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Enhancing Urban Sustainability in Abuja through E-Back-casting: A participatory methodology for sustainable city development

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Abstract

This study explores the potential of e-backcasting as a participatory tool for improving urban sustainability in Abuja, Nigeria. Given the rapid urbanization and environmental challenges faced by cities like Abuja, there is a growing need for innovative approaches that integrate environmental, social, and economic dimensions in urban planning. E-backcasting, a method that involves envisioning a sustainable future and working backward to develop actionable strategies, offers a promising approach. This study utilizes e-backcasting to engage stakeholders from diverse sectors—including urban planners, policymakers, academics, and residents—to collaboratively design long-term sustainability strategies. The results show significant improvements in participants' critical thinking, goal-setting abilities, and cross-sectoral collaboration. By fostering social learning, enhancing knowledge exchange, and facilitating inclusive urban planning, e-backcasting contributes to more resilient, sustainable urban environments. This article discusses the methodology, key findings, and implications of e-backcasting for sustainable urban development in Abuja, highlighting its potential to foster long-term change and collaboration in rapidly growing cities.

Keywords: E-backcasting; Urban sustainability; Abuja; Urban planning; Participatory planning; Stakeholder engagement

1. Introduction

Urban sustainability in rapidly growing cities like Abuja is a critical issue due to the increasing pressure on environmental, economic, and social systems. The challenge of balancing urban growth with sustainability requires integrated, forward-thinking solutions that engage multiple stakeholders in the planning process. E-backcasting, a strategic planning tool that involves envisioning future sustainability goals and working backward to identify necessary actions, has gained traction as an effective methodology for urban planning in dynamic environments [1]. By fostering a participatory and collaborative approach, e-backcasting enables stakeholders to engage in critical discussions, brainstorm innovative solutions, and collectively develop long-term strategies for urban sustainability. This paper examines the applicability of e-backcasting in Abuja, with a particular focus on the participatory aspect that brings together urban planners, policymakers, residents, and academics to jointly envision and implement sustainable city futures [2].

The rapid urbanization of Abuja, the capital city of Nigeria, has led to pressing challenges in infrastructure, resource management, environmental degradation, and social inequality. With projections for continued population growth, there is an urgent need for strategies that address these sustainability challenges in a holistic manner. Participatory approaches, like e-backcasting, which emphasize stakeholder involvement, are essential for crafting solutions that are not only sustainable but also inclusive and contextually appropriate for local needs [3]. This study aims to assess the potential of e-backcasting to catalyze the co-creation of sustainability solutions in Abuja, with the expectation that it will enhance participants' capacity to think critically, collaborate across sectors, and set long-term sustainability goals.

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2. Literature Review

Urban sustainability, defined as the ability of a city to meet the needs of its present population without compromising the ability of future generations to meet their own needs, is a growing concern in cities around the world. The accelerating pace of urbanization has led to significant challenges, including environmental degradation, social inequality, and unsustainable economic practices, which threaten the long-term viability of cities [4]; [5]. As urban populations expand, especially in developing regions, cities increasingly struggle to balance growth with sustainable practices, necessitating innovative urban planning approaches [6].

The United Nations Sustainable Development Goal 11 underscores the importance of making cities inclusive, safe, resilient, and sustainable. However, achieving this goal requires cities to adopt participatory and forward-thinking planning methodologies that address current and future challenges in a comprehensive and inclusive manner [7]. Rapid urbanization, particularly in cities across Africa and Asia, has exacerbated issues such as traffic congestion, inadequate housing, environmental pollution, and widening social inequities [8]. To address these complex challenges, urban planners are increasingly turning to participatory methods that emphasize collaboration and the integration of diverse stakeholder perspectives.

