Literature Review
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SDG Localization A systematic review of key themes and research modalities

The Sustainable Development Goals (SDGs), established by the United Nations in 2015, comprise 17 global objectives to address social, economic, and environmental challenges by 2030. SDG localization refers to the adaptation of these goals, targets, or indicators to local contexts. SDG localization is a growing area of study as countries adopt various approaches and levels of engagement. This literature review explores the underpinnings of SDG localization, focusing on research themes and modalities to guide future studies, identifying trends in SDG implementation efforts and research gaps, and suggesting areas for further exploration to assist policymakers, researchers, and stakeholders in developing effective SDG localization strategies. In this context, *research modalities* refer to the different methodological approaches - such as *frameworks, tools, measurements, or indicators* that are used by researchers to analyze SDG localization. In terms of research themes, we found that the integration of the SDGs into *policy, planning and capacity building* was the most commonly examined theme—in particular, its integration with national development policies. The second most prevalent theme was *environmental and climate resilience*, particularly its sub-theme of *ecosystem services (ES)*. Regarding research modalities, we found that developing a *framework* for adapting SDGs attracted the strongest attention from researchers, but less attention was paid to *measurements* and *indicators* for the attainment of the SDGs. We recommend that policymakers integrate the SDGs into national policies, such as the environment—especially ES and climate change—to accelerate the process of adapting the SDGs to local contexts. We also suggest that the scientific community develop ways to measure SDG progress more effectively by focusing on developing robust indicators, which are the key to measuring the achievement of SDGs.

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1. Introduction

The Sustainable Development Goals (SDGs) are a set of 17 global objectives established by the United Nations in 2015, aimed at addressing a wide range of social, economic, and environmental challenges by 2030 (UN, 2024). These goals build upon the Millennium Development Goals (MDGs) and represent a comprehensive framework for achieving sustainable development worldwide. The SDGs are characterized by their universality, inclusivity, and emphasis on collaborative partnerships to ensure that no one is left behind (UN, 2024).

SDG localization is to adapt the SDGs to the local level. The SDG localization process involves a strategic planning process that considers local contexts, governance structures, and resources (FAO-UNDP, 2023). The localization process requires prioritization, stakeholder involvement, and embedding innovative methodologies into local development plans (Mwebesa et al., 2021; Rimba & Hirabayashi, 2023; Sterling et al., 2020; Urquijo-Reguera et al., 2024). SDG localization has enhanced progress toward achieving the SDGs by tailoring global objectives to local contexts while addressing specific regional needs and challenges. For example, in small Indian cities, priority has been given to focusing on local agendas, implicitly addressing other agendas (Mwebesa et al., 2021), such as the Paris Agreement under the UN Framework Convention on Climate Change. SDG localization has helped address key priorities by focusing on the most pressing local issues. The localization process works effectively when supported by collaboration and consensus-based decision-making across sectors, which ensure that diverse perspectives and resources are integrated.

Similarly, in the UK , a bottom-up approach empowers individuals, including youth, to participate in the planning and execution of the SDGs (Bonsu et al., 2020). This method promotes inclusivity and ensures that local voices are taken into account in decision-making. In Los Angeles, the localization of the SDGs has been instrumental in advancing human rights by incorporating these goals into local governance, thereby facilitating the realization of rights at the community level (Morales, 2024). Moreover, localization helps address regional disparities by implementing place-based policies that consider unique regional characteristics. For example, localized assessments on Hainan Island, China, have shown significant regional disparities in improvements in SDGs related to poverty, health, and inequality (Zhang et al., 2023), calling for the introduction of region-specific policies. In another example from Australia, local governance activities have been identified as key to engaging with the SDGs due to their transformative potential to drive societal change (Ningrum et al., 2023).

