Resolving the Conflict Between Development Planning and Environmental Management in Kenya

Kariuki Muigua

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Abstract

This paper examines countries' difficult balance between socio-economic growth and environmental protection for sustainability. Rapid economic expansion has increased urban populations, creating congested, dirty, and resource-depleted cities. Urbanisation strains housing, sanitation, education, transportation, clean air, and water, yet sustainable development attempts to fulfil present and future demands.

Environmental management—preserving natural resources, encouraging sustainability, and recognising social equality—is essential for balance. Sustainable Urban Development (SUD) reduces human impact on the environment. However, worldwide SUD deployment is still lacking. A holistic planning and development strategy that considers ecological variables and is more resilient may assist accomplish sustainable urban objectives. In the 21st century, environmental planning, development, and urban policy prioritize urban sustainability.

Digital technology may improve urban planning public involvement, with universities and businesses producing and distributing location-based platforms. These platforms may encourage public participation in project design and decision-making, consultation, citizen-professional engagement, and engaging interfaces. E-participation will evolve with technology, complementing traditional techniques and encouraging design and decision-making autonomy. Urban planning may reshape cities at multiple institutional levels utilising bottom-up and top-down participation. Countries may reconcile these opposing ideas and create a more connected and inspirational urban environment by adopting technology and promoting participatory urban development planning and environmental management.

1. Introduction

This paper critically discusses how countries like Kenya, experiencing rapid economic development, can strike a balance between the competing interests of socio-economic development and environmental conservation for sustainability. In recent years, there has been a significant increase in rural-urban migration worldwide.[1] This has resulted in

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densely populated, polluted, and resource-depleted urban areas in the 21st century.[2] The expansion of Kenya's urban population is a consequence of a change in the economic equilibrium between urban and rural regions, which is driven by shifting patterns of job demand and supply.[3] Urbanisation is powered by the presence of improved prospects, such as improved access to education, healthcare services, greater remuneration, entertainment options, and living conditions in urban areas.[4] It is projected that by 2050, more than 80% of the population would reside in urban areas.[5] The living circumstances of urban residents are contingent upon the planning and management of urbanisation,

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[1] Addanki, S.C. and Venkataraman, H. (2017) 'Greening the economy: A review of urban sustainability measures for developing new cities', *Sustainable Cities and Society*, 32, pp. 1–8. Available at: https://doi.org/10.1016/j.scs.2017.03.009.

[2] Ibid.; *The Impact of Urbanization On City Infrastructure* (no date) *FasterCapital*. Available at: https://fastercapital.com/keyword/the-impact-of-urbanization-on-city-infrastructure.html (Accessed: 1 June 2024); Iamtrakul, P.A.W.I.N.E.E., Klaylee, J.I.R.A.W.A.N. and Ruengratanaumporn, I.S.O.O.N., 2021. Participatory planning approach towards smart sustainable city development. *Proc. Int. Struct. Eng. Constr*, *8*(11); Peter, L.L. and Yang, Y. (2019) 'Urban planning historical review of master plans and the way towards a sustainable city: Dar es Salaam, Tanzania', *Frontiers of Architectural Research*, 8(3), pp. 359–377. Available at: https://doi.org/10.1016/j.foar.2019.01.008.

[3] Hope Sr, K.R., 2012. Urbanisation in Kenya. *African journal of economic and sustainable development*, *1*(1), pp.4-26.

[4] Ibid.; Myers, G., 2021. Urbanisation in the global south. *Urban ecology in the global south*, pp.27-49; Ngware, M. (2012) 'Urbanization and Education in East Africa'. Available at: https://www.academia.edu/33170784/Urbanization_and_Education_in_East_Africa (Accessed: 1 June 2024); Mendez, M. and Popkin, B. (2004) 'Globalization, Urbanization and Nutritional Change in the Developing World', *The Electronic Journal of Agricultural and Development Economics*, 1, pp. 220–241.

[5] Ibid.; *African cities will double in population by 2050. Here are 4 ways to make sure they thrive* (2018) *World Economic Forum*. Available at: https://www.weforum.org/agenda/2018/06/Africa-urbanization-cities-double-population-2050-4%20ways-thrive/ (Accessed: 1 June 2024); Nations, U. (no date) *Around 2.5 billion more people will be living in cities by 2050, projects new UN report*, *United Nations*. United Nations. Available at: https://www.un.org/en/desa/around-25-billion-more-people-will-be-living-cities-2050-projects-new-un-report (Accessed: 1 June 2024).

as well as the sourcing and processing of resources by cities.[6] Sustainable development seeks to satisfy current requirements while safeguarding the needs of future generations.[7] Nevertheless, urbanisation exerts pressure on the availability of vital services such as housing, sanitation, education, transportation, clean air, and water. [8]

The process of globalization and the intensification of production are driving urbanisation in several nations, possibly enhancing economic development and enhancing the well-being of citizens.[9] Nevertheless, this may also result in the depletion of resources and the emergence of environmental problems.[10] It is essential to assess the impact of urbanisation on sustainable economic development and find the necessary modifications and tools.[11] The preservation of natural resources, the promotion of environmental sustainability, and the consideration of social equality are all essential for maintaining a balanced state.[12] Since the 1970s, researchers have been aware of the

[6] Ibid.; Mbaluka, G., 2023. *Assessing Drivers and Effects of Peri-urban Development in Secondary Towns: A Case Study of Kitui Town in Kitui County, Kenya* (Doctoral dissertation, University of Nairobi); Khanani, R.S., Adugbila, E.J., Martinez, J.A. and Pfeffer, K., 2021. The impact of road infrastructure development projects on local communities in peri-urban areas: the case of Kisumu, Kenya and Accra, Ghana. *International journal of community well-being*, *4*(1), pp.33-53.

