Exploring interdependencies and synergies to meet Sustainable Development Goal 11

- Few of the UN's Sustainable Development Goals (SDGs) are on track to be met by their target year of 2030.
- SDG 11 – making cities and human settlements inclusive, safe, resilient, and sustainable – is a complex goal to meet, especially in developing nations with low-income housing.
- To meet this and the other 16 SDGs, policymakers need to start taking a more integrated approach and find synergies across different sectors and disciplines.
- Through her research, Associate Professor Esther Obonyo at Penn State University, USA aims to provide transdisciplinary frameworks for effective and synergistic sustainable developments.

The UN's 17 Sustainable Development Goals (SDGs) include things like ending hunger and poverty and delivering clean, affordable energy to all; they aim to meet these lofty goals by 2030. Unsurprisingly, most of these ambitious goals are not on track to be achieved.

A transdisciplinary cross-sector approach is needed to build a sustainable world and meet the SDGs and other global goals, such as the Sendai Framework for Disaster Risk Reduction. The approach should concentrate on the interplay of different issues, including building science, urban design, climate justice, low-carbon technologies, and implementing policies that exploit the co-benefits of each.

To combat the lack of headway on built-environment-related SDGs, Associate Professor Esther Obonyo at the College of Engineering, Penn State University, USA aims to provide a systematic framework to deal with sustainability issues through a transdisciplinary, synergistic approach. Focusing specifically on SDG 11 – making cities and human settlements inclusive, safe, resilient, and sustainable – Obonyo has conducted a series of studies that take a transdisciplinary approach to ensuring more sustainable communities, particularly in low-income housing communities.

Interdependencies and synergies

One framework that Obonyo has used effectively is the Driving forces, Pressure, State, Impact, and Response (DPSIR) framework. This is used to assess the interplay between society and the environment; it brings together different disciplines and the views of key stakeholders to solve environmental problems. Under DPSIR, 'Driving forces' refer to the human influences and natural conditions that shape the environment, which put 'Pressures' on the environment that influence its 'State', resulting in 'Impacts' and 'Responses'. The

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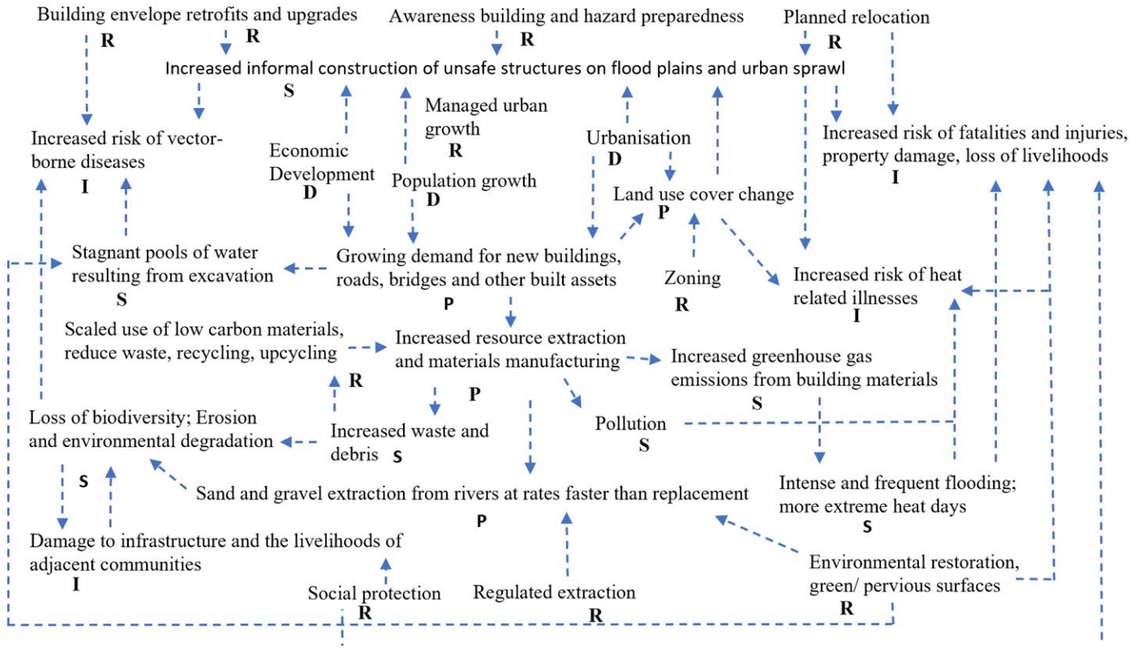

Figure 1. Obonyo created the figure 'Mapping synergies' to analyse the DPSIR and deduce how it may be effective in showing the complexities of actions in mitigating or adapting to environmental stressors.

responses then shape new driving forces, pressures, and impacts.