SDG localization is gaining momentum among countries, with various approaches and levels of engagement. For example in Sweden, the development of multi-actor platforms for SDG implementation demonstrates the challenges of cross-sector collaboration and underlines the need for impartial and inclusive leadership to coordinate diverse interests effectively. (Krantz & Gustafsson, 2023). Understanding the trends in SDG implementation efforts is crucial to evaluating their impacts, guiding policy decisions, and fostering global collaboration toward sustainable development. Monitoring such trends helps policymakers identify goals that are lagging and require more focus, enabling targeted

interventions and resource allocation (Mishra et al., 2023; Yumnam et al., 2024). Additionally, it offers insights into the effectiveness of current policies and frameworks, prompting necessary adjustments to achieve the desired outcomes by 2030 (Ordonez-Ponce, 2023). It also highlights research gaps, encouraging academic and scientific communities to explore under-researched areas, particularly in developing regions (Sweileh, 2020). Moreover, examining the trends in SDG research raises public awareness and encourages young people to adopt critical values and take collective action toward sustainable development (Feltrero et al., 2023). Hence, it is crucial to map the trends not only in global SDGs but also in SDG localization.

This review aims to explore the literature on SDG localization, focusing on research themes and modalities in SDG localization. It identifies trends in SDG implementation efforts, highlights existing research gaps, and suggests potential areas for future exploration. These findings provide valuable insights to support policymakers, researchers, and stakeholders in developing more effective strategies for implementing SDG localization.

2. Methodology and definitions

2.1 Data collection

Scientific papers were downloaded from the Web of Science (a well-known bibliographic database of curated scientific literature) using the search terms “Sustainable Development Goals” “SDGs” and “Localization” for the period from 2015 to 2024. A total of 51 papers were collected, including both open and non-open access publications (the list of 51 papers is provided in Appendix). After screening the titles and abstracts, 41 papers remained that fit to the aim of the study. The screening was based on identification of research themes and the judgment of whether the paper employed a specific research modality (such as methodology, framework, measurement, tool, or indicator) for analyzing SDG localization.

2.2 Definition of key terms and methodology

The literature review categorized the selected papers from two aspects: research themes and research modalities. These classifications facilitated understanding of the various investigation tools and assessment techniques used for SDG localization, as well as the themes or topics explored in SDG localization research. A database was created using Excel, linking research sub-themes and research modalities through a Sankey diagram generated using a specialized Python library. The diagram shows a clear visual representation of the relationships among categories, where the width of each connecting flow reflects the relative strength or frequency of the linkage..

The term “research theme” refers to the specific subject matter of a chosen paper. These themes are not just theoretical but also relevant to practical issues. The selected papers were reviewed comprehensively, and their research themes and sub-themes were identified based on their area of focus. They ranged across various fields. Based on the fields of research, they were grouped into seven categories: *(1) Collaboration,*

(2) Economic development and industry focus, (3) Environmental and climate resilience, (4) Participatory funding, (5) Policy, planning, and capacity building, (6) Reporting and accountability, and (7) *Technology and innovation,* as shown in Figure 1.

To examine the research modalities, the selected papers were categorized into *Methodology, Framework, Measurement, Tool,* and *Indicator* based on a previous study by Trane et al., (2023). Methodology includes methods or approaches to adapt SDGs to the national or sub-national scale. Framework refers to a structure, system, or guidelines to help stakeholders organize efforts to localize the SDGs. It may propose innovative approaches or utilize existing methods to meet these goals. The term includes wise resource management, environmental protection, valuing cultural knowledge, developing local solutions for global challenges, leveraging technology to benefit society, and establishing environmentally sustainable systems. Measurement refers to the systematic measuring and monitoring of SDG progress. It involves using specific methods for determining the interrelated impacts of various goals and establishing priorities among goals, targets or indicators. It allows for monitoring and quantifying the effectiveness of initiatives and policies to achieve the SDGs. Any study or application that proposes a new way to promote sustainable development can be categorized as a Tool for advancing the adaptation of the SDGs. It could include innovative technologies, digital solutions, or eco-friendly structures and systems. An Indicator can be numerical, partially numerical, or non-numerical and may be obtained from models, instruments, or direct observations.