[7] Bolay, J.C., 2019. *Urban Planning Against Poverty: How to Think and Do Better Cities in the Global South* (Vol. 14). Springer Nature, p.25.

[8] Ibid.; *The Impact of Urbanization On City Infrastructure* (no date) *FasterCapital*. Available at: https://fastercapital.com/keyword/the-impact-of-urbanization-on-city-infrastructure.html (Accessed: 1 June 2024); Zhang, Z. *et al.* (2023) 'How does urbanization affect public health? New evidence from 175 countries worldwide', *Frontiers in Public Health*, 10, p. 1096964. Available at: https://doi.org/10.3389/fpubh.2022.1096964; *Climate change will strain Africa's already congested cities* (no date) *ISS Africa*. Available at: https://issafrica.org/iss-today/climate-change-will-strain-africas-already-congested-cities (Accessed: 1 June 2024).

[9] Kwilinski, A., Lyulyov, O. and Pimonenko, T., 2023. The effects of urbanisation on green growth within sustainable development goals. *Land*, *12*(2), p.511.

[10] Ibid.

[11] Ibid.

[12] Bolay, J.C., 2019. *Urban Planning Against Poverty: How to Think and Do Better Cities in the Global South* (Vol. 14). Springer Nature, p.26.

discrepancy between our economy, which relies on non-renewable resources, and the growing worldwide poverty.[13]

Environmental management encompasses policies and practices aimed at preserving the environment, distributing and using natural resources in a sustainable and ethical manner, strengthening the connections between society and the environment, and enhancing human welfare for both the current and future generations.[14] The idea of Sustainable Urban Development, or SUD, has become more well-known as the globe struggles to deal with the effects of urbanisation, climate change, and contemporary lifestyles.[15] SUD is viewed as a way to reduce the negative effects that broad human activity has on the environment. [16]

It is believed that SUD enhances a city's ecological, cultural, political, institutional, social, and economic aspects of quality of life.[17] It offers a chance to create new systems for creating a desirable urban future without burdening present and future generations with things like depleted natural capital and excessive local debt.[18]

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[13] Ibid, p.2.6

[14] Sopiana, Y. and Harahap, M.A.K., 2023. Sustainable Urban Planning: A Holistic Approach to Balancing Environmental Conservation, Economic Development, and Social Well-being. *West Science Interdisciplinary Studies*, *1*(02), pp.43-53.

[15] Yigitcanlar, T. and Teriman, S., 2015. Rethinking sustainable urban development: towards an integrated planning and development process. *Int. J. Environ. Sci. Technol*, *12*, pp.341-352; *Toward the sustainable development of urban areas: An overview of global trends in trials and policies | Request PDF* (no date). Available at: https://www.researchgate.net/publication/278743782_Toward_the_sustainable_development_of_urban_areas_An_overview_of_global_trends_in_trials_and_policies (Accessed: 2 June 2024).

[16] Ibid.

[17] Ibid.

[18] Ibid.

2. Sustainability, Development Planning and Environmental Management

The notion of sustainable development is multifaceted, including economics, environment, and ethics. It encompasses the sustainability of social and economic systems in addition to the environment and resource systems.[19] All living things require their surroundings to survive, therefore preservation of the environment is essential to life as we know it. Human values are specific to each individual, but environmental ethics outline man's moral and ethical responsibility towards the environment.[20] The environment and human existence are impacted by technological advancement, which has advantages and disadvantages. As ethical concerns surface, it is critical to comprehend how humans either mitigate or exacerbate environmental degradation in order to achieve sustainable development.[21]

Due to human actions that have an impact on the environment globally, the relationship between humans and the environment is confronting problems in the modern world. The notion of sustainable development is multifaceted, including economics, environment, and ethics.[22] Modern methods of exploiting nature have led to an increase in demand for

[19] Trehan, A. and Trehan, R., 2019. Environmental Sustainability in Perspective of Human Values. *International Journal of Research in Social Sciences*, *9*(2), p.1.

[20] Ibid.

[21] Bisong, P. and Apologun, S. (2020) 'Technology Can Save the Environment', *International Journal of Humanities, Management and Social Science*, 3, pp. 11–19. Available at: https://doi.org/10.36079/lamintang.ij-humass-0301.108; luciaclemares (2024) *Technology and the environment: a battle between harm and benefit*, *Telefónica*. Available at: https://www.telefonica.com/en/communication-room/blog/technology-environment-a-battle-between-harm-benefit/ (Accessed: 2 June 2024).

[22] *Globalisation and sustainable development* (no date). Available at: https://assembly.coe.int/nw/xml/XRef/X2H-Xref-ViewHTML.asp?FileID=9961 (Accessed: 2 June 2024); *The 3 pillars of sustainability: environmental, social and economic* (2023). Available at: https://www.enel.com/company/stories/articles/2023/06/three-pillars-sustainability (Accessed: 2 June 2024).

energy and the environment; thus, in order to achieve sustainable development, nature must be protected.[23]

Our perspective on the world influences the way we interact with it, and the rising recognition of the mutually reinforcing nature of environmental impact and socio-economic growth underscores the necessity of fortifying current development initiatives.[24]

The ecosystem is under a lot of strain due to the expanding population and excessive use of natural resources. By progressively altering their ways of development, individuals are encouraged to conserve and increase natural resources through sustainable development, which strives for development without having a harmful influence on the environment.[25] An integrated strategy that leverages both the desire to shift public perception and conventional knowledge is necessary for sustainable development. People that care about environmental concerns and sustainable development should be informed, devoted, and proactive.[26]

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[23] *Rationality and the exploitation of natural resources: a psychobiological conceptual model for sustainability | Environment, Development and Sustainability* (no date). Available at: https://link.springer.com/article/10.1007/s10668-024-04470-3 (Accessed: 2 June 2024); Mihajlović, S.R. and Đorđević, N.G., 2022. Sustainable Development and Natural Resources Exploitation. *Podzemni Radovi*, (40), Pp.45-52.