2.1. Participatory Urban Planning and E-Backcasting

Participatory urban planning has emerged as a widely recognized approach to promoting sustainable urban development. It allows for the inclusion of diverse stakeholder voices, including government agencies, local communities, private sector actors, and civil society organizations, in decision-making processes. By fostering greater inclusivity, participatory urban planning leads to solutions that are more democratic, equitable, and sustainable [2]; [8]. For instance, participatory urban planning has been successfully applied in cities like Curitiba, Brazil, and Portland, Oregon, where stakeholder engagement has contributed to innovative transportation and land-use policies [10].

Within the realm of participatory planning, the integration of foresight and backcasting methodologies—collectively known as e-backcasting—has gained significant attention for its ability to enable stakeholders to envision and work toward future sustainability goals [2]. E-backcasting differs from traditional forecasting approaches by first establishing a vision of a desired future and then identifying the steps necessary to achieve it. This approach is particularly useful in the context of urban sustainability, as it focuses on long-term goals and allows cities to address uncertainty, complexity, and rapid change [1].

Studies have demonstrated that e-backcasting enhances urban planning processes by fostering collaboration, promoting social learning, and improving stakeholders' ability to articulate and pursue actionable sustainability goals [3]; [11]. For example, research by Singh [3] highlights how e-backcasting enables stakeholders to identify pathways to reduce carbon emissions and improve urban livability by aligning short-term actions with long-term objectives. Furthermore, the methodology encourages creative problem-solving, as stakeholders are empowered to explore alternative futures and challenge existing paradigms [4].

The advent of digital platforms has further enhanced the effectiveness of participatory foresight methods such as e-backcasting. Digital tools provide an interactive and accessible environment for stakeholders to collaborate in real-time, facilitating the co-creation of knowledge and strategies [12]. For instance, the use of Geographic Information Systems (GIS) and other digital mapping tools has been instrumental in identifying spatial patterns and informing urban planning decisions [13]. In addition, virtual platforms enable broader stakeholder engagement, overcoming geographical and logistical barriers to participation [4].

2.2. Application of E-Backcasting in Urban Contexts

The practical application of e-backcasting in urban contexts has shown promising results in addressing sustainability challenges. For instance, a study conducted in Stockholm, Sweden, demonstrated how e-backcasting facilitated the development of a low-carbon energy strategy by engaging multiple stakeholders in envisioning a sustainable energy future and identifying practical steps for achieving it [14]. Similarly, in Melbourne, Australia, e-backcasting was applied to create a vision for sustainable urban transport systems, resulting in policies that prioritized public transportation and active mobility options [15].

In developing regions, where urban challenges are often more acute, the application of e-backcasting has the potential to generate tailored solutions that address local needs and constraints. In African cities, for instance, issues such as traffic congestion, inadequate waste management, and social inequality require long-term, context-specific planning

approaches. By integrating stakeholder participation with future-oriented methods like e-backcasting, urban planners can create pathways to sustainable urban development that are both actionable and inclusive [16].

2.3. The Case of Abuja

Abuja, the capital city of Nigeria, provides a relevant context for the application of e-backcasting as a participatory planning tool. The city has experienced rapid population growth and urban expansion, leading to a range of challenges including traffic congestion, inefficient waste management systems, environmental degradation, and widening social inequality [17]. As the urban population in Abuja continues to grow, there is an urgent need for sustainable and integrated planning strategies that address these pressing issues.

E-backcasting offers a promising approach to tackling Abuja's urban challenges by enabling stakeholders to collaboratively envision a sustainable future and identify actionable steps to achieve it. For example, in addressing traffic congestion, e-backcasting could facilitate the development of long-term solutions such as investments in public transportation infrastructure, non-motorized transport systems, and integrated land-use planning [17]; [2]. Similarly, in waste management, e-backcasting could support the co-creation of innovative strategies such as waste-to-energy programs and community-based recycling initiatives.

By leveraging digital platforms, the application of e-backcasting in Abuja can enhance stakeholder engagement and knowledge-sharing, ensuring that proposed solutions are both contextually relevant and widely supported. Moreover, Abuja's experience with e-backcasting could serve as a model for other cities in Africa and beyond that face similar urban sustainability challenges [6].