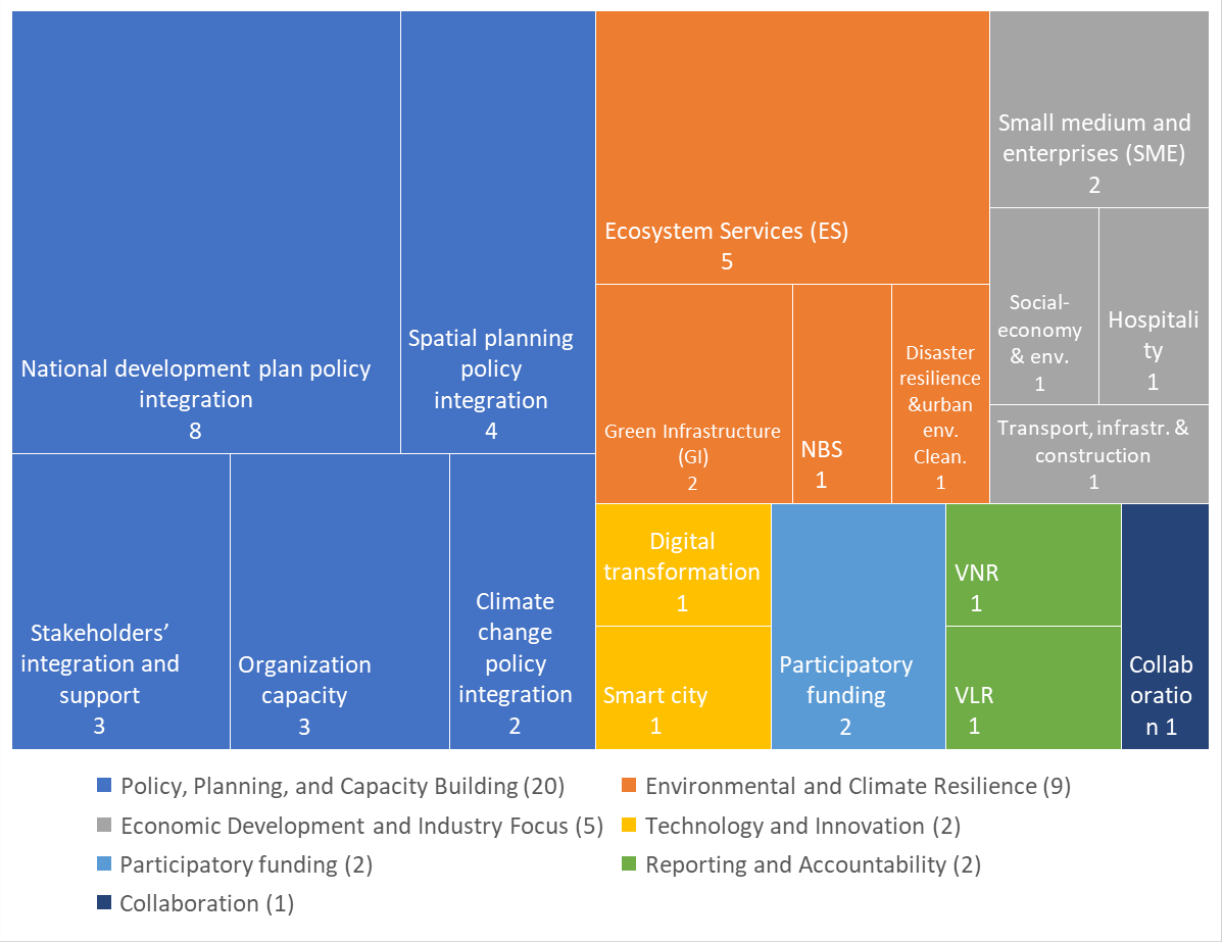

Figure 1: The number of SDG localization papers based on research theme and sub-theme. The Arabic numerals indicate the total number of selected papers related to each research theme and sub-theme. Abbreviations: Nature-based Solution (NBS); Voluntary National Review (VNR); Voluntary Local Review (VLR). *Source*: Authors

3. Trending themes of SDG localization and identification of existing gaps.

To understand the trends in SDG localization themes and identify gaps in SDG localization research, we reviewed 41 papers on SDG localization. The category of Policy, planning, and capacity building had the highest number of contributions, totaling 20 papers. It was followed by Environmental and climate resilience, which included nine papers. The next theme, Economic development and industry focus, was featured in five papers. The categories, Technology and innovation, Participatory funding, and Reporting and accountability had two papers, respectively. Lastly, the Collaboration category had only one paper, as shown in Figure 1. We kept sub-themes (such as Digital transformation and Smart cities) to show a range of SDG localization approaches, even when the related literature is limited. This section gives concise summary descriptions of the papers rather than research weights.