[24] *The Sustainable Use of Natural Resources: The Governance Challenge* (no date) *International Institute for Sustainable Development*. Available at: https://www.iisd.org/articles/deep-dive/sustainable-use-natural-resources-governance-challenge (Accessed: 2 June 2024).

[25] *The Sustainable Use of Natural Resources: The Governance Challenge | International Institute for Sustainable Development* (no date). Available at: https://www.iisd.org/articles/deep-dive/sustainable-use-natural-resources-governance-challenge (Accessed: 2 June 2024);

[26] Hariram, N.P., Mekha, K.B., Suganthan, V. and Sudhakar, K., 2023. Sustainalism: An integrated socio-economic-environmental model to address sustainable development and sustainability. *Sustainability*, *15*(13), p.10682; Maja, M.M. and Ayano, S.F., 2021. The impact of population growth on natural resources

A comprehensive strategy is necessary to address the complicated and varied issue of sustainable urban development.[27] Urban extension has led to patterns of urban growth that are not sustainable from an environmental, social, or economic standpoint.[28] Population growth-related urban expansion has an adverse effect on environmental services including carbon sequestration and biodiversity support. Understanding the needs and requirements of various groups and people is crucial, particularly in situations when moral or political considerations are involved.[29]

It is necessary to investigate the emerging and significant problem of sustainable urban development, which considers the natural environment and quality of life in addition to its economic and social advantages.[30] An essential aspect of urban planning reform is the thorough reassessment of environmental, economic, and social factors. By incorporating interests into a long-term vision and coordinating activities, we may guarantee that economic interests and social concerns align with the protection of the environment.[31]

3. Development Planning and Environmental Management in Kenya

The Kenya Vision 2030 is a comprehensive and ambitious development strategy that seeks to establish a highly competitive, wealthy, and high-quality society on a global scale

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and farmers' capacity to adapt to climate change in low-income countries. *Earth Systems and Environment*, *5*(2), pp.271-283; Mondal, S. and Palit, D., 2022. Challenges in natural resource management for ecological sustainability. In *Natural Resources Conservation and Advances for Sustainability* (pp. 29-59). Elsevier.

[27] Sopiana, Y. and Harahap, M.A.K., 2023. Sustainable Urban Planning: A Holistic Approach to Balancing Environmental Conservation, Economic Development, and Social Well-being. *West Science Interdisciplinary Studies*, *1*(02), pp.43-53.

[28] Ibid.

[29] Ibid.

[30] Ibid.

[31] Bolay, J.C., 2019. *Urban Planning Against Poverty: How to Think and Do Better Cities in the Global South* (Vol. 14). Springer Nature, p.27.

by the year 2030.[32] The objective is to convert Kenya into a newly industrialised nation with a middle-income status, ensuring a clean and safe environment for its population.[33] Kenya's Vision 2030 goal is to make the country sustainable, safe, and clean by the year 2030.[34] Kenya's long-term national development plan, which is built around the economic, social, and political pillars, is to transform the nation into a middle-income one where every citizen enjoys a good standard of living.[35] The Vision 2030's first phase, which ran from 2008 to 2012, saw the implementation of many "flagship" projects. The goal of Vision 2030's first phase is to sustain 10% annual economic growth for the following 25 years.[36] The vision also highlights how crucial it is to preserve the natural environment since human well-being is dependent on environmental sustainability, which includes biodiversity protection. Basic necessities, cleaner air and water, healthy soils, nutrient cycling, and temperature regulation are all provided by nature.[37] The vision also highlights how development goals can only be realised with preparation for climate-related calamities.

Promoting environmental conservation, enhancing waste and pollution control, and forming public-private partnerships to enhance the delivery of water and sanitation are some strategies for accomplishing these objectives.[38] Though they only make up 3% of

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[32] 'Kenya Vision 2030 – State Department for Economic Planning' (no date). Available at: https://www.planning.go.ke/kenya-vision-2030/ (Accessed: 1 June 2024).

[33] Ibid.

[34] Nyangena, W., 2012. The Kenya Vision 2030 and the Environment: issues and challenges. *Environment for Development (EfD-Kenya)*, pp.45-56; 'Kenya Vision 2030 – State Department for Economic Planning' (no date). Available at: https://www.planning.go.ke/kenya-vision-2030/ (Accessed: 1 June 2024).

[35] United Nations Environmental Programme, "Chapter 1: Environment and Vision 2030", available at https://na.unep.net/atlas/kenya/downloads/chapters/Kenya_Screen_Chapter1.pdf[Accessed 25 May 2024].

[36] Ibid.

[37] Ibid.

[38] *Water and sanitation: Sustainable Development Knowledge Platform* (no date). Available at: https://sustainabledevelopment.un.org/topics/water/decisions (Accessed: 1 June 2024).

Kenya's geographical area, fountains are vital to the country's citizens' daily needs and economy. They also function as important cultural centres and habitats for animals.[39]

The interaction between humans and the environment is becoming more difficult in the modern world since human activity is changing the environment on a global scale.[40] Ecological, economic, and ethical considerations are all part of the multifaceted idea of sustainable development.[41] For this to happen, the social and economic systems as well as the environment and resource systems must all be sustainable. In the process of exploiting environmental resources, human beings are jeopardising their own future by undermining its sacredness and purity for financial gain. Life on Earth would not be feasible without environmental protection.[42]

Kenya is urbanising rapidly without a blueprint for the ideal urban structure and shape. Wild urbanisation is resulting from unregulated urban growth. Urban form directly effects habitat, ecosystems, and water quality, causing the extinction of numerous endangered species and greenhouse gas emissions that worsen climate change, water quality, and human health.[43] Massive developments on sensitive and vulnerable places including wetlands, riparian reserves, and hill tops show that Kenya still has environmental issues despite many laws and regulations.[44] Flooding and surface runoff

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[39] Soja, E.W., 1968. *The geography of modernization in Kenya*. Syracuse University Press; Peltorinne, P., 2004. The forest types of Kenya. *Expedition reports of the Department of Geography, University of Helsinki*, *40*, pp.8-13.