2.4. Conclusion of Literature Review

The literature highlights the critical role of participatory planning approaches, particularly e-backcasting, in achieving urban sustainability. E-backcasting provides a forward-thinking methodology that empowers stakeholders to collaboratively envision sustainable futures and design actionable pathways to achieve them. The integration of digital platforms further enhances the accessibility and effectiveness of this approach, fostering broader stakeholder participation and knowledge co-creation.

In cities like Abuja, where rapid urbanization poses significant challenges, e-backcasting offers a valuable tool for addressing complex issues such as traffic congestion, waste management, and social inequality. By tailoring solutions to local contexts and ensuring inclusive stakeholder participation, e-backcasting can contribute to more democratic, equitable, and sustainable urban development outcomes. This approach has the potential to serve as a model for other developing cities seeking to navigate the challenges of urban growth while advancing long-term sustainability goals.

2.5. Conceptual Framework

This study is grounded in the conceptual framework of participatory urban planning, sustainability, and social learning. It draws on the theory of social learning, which posits that knowledge is co-created through social interaction, dialogue, and shared experience [3]. By involving a diverse group of stakeholders in the e-backcasting process, this study aims to facilitate social learning, where participants not only gain insights into urban sustainability challenges but also contribute to the creation of solutions through collaborative dialogue.

The framework also incorporates principles of sustainable urban development, which emphasize the integration of environmental, economic, and social dimensions into urban planning. This comprehensive approach to sustainability ensures that solutions are not only ecologically viable but also socially inclusive and economically feasible. The participatory nature of e-backcasting facilitates the alignment of sustainability goals with the needs and aspirations of local communities, ensuring that solutions are contextually appropriate [2].

3. Methodology

This study utilized a quantitative approach, employing an online platform to conduct e-backcasting sessions with 239 participants from diverse sectors, including urban planners, policymakers, academics, and residents. The use of an online platform allowed for real-time interactions, enabling participants to collaboratively develop sustainability strategies. Participants were asked to envision a sustainable future for Abuja and work backward to identify the steps required to achieve this vision. Pre- and post-engagement surveys were administered to assess improvements in participants' critical thinking, goal-setting abilities, and collaborative skills.

4. Results

The results of the e-backcasting sessions highlight substantial improvements in participants' ability to critically engage with urban sustainability issues and foster collaboration across sectors. A key outcome of the process was a marked increase in participants' understanding of sustainability concepts, including environmental sustainability, social inclusion, and economic resilience. The e-backcasting approach facilitated social learning by creating a collaborative environment where participants were able to engage in discussions, share knowledge, and collaboratively develop actionable plans for sustainable urban development.

4.1. Main Findings from the Study

The tables below provide a comprehensive overview of the improvements observed in participants' skills, understanding, and engagement throughout the e-backcasting process.

Table 1 Pre- and Post-Engagement Assessment of Participants' Critical Thinking Skills

Assessment Area	Pre-Engagement	Post-Engagement	Difference	Percentage Change
Critical Thinking on Sustainability	3.2/5	4.5/5	+1.3	+40.6%
Problem-Solving in Urban Planning	3.1/5	4.4/5	+1.3	+41.9%
Ability to Formulate Long-term Goals	3.3/5	4.6/5	+1.3	+39.4%

Table 1 suggests that e-backcasting significantly improved participants' critical thinking and problem-solving abilities, with an average increase of 1.3 points (40%) across these areas. The improvement underscores the efficacy of e-backcasting in enhancing participants' capacity to address complex sustainability challenges.

Table 2 Participants' Understanding of Sustainability Concepts (Pre- and Post-Engagement)

Concept	Pre-Engagement	Post-Engagement	Difference	Percentage Change
Environmental Sustainability	3.4/5	4.7/5	+1.3	+38.2%
Social Inclusion	3.2/5	4.6/5	+1.4	+43.8%
Economic Resilience	3.5/5	4.8/5	+1.3	+37.1%

Table 2 revealed participants exhibited significant improvements in their understanding of sustainability concepts. Social inclusion saw the largest increase (43.8%), followed by environmental sustainability and economic resilience. This suggests that e-backcasting was particularly effective in enhancing participants' understanding of the more socially oriented aspects of sustainability.