3.1 Policy, planning and capacity building.

The theme of Policy, planning, and capacity building comprises five sub-themes: *National development plan policy integration, Spatial planning policy integration, Climate change policy integration, Stakeholders' integration and support,* and *Organizational capacity,* as outlined in Figure 1. Among these, National development plan policy integration has the highest number of papers, totaling eight.

We found that incorporating the SDGs into national development plans is the most discussed area among sub-themes in SDG localization, likely because it aligns international goals with local contexts and priorities. It allows for harmonizing local efforts with international goals and improves local governments' ability to tackle issues through customized strategies. The national plan serves as a primary vehicle for integrating SDGs by providing a framework for aligning global goals with domestic priorities. The SDGs offer flexibility in translating and adapting them to local contexts (Okitasari & Katramiz, 2022). For example, in Indonesia, national development plans that integrate the SDGs highlight the importance of aligning SDG principles with local government structures. This action involves content analysis of political, legal, financial, and administrative frameworks to determine whether national development policies encompass the broad dimensions of the SDGs (Putra et al., 2024). However, the key challenges include limited available resources, the need for multi-stakeholder support, and insufficient attention to environmental issues.

Moreover, in Indonesia, economic elements and governance remain dominant paradigms, necessitating broader support to strengthen the integration of the SDGs into national development strategies (Putra et al., 2024). Another example is Norway, where municipalities use selective SDG integration into high-priority policies. However, this process is challenging to achieve because focusing only on specific SDGs means that other important ones might be overlooked. This constant picking and choosing makes it hard to work towards all the goals together (Reinar & Lundberg, 2023). Moreover, other gaps include system development and coordination, and regional disparities (Hu et al., 2023). For example, a significant gap is the management of informal settlements in urban areas, particularly in megacities like Beijing, Shanghai, and Guangzhou in China, which are densely populated and disorganized (Peng et al., 2023).

In this literature review, we found that Spatial planning policy integration was considered important for SDG localization due to its ability to integrate various dimensions of sustainability (social, economic, and environmental) into cohesive strategies tailored to specific local contexts. Additionally, spatial planning facilitates the adaptation of global SDGs to local priorities, ensuring effective implementation and monitoring by tracking spatial development. Flexibility and organization in multi-level governance make spatial planning the preferred approach for dealing with the interlinkages and complex nature of the SDGs. This structure provides policy consistency and facilitates the straightforward inclusion of SDGs into local planning contexts (David et al., 2024).

However, several risks and gaps remain unaddressed. Kulonen et al. (2019) identified a gap in data collection methodologies and review schemes at sub-national and regional levels, which risk excluding remote populations from sustainable development efforts. Mejia-Dugand and Pizano-Castillo (2020)

investigated how municipal physical-spatial planning can serve as a vehicle for SDG implementation, particularly in cities facing poverty and violence in Medellín, Colombia. Wang et al. (2020) examined urban sustainable development in China, revealing disproportionate urban growth relative to population increases, and recommended using Earth observation data to monitor SDG indicator 11.3.1 (Ratio of land consumption rate to population growth rate) effectively. The identified gap was the lack of coordinated urban development, with many cities experiencing unbalanced growth. These studies recommended enhancing spatial data methodologies and developing spatially aware data collection methods to integrate SDG considerations into local planning and citizen participation instruments, thereby aligning the development agenda more closely with SDG targets.