[40] El Chalfoun, F., 2018. Is environmental sustainability a case of failure of policy implementation? *Journal of advanced research in social sciences and humanities.*, *3*(6), pp.229-235.

[41] Ibid.

[42] Ibid.

[43] Ngetich, J.K., Opata, G.P. and Mulongo, L.S., 2014. Urban environmental planning and development control of medium sized towns in Kenya. A case of Eldoret Municipality. *Journal of Emerging Trends in Economics and Management Sciences*, *5*(3), p.351.

[44] Ibid.

may result from authorized constructions and paved surfaces blocking natural water drains.[45]

Kenya's fast urbanisation requires strong urban development control tools and techniques to solve environmental challenges. There is a need for strong enforcement and adherence to Physical and Land Use Planning Act, 2019[46] which was enacted to make provision for the planning, use, regulation and development of land and for connected purposes[47]; National Spatial Plan 2015-2045, which, by identifying the key sites of the flagship projects outlined in Kenya Vision 2030 and offering a framework for mitigating their spatial implications, the Spatial Plan facilitates the implementation of important national projects[48]. Article 69 of the Constitution of Kenya 2010 outlines the obligations of the State in respect of the environment as including, to: ensure sustainable exploitation, utilisation, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits; work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya; protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities; encourage public participation in the management, protection and conservation of the environment; protect genetic resources and biological diversity; establish systems of environmental impact assessment, environmental audit and monitoring of the environment; eliminate processes and activities that are likely to

[45] Ibid.
[46] Physical and Land Use Planning Act, No. 13 of 2019, Laws of Kenya.
[47] Ibid., preamble.
[48] 'Kenya National Spatial Plan (2015 – 2045) | Kenya Vision 2030' (no date), Government of Kenya, First published in 2016. Available at: https://vision2030.go.ke/publication/kenya-national-spatial-plan-2015-2045/ (Accessed: 4 May 2024).

endanger the environment; and utilise the environment and natural resources for the benefit of the people of Kenya.[49]

Also relevant is the Fourth Schedule to the Constitution of Kenya 2010 on Distribution of Functions Between the National Government and the County Governments which provides for the functions of the National Government as including: protection of the environment and natural resources with a view to establishing a durable and sustainable system of development, including, in particular—fishing, hunting and gathering; protection of animals and wildlife; water protection, securing sufficient residual water, hydraulic engineering and the safety of dams; and energy policy; and agricultural policy.[50]

The functions and powers of the county governments are—Agriculture, including—crop and animal husbandry; livestock sale yards; county abattoirs; plant and animal disease control; and fisheries; County planning and development, including—statistics; land survey and mapping; and boundaries and fencing; Implementation of specific national government policies on natural resources and environmental conservation, including—soil and water conservation; and forestry; and ensuring and coordinating the participation of communities and locations in governance at the local level and assisting communities and locations to develop the administrative capacity for the effective exercise of the functions and powers and participation in governance at the local level.[51]

More effective enforcement of Environmental Management and Coordination Act (EMCA) 1999[52] and related regulations is also important in streamlining issues of

[49] Article 69 (1), Constitution of Kenya 2010.
[50] Constitution of Kenya, 2010, Fourth Schedule, Part One.
[51] Constitution of Kenya, Fourth Schedule, Part Two.
[52] Environmental Management and Co-ordination Act, No. 8 of 1999, Laws of Kenya, Revised Edition 2019 [1999].

development planning and environmental management for sustainability. The *Environmental Management Coordination Act (EMCA)*[53] envisages environmental impact assessments (EIA). Indeed, various requirements relating to the implementation of environmental impact assessments (EIA), strategic environmental assessments (SEA), environmental audits (EA), and management activities for air, water, wastes, and noise are included in the EMCA.

4. Reconciling Development Planning with Environmental Management for Sustainability

The implementation of environmental legislation has become essential in tackling the planet's urgent sustainability issues, including pollution, biodiversity loss, and climate change.[54] Ensuring the welfare of present and future generations, these laws seek to achieve a balance between environmental preservation and economic growth as part of a common commitment to a sustainable future.[55]

The goals of sustainable development include resource conservation and the wise use of natural resources. The increasing recognition of the reciprocal link between environmental impact and socio-economic development underscores the necessity of fortifying current development initiatives to tackle issues at both their root cause and their effect.[56]

Sustainable development gradually modifies development strategies to encourage people to protect and improve natural resources.[57] To realise it, an integrated strategy

[53] Environmental Management Coordination Act, No. 8 of 1999, Laws of Kenya.
[54] Islam, M., Wattoo, O. M., & Saleem, S. (2023). Environmental Regulations and their Implications for Global Sustainability. *Pakistan Journal of Humanities and Social Sciences*, *11*(3), 3801–3809. https://doi.org/10.52131/pjhss.2023.1103.0665.
[55] Ibid.
[56] El Chalfoun, F., 2018. Is environmental sustainability a case of failure of policy implementation? *Journal of advanced research in social sciences and humanities.*, *3*(6), pp.229-235.
[57] Ibid.

that makes use of conventional wisdom and a willingness to shift perceptions is needed.[58] When it comes to environmental and sustainable development concerns, people ought to be informed, devoted, and proactive. All countries on our world are concerned about environmental sustainability.[59]

Brundtland's definition of environmental sustainability requires planners to strike a balance between economic development and sustainability.[60] This calls for striking a balance between social and ecological sustainability and growth and development. These two imperatives clash, making it necessary to decide which alternatives for economic development to pursue and how those options could affect sustainability.[61] The possible effects on future generations must be carefully considered.