To take a deeper look at the DPSIR and how it may effectively show the complexities of every action in mitigating or adapting to environmental stressors, Obonyo created the figure 'Mapping synergies' (figure 1). Suppose you look at the response 'environmental restoration'. This *response* can affect the *state* of stagnant pools of water from excavation, the *pressure* of removing sand and gravel from riverbeds, and the *impact* of increased risk of heat and risk of affecting human health and property. And the *response* to using low-carbon materials is influenced by the *state* of increased waste and debris and influences the *pressure* of increased resource extraction.

Understanding the complexity of how a response to an impact affects drivers, pressures, states, and impacts, and vice versa, helps policymakers to be proactive in adapting to environmental and social issues.

The ADRELO project

To show how these frameworks can work in action, Obonyo brought together a globally dispersed team to explore strategies for enhancing the resilience of low-income communities living in disaster-prone areas. This work is funded through the Belmont Forum Framework, an international research initiative aimed at addressing global environmental change and promoting sustainability through transdisciplinary collaboration.

The project that Obonyo leads is known as the ADRELO project: Advancing Resilience in Low-income Housing. It focuses on low-lying coastal zones at high risk of drought and flooding in select parts of Brazil, East Africa, and North America, and aims to enhance the resilience of these low-income communities through transdisciplinary work. The research involves gathering georeferenced data on infrastructure and natural heritage sites, investigating technology adoption barriers, and designing affordable, disaster-resilient housing systems using sustainable, locally sourced materials.

The study emphasises the importance of considering the geographic, socioeconomic, and governance factors in urban development to promote resilient housing. It highlights the need for policy packages that address the unique circumstances of vulnerable populations and incorporates environmental sustainability and public health considerations.

Obonyo's research promotes cross-sector and transdisciplinary collaboration by integrating geographic, socioeconomic, and environmental considerations into urban development strategies.

Machine learning and big data analytics are also utilised to identify optimal disaster-resilient housing, urban design, and planning policies, considering climate change-related extreme weather scenarios. The study also uses the DPSIR framework to understand natural resource flows and how politics, society, and economy affect the local environment.

The ADRELO project recognises the role of housing as a nexus where the impact of human–natural system interactions can be examined through a holistic, systems-thinking approach. It highlights the challenges in predicting localised and seasonal climate changes and emphasises the need for approaches that can work with big data or sparse data.

Obonyo's research promotes cross-sector and transdisciplinary collaboration by integrating geographic, socioeconomic, and environmental considerations into low-income housing strategies. By incorporating sustainable and locally sourced materials in housing systems, the research aligns with other SDGs related to climate justice, poverty reduction, and sustainable communities.

Meeting the SDGs by 2030 will be challenging. Through implementing frameworks, such as the DPSIR, and the findings of Obonyo's research, policymakers will have better tools to remedy multi-faceted environmental and social issues like improving disaster resilience and making steady progress toward minimising the effects of climate change.

Personal response

Why did you focus on SDG 11 specifically?

I was born and brought up in Nairobi, Kenya. I have several family members and close friends who are inadequately housed. It breaks my heart when I realise that the best that building-related technology has to offer today cannot scale easily because of implementation obstacles that my University of Nairobi mentors, Professor Saad Yahya (retired) and Professor Paul Syaggah (retired), experienced in the 1970s and 1980s. If we do not intersect with other sectors and disciplines, our outcomes will not be any different.

Do you believe that by using some of the proposed frameworks, SDG 11 and other goals can be met by their 2030 target, or should a more realistic timeline be created?

I like working with an aggressive schedule. I think if we get our act together now, we can end up with an 'against all odds' outcome by 2030. If we lower the bar and we fail, there will be more disappointment and despair than if we remain bold and audacious.

Do you believe each of the SDGs needs a conference of parties (COP), similar to the COPs that have brought ambition and progress to climate change and, more recently, biodiversity, to bring real progress toward each?

I think we need more 'neutral' meeting grounds where efforts by people whose line of work does not intersect easily can converge. The 2023 Sustainability Research and Innovation Congress that was recently held in Panama City is a good example of platforms that have been set up to address this need. Through hosting a session at this conference, my low-income housing focused work has now intersected with efforts of a conversation and tourism champion who sees the big picture.

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Bio

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Further reading

Obonyo, E, Mutunga, J, (2021) A global building network research for advancing healthy and affordable housing, *Cities & Health*, 5(1), S166–S169.

Obonyo, E, Pareek, S, Woldu, DO, (2019) Decision making within the built environment as a strategy for mitigating the risk of malaria and other vector-borne diseases, *Buildings*, 9(1), 2.