Australia's Hunter Valley Region implemented a climate change integration policy to address flooding caused by climate change (Mortimer et al., 2023). Localizing SDG 13 (Climate action) can enhance the effectiveness of municipal climate strategies, although there has been limited research and guidance on how local governments can put this approach into practice. Nonetheless, Mortimer et al. (2023) suggested that incorporating the SDGs into local policies could strengthen climate actions and reduce regional flood risks.

Stakeholder integration and support has an important role in SDG localization. Bonsu et al. (2020) conducted a study using a novel integrated social innovation and scenario-thinking mechanism in the UK. They identified the need for an inclusive, bottom-up governance mechanism to engage citizens—particularly youth—in localizing the SDGs. The study underscored the interconnectedness of the SDGs and called for cross-sectoral thinking to prevent the SDGs from becoming a mere performative exercise. Rauf et al. (2024) identified governance and operational challenges in SDG localization in Canadian cities. Support from higher government levels was found to be essential, along with horizontal and vertical stakeholder collaboration. They suggested integrating the subsidiarity principle with place-based policy and innovation theory for successful localization. In another study in Quebec City, Tremblay et al. (2021) applied a systemic sustainability analysis tool to integrate SDGs into a local strategy to highlight priorities, stakeholder engagement, synergies, and tradeoffs. However, this study revealed the need for a more holistic approach to SDG localization and suggested innovative governance integration with systemic thinking and multi-level coordination to ensure effective implementation and long-term sustainability.

3.2 Environmental and climate resilience

Environmental and climate resilience emerged as the second most frequently discussed theme in the SDG localization literature, reflecting its central role in linking ecological sustainability with community well-being. This section highlights how localizing SDGs involves protecting ecosystems, integrating climate change adaptation, and developing nature-based solutions to strengthen resilience against environmental risks. Sub-themes under this research theme encompass ecosystem services (e.g., mangroves and post-mining restoration), green infrastructure, nature-based solutions, and disaster resilience, as well as urban environmental cleanliness. Together, these studies demonstrate how environmental strategies not only

contribute to SDG 13 (Climate Action) but also support multiple other goals, including SDG 14 (Life Below Water) and SDG 15 (Life on Land).

The selected literature discussed the benefits of mangroves in providing Ecosystem services (ES), as a subtheme of Environmental and climate resilience. ES is the benefits that humans derive from ecosystems, such as mangroves, forests, and wetlands, that support environmental sustainability and human well-being. The ES includes regulating climate, protecting coastlines, and sustaining livelihoods, which collectively contribute to environmental and climate resilience. This concept refers to the capacity of ecosystems and societies to absorb disturbances and adapt to environmental change. The selected literature discussed the benefits of mangroves in providing ES as a subtheme of environmental and climate resilience. The detailed definition and discussion of resilience are provided in Section 4. Integrating mangrove conservation and restoration into SDG strategies can enhance environmental sustainability, socio-economic development, and climate resilience. Mangroves store significant amounts of carbon. For example, Indonesia's mangrove forests alone store approximately 3.14 PgC, representing about 33% of the global carbon stored in coastal ecosystems (Arifanti et al., 2024). In the Niger Delta, mangrove sediments have been found to sequester carbon at a rate of 4.54 g C cm-2 yr-1, highlighting their potential in climate change mitigation (Nwankwo et al., 2023).

Moreover, mangrove ecosystems play a crucial role in disaster risk reduction by serving as natural barriers against coastal hazards. Mangroves attenuate wave energy and stabilize shorelines and are therefore crucial for protecting coastal communities from tropical cyclones and other extreme weather events (Bastien-Olvera et al., 2024; Hülsen et al., 2023). In river deltas, mangroves help mitigate compound flood risks by attenuating oceanic contributions to high water levels, although their effect on riverine components is limited (Pelckmans et al., 2024). Mangrove restoration supports climate resilience by enhancing carbon sequestration and reducing the vulnerability of coastal areas to climate-induced hazards, thus supporting the achievement of SDG 13 (Climate action) (Eyzaguirre et al., 2023; Gong et al., 2024). Mangroves provide critical habitats for marine biodiversity, supporting fisheries and maintaining ecological balance, which is essential for achieving SDG 14 (Life below water) (Eyzaguirre et al., 2023). By preventing land degradation and promoting biodiversity, mangroves conserve terrestrial ecosystems, contributing to the achievement of SDG 15 (Life on land) (Eyzaguirre et al., 2023).