4.1. Use of Technology in Planning and Environmental Protection

The planning and construction of cities is being revolutionized by technology, which is making the process simpler and more effective than ever. Technological advancements such as generative AI, augmented reality, blockchain, and computer-aided design (CAD) software are accelerating, streamlining, and improving the sustainability of the urban planning process.[62] For many years, CAD software has been used to produce precise and in-depth designs for infrastructure and new development projects.[63] Planners may

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[58] Ibid.

[59] Ibid.

[60] Barnard, S. and Elliott, M., 2015. The 10-tenets of adaptive management and sustainability: An holistic framework for understanding and managing the socio-ecological system. *Environmental Science & Policy*, *51*, pp.181-191.

[61] Ibid.

[62] *The Use of Technology in Modern Urban Planning: Revolutionizing the Way Cities are Built | Maket* (no date). Available at: https://www.maket.ai/post/the-use-of-technology-in-modern-urban-planning-revolutionizing-the-way-cities-are-built (Accessed: 26 May 2024).

[63] *The Use of Technology in Modern Urban Planning: Revolutionizing the Way Cities are Built | Maket* (no date). Available at: https://www.maket.ai/post/the-use-of-technology-in-modern-urban-planning-revolutionizing-the-way-cities-are-built (Accessed: 26 May 2024).

quickly and simply make design adjustments and construct 3D models of prospective projects to see them from various viewpoints. This has aided in expediting the planning phase and guaranteeing the greatest calibre of construction for projects.[64]

The use of digital technology in urban administration and planning has gained popularity within the past ten years.[65] This is because of advances in technology as well as a worldwide political, social, and economic drive to create concepts and implementations for smart cities.[66] The paradigms of urban informatics, analytics, and city science are also growing, which has led to new programmes being offered by higher education institutions to teach the next generation of urban planners who possess these skills.[67] Digital technology advancements such as cloud computing, high-performance, optimised computer systems, and customised sensor manufacture have made it possible for agencies to gather, store, and analyse unprecedented volumes of high-resolution data.[68]

The creation of cities that support biodiversity and promote human well-being are intimately connected. Urbanisation is directly related to the future of biodiversity and is a major cause of environmental change.[69] Urban development issues including excessive resource use, rising pollution, a rise in urban illnesses, extreme weather occurrences, and a persistent decline in the quality of the living environment have been brought on by

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[64] *The Use of Technology in Modern Urban Planning: Revolutionizing the Way Cities are Built | Maket* (no date). Available at: https://www.maket.ai/post/the-use-of-technology-in-modern-urban-planning-revolutionizing-the-way-cities-are-built (Accessed: 26 May 2024).

[65] Sabri, S. and Witte, P. (2023) 'Digital technologies in urban planning and urban management', *Journal of Urban Management*, 12(1), pp. 1–3. Available at: https://doi.org/10.1016/j.jum.2023.02.003.

[66] Ibid.

[67] Ibid.

[68] Ibid.

[69] Sopiana, Y. and Harahap, M.A.K., 2023. Sustainable Urban Planning: A Holistic Approach to Balancing Environmental Conservation, Economic Development, and Social Well-being. *West Science Interdisciplinary Studies*, *1*(02), pp.43-53.

rapid urbanisation.[70] Effective solutions for outstanding issues in the process of rapid urban development and sustainable development can be found by analysing the fundamental theory and transformation of urban design, talking about new urban design concepts, technologies, and methods, and scientifically identifying the opportunities and challenges of urban design development.[71]

Technology is essential for fostering sustainable urbanisation since it increases the effectiveness of urban services, uses less energy, and enhances the quality of life for inhabitants. Green artificial intelligence (AI), smart city technology, and innovative ideas, tools, and techniques in urban planning may all assist sustainable development while addressing the problems associated with fast urbanisation.[72]

The preservation of biodiversity and sustainable urban development are directly related to each other as well as to human welfare. Urban biodiversity provides a range of regulatory, provisional, and cultural ecosystem services, and study findings can help guide the development of sustainable cities by promoting the adoption of urban conservation strategies.[73]

Although technology is frequently hailed as the solution to every sustainability issue, the availability of technological solutions should not be the only factor considered when formulating solutions.[74] Technology applications are commonly used in SUD planning, however SUD has to be rethought. It is undeniable that the environment has to be protected from the severe ecological damage caused by unchecked economic expansion and conspicuous consumerism, and SUD is thought to be the primary means of doing

[70] Ibid.
[71] Ibid.
[72] Ibid.
[73] Ibid.
[74] Permana, C.T. and Harsanto, B., 2020. Sustainable city planning concepts and practices in emerging economies: A systematic review. *The Journal of Indonesia Sustainable Development Planning*, *1*(1), pp.67-82.

this.[75] Nevertheless, the creation of sustainable cities and the application of SUD at large city sizes remain unrealized. This necessitates reevaluating the mechanisms—such as urban planning and development processes—involved in the implementation of SUD.[76]

According to recent research, digital technology could play a bigger part in urban planning and administration than only automating repetitive tasks that benefit infrastructure, buildings, and people.[77] Rather, these technologies ought to establish a cooperative and integrative ecosystem that supports a network and a constant flow of information for the purpose of planning for fairness, environmental sustainability, efficiency, and quality of place and living in urban areas. [78]Adopting new technologies, such as Digital Twins, AI, ML, and IoT, is seen by many governments, businesses, and academic institutions throughout the world as a way to enhance the quality of public services, as well as the well-being and standard of living of communities.[79] It is unknown, nonetheless, which planning procedures may be impacted and what the advantages, hazards, and consequences of implementing such technology are.[80]

Contextualizing smart city technology across jurisdictions is crucial, according to some experts, as the use of digital technologies in urban planning and administration is expanding quickly.[81] Advocates for smart cities and planners should take into account the importance of context while addressing urban problems with the use of digital technology.[82] The comparison of three smart city initiatives in China, Singapore, and the

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[75] Ibid.
[76] Ibid.
[77] Sabri, S. and Witte, P. (2023) 'Digital technologies in urban planning and urban management', *Journal of Urban Management*, 12(1), pp. 1–3. Available at: https://doi.org/10.1016/j.jum.2023.02.003.