Table 3 Collaborative Engagement During E-Backcasting Sessions

Engagement Activity	Pre-Engagement	Post-Engagement	Difference	Percentage Change
Engagement in Group Discussions	3.0/5	4.5/5	+1.5	+50%
Sharing Knowledge with Peers	3.1/5	4.6/5	+1.5	+48.4%
Contribution to Action Plans	3.2/5	4.7/5	+1.5	+46.9%

Table 3 indicates collaborative engagement was another area of significant improvement. Participants showed an increase in group discussions, knowledge sharing, and contribution to action plans, with improvements ranging from 46.9% to 50%. This indicates that e-backcasting created a space for social learning and active knowledge exchange, which was essential for developing concrete sustainability solutions.

Table 4 Participants' Satisfaction with E-Backcasting Process

Satisfaction Area	Rating (1-5)	Comments
Ease of Use of Platform	4.3/5	Positive feedback on the platform's accessibility and user-friendly interface.
Interaction with Other Participants	4.6/5	Participants appreciated the collaborative nature of the process.
Effectiveness in Achieving Sustainability Goals	4.5/5	Most participants felt that the process led to tangible, actionable solutions.

Table 4 shows overall, participants expressed high satisfaction with the e-backcasting process. Positive feedback was provided regarding the platform's usability and the interactive nature of the sessions. Furthermore, the process was viewed as effective in achieving sustainability goals and generating actionable outcomes for urban development.

5. Discussion

This study examined the effectiveness of e-backcasting as a participatory tool for addressing urban sustainability challenges, with a particular focus on Abuja. The key findings from the study, supported by data presented in the tables below, underscore the potential of e-backcasting in enhancing participants' skills, understanding, and collaborative engagement. These improvements, in turn, contributed to the development of actionable strategies for urban sustainability.

5.1. Critical Thinking and Problem-Solving Skills

One of the most notable findings from this study was the significant improvement in participants' critical thinking and problem-solving abilities. As shown in Table 1, participants demonstrated an average increase of 1.3 points (40%) in critical thinking on sustainability, problem-solving in urban planning, and the ability to formulate long-term goals. The ability to think critically about sustainability challenges is essential for urban planners, as it allows them to navigate the complexities of urban growth, environmental degradation, and social inequality. The e-backcasting process, by engaging participants in future-oriented thinking and scenario development, enhanced their capacity to analyze these challenges and devise effective solutions. This improvement highlights the efficacy of e-backcasting in fostering critical thinking and preparing participants to tackle complex urban sustainability issues [1].

5.2. Understanding of Sustainability Concepts

Participants also showed substantial gains in their understanding of key sustainability concepts, including environmental sustainability, social inclusion, and economic resilience (Table 2). The largest increase was observed around social inclusion, with a 43.8% improvement, followed by environmental sustainability and economic resilience, both of which showed increases of around 38-39%. This suggests that e-backcasting was particularly effective in expanding participants' knowledge of the socially oriented aspects of sustainability, which are often more complex and difficult to address than purely environmental or economic concerns. The emphasis on social inclusion is crucial in creating equitable urban spaces, as it ensures that the needs of marginalized populations are considered in the planning process. By enhancing participants' understanding of these concepts, e-backcasting contributed to the development of more holistic and inclusive sustainability strategies, aligning with findings in previous studies highlighting the importance of social learning in participatory planning processes [3].

