIM and Lean	Slow adoption of digital tools in construction	Integration of BIM & Lean

		Construction for prefabrication		methods enhances prefab outcomes

prefabrication with digital tools such as Building Information Modeling (BIM) and Lean Construction can enhance planning, design, and project execution. These technologies improve coordination, supply chain management, and material efficiency—critical for mini-city success. Nonetheless, challenges exist: Lagos' poor transport infrastructure and traffic congestion could delay module delivery, while limited local production capacity and reliance on imported materials could increase costs.

The increasing population on Lagos Island has overwhelmed existing infrastructure such as roads, drainage systems, and public utilities. Persistent issues like traffic congestion, flooding, and poor waste management have deteriorated the urban environment. Additionally, high construction costs and the limited availability of affordable land make it difficult for low- and middle-income residents to secure adequate housing. As demand far outpaces supply, rental prices soar, pushing many into informal settlements. Government efforts to address the housing gap through public schemes have largely failed due to bureaucracy, funding shortages, and mismanagement. Consequently, there is an urgent need for innovative, sustainable, and scalable housing solutions to accommodate Lagos Island's growing population.

Prefabricated construction offers a viable alternative to conventional methods by enhancing efficiency, sustainability, and cost-effectiveness. Studies by Lakhani (2024) and Magar (2020) highlight its modularity, standardization, and industrialized processes. Unlike traditional, labor-intensive construction, prefabrication improves precision, reduces material waste, and lessens reliance on skilled labor, which remains scarce in Lagos. Research by Rocha et al. (2023) and Ibrahim et al. (2023) also emphasizes its contribution to green construction, optimizing resource use and lowering carbon emissions. Prefabricated methods enhance quality control in factory settings, ensuring durable structures with lower maintenance needs, while minimizing environmental disruptions like dust, noise, and waste. These advantages make prefabrication a strong solution for cities like Lagos, where space and environmental concerns are critical.

However, its feasibility in Lagos Island's mini-city development requires careful evaluation. Mini-cities—self- sufficient communities integrating residential, commercial, and infrastructure—could benefit from prefabricated methods given Lagos' land constraints and high property values. Robey and Issa (2015) suggest that combining

Despite these barriers, prefabrication remains a promising option for delivering cost-effective and sustainable urban developments if supported by the right infrastructure and policy reforms.

The adoption of prefabrication in Lagos faces additional challenges such as financial constraints, regulatory issues, and resistance to change. According to Liu and Abidin (2024), high initial capital costs for setting up plants and machinery discourage developers. Many still prefer traditional methods due to familiarity and lower upfront costs, despite prefabrication's long-term benefits. Ibrahim et al. (2023) note a shortage of skilled workers in prefabrication technologies, further slowing adoption. Moreover, the absence of standardized codes and supportive regulations in Nigeria creates uncertainty for investors and developers, unlike in countries where government incentives have promoted prefabrication.

Nonetheless, several enablers could accelerate adoption. Public-private partnerships, subsidies, and regulatory reforms could encourage investment in prefabrication. Establishing local manufacturing plants would reduce reliance on imports and lower production costs. Furthermore, capacity-building initiatives through training programs and academic-industry collaborations could address the skills gap. With these measures, prefabrication could transition into mainstream construction, helping solve Lagos' housing crisis and contributing to sustainable urban development.

CONCLUSION

This study reaffirms that prefabricated construction can offer innovative solutions to the urban housing crisis on Lagos Island. It aligns with sustainable development goals by reducing environmental impact and improving housing delivery efficiency. To implement this model successfully, Lagos requires supportive policies, investment in local prefabrication industries, and comprehensive training programs. Strategic public-private partnerships will also be vital to scaling prefabrication across urban projects in Nigeria.

REFERENCES

[1] Adelakun, A. A., Ayinde, T., & Olusola, A. (2021): Urban challenges and prospects of sustainable housing in Lagos State. Lagos Journal of Urban Development, 12(3), 45–58.

[2] Adebayo, M. (2020): Housing challenges and innovative construction in Lagos.

[3] Adekunle, A., Oluwaseun, J., & Okonkwo, E. (2020): Sustainable urban development through mini cities: A case for Lagos, Nigeria. Journal of Urban Planning and Development, 146(3), 45–57.

[4] Ajayi, O., Oke, A., & Akinradewo, O. (2021): Barriers to prefabricated construction adoption in Nigeria. Journal of Sustainable Construction, 12(4), 34–45.

[5] Akinshipe, O., Oluleye, I. B., & Aigbavboa, C. (2019): Adopting sustainable construction in Nigeria: Major constraints Adopting sustainable construction in Nigeria: Major constraints. January 2020. https://doi.org/10.1088/1757-899X/640/1/012020.

[6] Aluko, O. E. (2010): The Impact of Urbanization on Housing Development: The Lagos Experience, Nigeria.

[7] Bertram, N., Fuchs, S., Mischke, J., Palter, R., & Strube, G. (2019): Modular construction: From projects to products.McKinsey & Company.