[78] Ibid.
[79] Ibid.
[80] Ibid.
[81] Ibid.
[82] Ibid.

Netherlands led to the conclusion that the scope and variety of digital technology application domains are contingent upon the differences in sociotechnical and political environments.[83] The socio-spatial framework in which smart city plans are anchored and the technology itself must be closely connected for the strategies to be successful.[84]

Technology can also be used in environmental protection which would make it easy to not only eliminate any conflict with physical planning but also track any subsequent changes that may arise. Among the areas of activities that require digitization is environmental protection. Environmental safety management tasks should be included in this process, in addition to gathering, evaluating, and communicating environmental data to the general public, the populace, and users of the environment.[85]

In the early 1990s, environmental protection structures and related business processes in Russia started to be automated.[86] The most preferred programmes were those that automated specific tasks, like counting environmental impact fees, inventorying impact sources, and primary accounting for waste management, water resources, and air protection.[87] The market for environmental automation has shown several programme increases during the previous 20 years, and this growth is still expected, as the qualitative approach to automation shifts from single-process to complex.[88] Three categories now

[83] Ibid.

[84] Ibid.

[85] Kalymbek, B., Yerkinbayeva, L., Bekisheva, S. and Saipinov, D., 2021. The Effect of Digitalization on Environmental Safety. *Journal of Environmental Management & Tourism*, *12*(5), pp.1299-1306.

[86] Nasyrova, L.A., Akchurina, L.R. and Valiakhmetova, J.A., 2024. Digital technologies in environmental protection and rational use of natural resources. In *E3S Web of Conferences* (Vol. 486, p. 04022). EDP Sciences.

[87] Ibid.

[88] Ibid.; Bekezhanov, D., Kopbassarova, G., Rzabay, A., Kozhantayeva, Z., Nessipbayeva, I. and Aktymbayev, K., 2021. Environmental and legal regulation of digitalization of environmental protection. *Journal of Environmental Management and Tourism*, *12*(7), pp.1941-1950.

make up the environmental protection software market: self-written, highly specialized, and ERP systems.[89]

Ecologists can use software that falls into multiple categories: information and legal systems; data processing and reporting of chemical-analytical environmental control laboratories; methods for calculating the impact on the environment; and software systems for territorial environmental services.[90]

Effective management is always necessary to protect the environment, promote energy conservation, and ensure the sustainable development of territory.[91] Through digital innovation, citizens may get more involved, learn how to volunteer for the environment, increase their environmental literacy, gather more environmental data, and enhance governance.[92] For the purpose of protecting water resources, it is imperative to establish hybrid environmental supervision systems that can remotely monitor land use, deforestation, air and water quality, and the identification of instances of illegal construction and building code violations.[93]

[89] Ibid.

[90] Ibid.; see also Kalymbek, B., Yerkinbayeva, L., Bekisheva, S. and Saipinov, D., 2021. The effect of digitalization on environmental safety. *Journal of Environmental Management & Tourism*, *12*(5), pp.1299-1306.

[91] Balabanova, A., Keschyan, N., Borisova, T. and Hachemizova, E., 2021. Using digital platforms for environmental management. In *E3S Web of Conferences* (Vol. 244, p. 07006). EDP Sciences.

[92] Ibid.; See also Vaslavskaya, I. *et al.* (2023) 'Achieving the principles of sustainable development: Implementation of smart solutions in the infrastructure of modern megacities', *E3S Web of Conferences*, 449, p. 05001. Available at: https://doi.org/10.1051/e3sconf/202344905001.

[93] Balabanova, A., Keschyan, N., Borisova, T. and Hachemizova, E., 2021. Using digital platforms for environmental management. In *E3S Web of Conferences* (Vol. 244, p. 07006). EDP Sciences.

4.2. Participatory Approaches to Urban Development Planning and Environmental Planning and Management

Participation is often associated with the concept of democracy and has a multidisciplinary, inclusive nature.[94] The concept of participation has not been central to the nature of many countries' planning systems including Kenya; institutionally, they have been centralized and top-down and lacking local effective participation and communication between all actors.[95] The dynamic and adaptable nature of participatory research and development techniques is what distinguishes them from other methods. These approaches make it possible to gather information on the situation of local people as well as their means of subsistence.[96] Participatory techniques are becoming more often used in many social and ecological settings, influencing research and development programmes and policies worldwide.[97] Traditionally linked to the development of rural areas and primary healthcare initiatives, there is now an increasing amount of knowledge and expertise in using these methods in urban environments.[98]

For the purpose of urban development planning, the Environmental Planning and Management (EPM) process need to be considered a participatory approach rather than a technocratic one.[99] Urban planning and design often use a top-down methodology,

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[94] Türken, A. and Eyuboglu, E. (2020) 'E-participatory Approaches in Urban Design', *Journal of Contemporary Urban Affairs*, 5. Available at: https://doi.org/10.25034/ijcua.2021.v5n2-2.