5.3. Collaborative Engagement and Knowledge Sharing

Another significant finding was the improvement in collaborative engagement among participants during the e-backcasting sessions. As shown in Table 3, engagement in group discussions, knowledge sharing, and contribution to action plans all increased significantly, with improvements ranging from 46.9% to 50%. These results indicate that e-backcasting facilitated a dynamic and interactive learning environment where participants could exchange ideas, learn from one another, and work together to develop actionable strategies. The collaborative nature of the e-backcasting process is crucial for addressing urban sustainability challenges, as it ensures that the perspectives and expertise of diverse stakeholders are incorporated into the planning process. This social learning component of e-backcasting fostered a sense of shared ownership and collective responsibility for the solutions developed, which is essential for ensuring their successful implementation. Participatory tools like e-backcasting are critical for generating effective, collaborative solutions to urban sustainability challenges, as demonstrated in previous research [2].

5.4. Satisfaction with the E-Backcasting Process

Overall, participants expressed elevated levels of satisfaction with the e-backcasting process, as indicated in Table 4. The ease of use of the platform, the opportunity for interaction with other participants, and the effectiveness of the process in achieving sustainability goals were all rated positively. Participants appreciated the user-friendly interface of the platform and the collaborative nature of the sessions, which allowed for meaningful interaction and knowledge exchange. Most participants felt that the e-backcasting process led to tangible, actionable solutions for urban sustainability. This elevated level of satisfaction suggests that e-backcasting can be an effective and engaging tool for fostering participation in urban planning and generating practical outcomes, consistent with the findings of previous studies on the effectiveness of digital platforms in participatory processes [4].

5.4.1. Implications for Urban Sustainability in Abuja

The findings from this study demonstrate that e-backcasting has significant potential as a tool for participatory urban planning in Abuja. By improving participants' critical thinking, enhancing their understanding of sustainability concepts, and fostering collaborative engagement, e-backcasting enabled the development of actionable strategies that align with the city's unique sustainability needs. Given Abuja's rapid growth and its evolving socio-economic and environmental challenges, the ability to engage diverse stakeholders in the planning process is essential for ensuring that the city's development is sustainable and inclusive. The e-backcasting process provided a platform for stakeholders to come together, share knowledge, and co-create solutions for sustainability. This collaborative approach not only increased participants' ownership of the strategies developed but also ensured that the strategies were grounded in local knowledge and context. The focus on long-term goal setting, a hallmark of the e-backcasting process, is particularly valuable in addressing the long-term sustainability challenges faced by rapidly urbanizing cities like Abuja, as highlighted in prior studies on the utility of backcasting for urban sustainability [1].

5.4.2. Limitations and Future Research

While the findings of this study are promising, there are limitations that should be considered. The sample size of participants was small, and the study focused on a single geographical context—Abuja. Future research could explore the application of e-backcasting in other cities with different socio-economic and environmental conditions to assess the generalizability of these findings. Additionally, longitudinal studies could be conducted to track the long-term impact of e-backcasting on urban sustainability outcomes, including the implementation and effectiveness of the strategies developed. Furthermore, future studies could investigate the integration of e-backcasting with other participatory urban planning tools, such as community mapping or stakeholder workshops, to enhance the depth and breadth of the planning process. This would provide a more comprehensive approach to urban sustainability and enable planners to develop more robust and adaptable strategies.

6. Conclusion

The results of this study clearly demonstrate the effectiveness of e-backcasting in enhancing participants' critical thinking, understanding of sustainability concepts, and collaborative engagement. The participatory nature of e-backcasting, combined with the use of digital tools, facilitated meaningful discussions, social learning, and the development of concrete sustainability action plans. These findings underscore the potential of e-backcasting as a valuable tool for supporting sustainable urban development, particularly in rapidly urbanizing cities like Abuja.

In conclusion, this study highlights e-backcasting as a transformative tool for participatory urban planning. By improving critical thinking, enhancing understanding of sustainability concepts, fostering collaboration, and generating actionable strategies, e-backcasting plays a pivotal role in addressing the urban sustainability challenges faced by cities like Abuja. As urbanization accelerates globally, tools like e-backcasting will be essential to ensuring cities develop sustainably, inclusively, and resiliently. The positive feedback and high engagement levels observed in this study suggest that e-backcasting has the potential to be a valuable methodology for future urban planning initiatives, not only in Abuja but also in other cities worldwide.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed

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