[8] Fagbenro, R. K., & Sunindijo, R. Y. (2020). Positive Impact of Prefabrication on The Mental Health of Construction Workers.

[9] Fasona M., Ariori A., & Akintuyi A. (2024). The Challenge of Urban Evolution and Land Management in Developing Countries: Some Lessons from the City of Lagos.

[10] Hoong, C. Y. (2024, December 10). SkyWorld signs agreement to develop Malaysia's largest affordable housing project in Penang. Retrieved from The Edge Malaysia: https://theedgemalaysia.com/node/737203?.

[11] Ibrahim, A., Hamdy, K., & Badawy, M. (2023). Overall Barriers to The Prefabricated Construction Industry: A Fuzzy-SEM. Preprint Researchsquare

[12] Kamar, K. A. M., Alshawi, M., & Hamid, Z. A. (2018): The critical success factors of using prefabrication for sustainable construction. Journal of Construction Engineering and Management, 144(2), 25–38.

[13] Lai, A. (2024, December 10). SkyWorld launches Malaysia's largest affordable housing project in Penang. Retrieved from The Sthttps://www.thestar.com.my/news/nation/2024/12/10/developer-launches-malaysia039slargest-affordable-housing-project-in-penang?.

[14] Lakhani, B. G. (2025). The Role of Prefabrication and Modular Construction In Reducing. February.

[15] Liu, H. (2024). A Review on Research of Prefabricated Building Costs: Exploring Collaborations, Intellectual Basis, And Research Trends.

[16] Lu, W., Chen, X., & Xiao, Y. (2020): Prefabrication and its role in sustainable urban housing: A review of global practices. Building Research & Information, 48(2), 129–141.

[17] Magar, J. S. (2020). Effective & Sustainable Construction by Prefabrication Method Effective & Sustainable Construction by Prefabrication Method. July. Https://Doi.Org/10.5281/Zenodo.3994965

[18] Masood, R., & Roy, K. (2022). Work-Based Learning 4: Technology. November.

[19] Nguyen, T. D., & Pishdad-Bozorgi, P. (2023). Overcoming the Barriers Toward Widespread Adoption of Prefabrication: An Approach Involving Emerging Technologies. Proceedings of the 31st Annual Conference of the

International Group for Lean Construction (IGLC31), July, 699–710. https://doi.org/10.24928/2023/0116

[20] Oladiran, O. J., & Akomolafe, A. (2021): Sustainable construction methods in Lagos.

[21] Olowu, T., & Adeoye, R. (2021): Urban expansion and the housing deficit in Lagos State.

[22] Oloto, E. N., & Adebayo, A. A. K. (2023): Development of An Inclusive Sustainable Adoption Support Framework (Asf) For Optimizing Prefabrication Adoption In Nigeria's Housing Development Industry. 14(3), 79–92.

[23] Oluwole, T. F., Adebayo, K. S., & Abiodun, O.R. (2019): The role of prefabricated construction in housing delivery in Nigeria: Challenges and prospects. Journal of Sustainable Construction, 11(4), 56–68

[24] Omopariola, E. D., Albert, I., & Windapo, A. O. (2019). Appropriate drivers for sustainable construction practices on construction sites in Nigeria. August. https://doi.org/10.33796/waberconference2019.07

[25] Profile, S. E. E. (2023): Challenges Faced in Prefabrication or Modular Construction. January 2022. Https://Doi.Org/10.22214/Ijraset.2022.39789.Cita tion

[26] Rocha, P. F., Ferreira, N. O., Pimenta, F., & Pereira, N. B. (2023): Impacts of Prefabrication in the Building Construction Industry. 28–45.

[27] Robey M. W., & Issa R. A. (2015): Implementation of Prefabrication & Modular Offsite Construction using BIM and Lean Construction Techniques.

[28] Said, H. (2016). Predictive Modeling of Prefabrication Feasibility for The United Predictive Modeling of Prefabrication Feasibility for the United States Electrical Contracting Firms. June. Https://Doi.Org/10.14288/1.0076461

[29] Science, E. (2020). Review And Feasibility Analysis of Prefabricated Recycled Concrete Structure Review and Feasibility Analysis of Prefabricated Recycled Concrete Structure. Https://Doi.Org/10.1088/1755-1315/531/1/012052

[30] Syamsunur, D. (2025). Identification Of Impeding Factors In Utilising Prefabrication During Lifecycle Of Construction Projects: An Extensive. February. Https://Doi.Org/10.3390/Buildings14061764

[31] The United Nations. (n.d.). Informal settlements. United Nations Human Settlements Programme (UN-Habitat). Retrieved from https://www.unescwa.org/sd-glossary/informal-settlements

[32] United Nations Habitat. (2020). Integrated approaches to sustainable urban development. https://unhabitat.org

[33] United Nations. (2015). Transforming our world: The 2030 Agenda for Sustainable Development. https://sustainabledevelopment.un.org

[34] Zhou, J., & B, J. Z. (N.D.). Exploring The Application of Prefabricated Construction Technology Under the Concept of Green Building. Springer Nature Singapore. Https://Doi.Org/10.1007/978-981-97- 5108-2