[95] Wang, X. *et al.* (2008) 'Enhancing participation: Experiences of participatory geographic information systems in Shanxi province, China', *Applied Geography*, 28(2), pp. 96–109. Available at: https://doi.org/10.1016/j.apgeog.2007.07.007.

[96] Mitlin, D. and Thompson, J., 1995. Participatory approaches in urban areas: strengthening civil society or reinforcing the status quo? *Environment and urbanization*, *7*(1), pp.231-250.

[97] Ibid.

[98] Ibid.

[99] Halla, F. and Majani, B., 1999. The environmental planning and management process and the conflict over outputs in Dar-Es-Salaam. *Habitat international*, *23*(3), pp.339-350.

whereby planners, acting as authorities, give recommendations to decision-makers.[100] This results in conflicts on the allocation of urban space, preservation of the environment, concerns of residents, working conditions, economic growth, and the establishment of urban identities among those involved.[101] This is despite the fact that urban regions exhibit a wide range of ecosystems and institutional hierarchies, which often leads to conflicts in the process of planning and designing.[102] In order to tackle this issue, it is advisable to use a multi-scale strategy that integrates both bottom-up and top-down methods of engagement.[103] This method seeks to align diverse perspectives and meet the requirements of many stakeholders, therefore creating a well-coordinated and effective urban environment.[104]

From the later part of the 20th century forward, participatory planning and design processes have become more popular and have begun to substitute top-down approaches.[105] Active involvement of citizens is essential in the administration of a city, but, its efficacy is impeded by several hurdles and bureaucratic impediments.[106] Some

[100] Semeraro, T., Zaccarelli, N., Lara, A., Sergi Cucinelli, F. and Aretano, R., 2020. A bottom-up and top-down participatory approach to planning and designing local urban development: Evidence from an urban university center. *Land*, *9*(4), p.98.

[101] Ibid.

[102] Semeraro, T., Zaccarelli, N., Lara, A., Sergi Cucinelli, F. and Aretano, R., 2020. A bottom-up and top-down participatory approach to planning and designing local urban development: Evidence from an urban university center. *Land*, *9*(4), p.98.

[103] Ibid.

[104] Ibid.

[105] Türken, A. and Eyuboglu, E. (2020) 'E-participatory Approaches in Urban Design', *Journal of Contemporary Urban Affairs*, 5. Available at: https://doi.org/10.25034/ijcua.2021.v5n2-2.

[106] Calogero, A., Flores, P., Biscan, B. and Jarrot, S., 2017. A participatory approach to urban planning in slum neighbourhoods of the metropolitan area of Port-au-Prince. *Summary Report. Urban Crises Learning Partnership (UCLP)*.

scholars have found that it is often used for its symbolic significance in democracy rather than for its substantial impact on decision-making.[107]

Planning that incorporates public engagement in literature has undergone different techniques throughout the 20th century, although these strategies have often been characterized by time-consuming and laborious discussions.[108] By incorporating digital technology into participatory processes, it is possible to engage with a wide range of people and allow them to participate at their own convenience, regardless of location.[109] The growing popularity of e-participation may be attributed to many factors, including its ability to reach a wide audience, its flexibility in terms of time and location, its cost-effectiveness, and its support for the involvement of younger demographics in decision-making processes related to urban spaces.[110] The participatory criteria include factors such as the flow of information, the extent of involvement, the techniques used for participation, the key individuals or groups involved, the driving forces behind participation, the provision of feedback and the direction of communication, the technological attributes, and the data generated.[111] Weaknesses associated with e-participation include the laborious and expensive construction of platforms and apps, along with the need for proficient assistance in adapting to new initiatives.[112] The opportunities include aspects like as accessibility and comprehensibility, deliberate

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[107] Ibid.

[108] Türken, A. and Eyuboglu, E. (2020) 'E-participatory Approaches in Urban Design', *Journal of Contemporary Urban Affairs*, 5. Available at: https://doi.org/10.25034/ijcua.2021.v5n2-2.

[109] Ibid.; Haleem, A., Javaid, M., Qadri, M.A. and Suman, R., 2022. Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, *3*, pp.275-285.

[110] Ibid.

[111] Ibid.; *Participatory Development Communication* (no date). Available at: https://idrc-crdi.ca/sites/default/files/openebooks/306-2/index.html (Accessed: 2 June 2024).

[112] Türken, A. and Eyuboglu, E. (2020) 'E-participatory Approaches in Urban Design', *Journal of Contemporary Urban Affairs*, 5. Available at: https://doi.org/10.25034/ijcua.2021.v5n2-2.

interface design, extensive involvement, feedback mechanisms, and open-source functionalities that enhance the appeal of local authorities and planning agencies.[113]

Participation has played a vital role in sustainable city ideas since the 1970s, with the aim of achieving sustainable development objectives via the implementation of diverse urban concepts such as smart cities, digital cities, and responsive cities.[114] Smart cities are comprised of six fundamental elements: smart economics, smart government, smart citizenry, smart transportation, smart environment, and smart lifestyle.[115] The governance of smart cities encompasses several elements such as participatory decision-making, provision of public and social services, transparent government, political strategies, and different opinions.[116]

Participation may be done via several methods such as submitting applications, engaging in discussion forums, using online mapping tools, completing surveys, participating in e-voting, taking part in interviews, attending meetings, and contributing location-based

[113] Ibid.

[114] Ibid.; Anthony Jnr, B. (2023) 'The Role of Community Engagement in Urban Innovation Towards the Co-Creation of Smart Sustainable Cities', *Journal of the Knowledge Economy* [Preprint]. Available at: https://doi.org/10.1007/s13132-023-01176-1.

[115] Ibid.; Hassan, R., Smart Cities–The Road Towards Sustainable Growth. *Smart Cities in India: The Road Ahead*, p.24.

[116] Ibid.; Anand, P. and Navio-Marco, J. (2018) 'Governance and economics of smart cities: opportunities and challenges', *Telecommunications Policy*, 42. Available at: https://doi.org/10.1016/j.telpol.2018.10.001; Viale Pereira, G. *et al.* (2017) 'Increasing collaboration and participation in smart city governance: a cross-case analysis of smart city initiatives', *Information Technology for Development*, 23(3), pp. 526–553. Available at: https://doi.org/10.1080/02681102.2017.1353946; Gohari, S. *et al.* (2020) 'The Governance Approach of Smart City Initiatives. Evidence from Trondheim, Bergen, and Bodø', *Infrastructures*, 5(4), p. 31. Available at: https://doi.org/10.3390/infrastructures5040031; Bednarska-Olejniczak, D., Olejniczak, J. and Svobodová, L. (2019) 'Towards a Smart and Sustainable City with the Involvement of Public Participation—The Case of Wroclaw', *Sustainability*, 11(2), p. 332. Available at: https://doi.org/10.3390/su11020332.

information to projects in development.[117] The generated data comprises maps, project photos, information, notifications, and 3D project models. Citizens may provide feedback about urban issues, including reporting problems, making comments, or participating in decision-making processes for project development.[118]

Urban planning should integrate both bottom-up and institutional methods, including active involvement of stakeholders and strategic spatial planning at various urban scales.[119] Public engagement facilitates an understanding of stakeholders' needs and motivates them to provide ideas rooted on their expertise, perspectives, and behaviours.[120] Urban design is improved by this activity, which increases the capacity to make well-informed planning decisions and raises awareness of their significance in urban growth.[121] The participatory approach requires equal knowledge across all stakeholders, empowering the local people to develop their role, establishing meaningful engagement, and fostering accountability to the community.[122] Training is an essential component of citizen engagement mechanisms to facilitate the development of political and social capacities, together with technical abilities, in order to provide knowledge that is comprehensible and easily available to the whole populace.[123] This, thus requires the

[117] Türken, A. and Eyuboglu, E. (2020) 'E-participatory Approaches in Urban Design', *Journal of Contemporary Urban Affairs*, 5. Available at: https://doi.org/10.25034/ijcua.2021.v5n2-2.

[118] Ibid.

[119] Semeraro, T., Zaccarelli, N., Lara, A., Sergi Cucinelli, F. and Aretano, R., 2020. A bottom-up and top-down participatory approach to planning and designing local urban development: Evidence from an urban university center. *Land*, *9*(4), p.98.

[120] Ibid.

[121] Ibid.

[122] Mitlin, D. and Thompson, J., 1995. Participatory approaches in urban areas: strengthening civil society or reinforcing the status quo? *Environment and urbanization*, *7*(1), pp.231-250.

[123] Ibid.

need of clearly defining the methods, techniques, and goals of involvement to appropriately establish expectations and the extent of impact on decision-making.[124]

5. Conclusion

The implementation of a comprehensive planning and development methodology can provide substantial advancements in the realisation of sustainable urban agendas.[125] Cities may better meet the difficulties posed by climate change, rising urbanisation, and modern urban lifestyles by taking ecological factors into account and adopting a more effective and resilient planning and development perspective.[126] In the twenty-first century, choices on environmental planning, development, and urban policy now heavily consider urban sustainability.[127] Sustainable Urban Development (SUD) has to be reconsidered as society grows increasingly conscious of the effects of careless urban planning decisions.[128]

Public engagement in urban planning can be progressively enhanced via the use of digital technology.[129] Government agencies, universities and the commercial sector can take on prominent roles in the creation and dissemination of location-based platforms.[130] Key features of digital participation platforms can encompass citizen engagement and community involvement, facilitating citizen input in project design and decision-making, offering consultation processes, fostering interaction between citizens and professionals,

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[124] Ibid.

[125] Permana, C.T. and Harsanto, B., 2020. Sustainable city planning concepts and practices in emerging economies: A systematic review. *The Journal of Indonesia Sustainable Development Planning*, *1*(1), pp.67-82.

[126] Ibid.

[127] Ibid.

[128] Ibid.

[129] Türken, A. and Eyuboglu, E. (2020) 'E-participatory Approaches in Urban Design', *Journal of Contemporary Urban Affairs*, 5. Available at: https://doi.org/10.25034/ijcua.2021.v5n2-2.

[130] Ibid.

and incorporating engaging interfaces to encourage participation.[131] E-participation procedures will progress with advancing technology, while also complementing conventional participation methods. Promoting autonomy in design and decision-making processes and empowering individuals will enhance the democratic nature of e-participation.[132]

Urban planning has the ability to change urban areas at many levels of institutions by using both bottom-up and top-down techniques of engagement.[133] This strategy enhances civic participation, promoting a vision for the creation of high-quality urban spaces.[134] Decision-makers may determine appropriate territorial development hypotheses by considering present and future economic, environmental, and social possibilities, therefore creating a more integrated and inspiring urban setting.[135]

Embracing technology and enhancing a more participatory approach to urban development planning and environmental management can go a long in resolving the clash between these two conflicting but often important concepts.

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[131] Ibid.

[132] Ibid.

[133] Semeraro, T., Zaccarelli, N., Lara, A., Sergi Cucinelli, F. and Aretano, R., 2020. A bottom-up and top-down participatory approach to planning and designing local urban development: Evidence from an urban university center. *Land*, *9*(4), p.98.

[134] Ibid.

[135] Ibid.; Newell, R. and Picketts, I. (2020) 'Spaces, places and possibilities: A participatory approach for developing and using integrated models for community planning', *City and Environment Interactions*, 6, p. 100040. Available at: https://doi.org/10.1016/j.cacint.2020.100040.

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