Another example of ES in this study is the restoration of mining areas. Mining restoration focuses on reestablishing forests, restoring water bodies and wetlands, and designating land for agriculture and public use, aligning with Ecosystem services and SDG localization for SDG 15 (Bimrah et al., 2022).

Other sub-themes of Environmental and climate resilience for SDG localization include Green Infrastructure (GI), which encompasses various natural and semi-natural systems that provide essential ecosystem services crucial for urban resilience, climate change mitigation, and enhancing the quality of life in urban areas (Lu et al., 2024). Integrating GI into urban planning and development can significantly contribute to achieving the SDGs by addressing environmental, social, and economic challenges. GI plays a key role in mitigating urban heat islands and reducing surface temperatures, directly supporting SDG 13

(Climate action) by enhancing urban resilience to climate change. The use of green building materials and renewable energy in GI projects reduces environmental impact and supports SDG 7 (Affordable and clean energy) and SDG 12 (Responsible consumption and production) (Dai et al., 2023). Implementing GI in socially vulnerable areas can enhance social equity by providing access to green spaces and improving living conditions, thereby supporting SDG 10 (Reduced inequalities) (Rodrigues et al., 2023). Furthermore, GI offers alternatives to traditional infrastructure by lowering energy costs and enhancing property values, contributing to economic growth and supporting SDG 8 (Decent work and economic growth) (Mahmood et al., 2024).

Nature-based solutions (NBS), as a sub-theme of Environmental and climate resilience, can enhance city resilience, improve resource efficiency, and provide social inclusiveness, thereby emerging as a valuable tool in adapting SDG targets at the local level. Integrating NBS into urban planning and management can lead to improved achievement of SDGs and more livable cities. In the Lahn River landscape in Germany, NBS interventions for SDG localization were implemented by re-naturalizing floodplains through changes in land use, revitalizing historic floodplains, and creating buffer strips (Schmidt et al., 2022).

Another sub-theme under the Environmental and climate resilience theme is Disaster resilience and urban environmental cleanliness. It has been applied to SDG localization in China; however, achieving this localization is challenging because current levels of city disaster resilience and urban cleanliness fall short of the required standards of SDG indicators (Wang et al., 2019).

3.3 Economic development and industry focus

Five papers selected in this literature review discussed Economic development and industry focus with sub-themes on *Social economy and environment, Small to medium enterprises (SMEs), Hospitality, and Transport, infrastructure and construction*. In this study, we concluded that economic development provides the necessary resources, infrastructure, and incentives for local actors to engage in sustainable practices. Moreover, it aligns with the local population's immediate needs and priorities, making it a practical entry point for SDG localization.

However, several challenges remain within SDG localization in the Economic development and industry focus theme. For example, Dube (2021) identified a gap in how the tourism industry in the Hospitality sub-theme—particularly hotels in Zimbabwe and Botswana—is localizing the SDGs. Although some progress has been made, significant work remains to be done by 2030. The article recommended continuous monitoring and support to achieve sustainable tourism. Xu et al. (2019) addressed the inadequacy of current SDG indicators for the Transport, infrastructure, and construction sub-theme at the country level in China, proposing an improved system that better reflects local realities by incorporating additional metrics like road density and postal business. Koh et al. (2021) evaluated SDG indicators for local governments in Gyeonggi Province, South Korea, identifying local government sustainability profiles and suggesting policy priorities for those facing the most significant challenges,

especially in the Social-economy and environmental sub-theme.

Moreover, the research on SMEs emphasizes the lack of reported contributions of digital SMEs to sustainable economic growth, proposing a new digital business model to enhance SME performance and regional development. It recommends tailoring approaches and improving metrics to localize and implement SDGs across different contexts effectively (Chaichana et al., 2024).

3.4 Technology and innovation

The theme Technology and innovation has the sub-themes, digital transformation and Smart city. Although this theme shows fewer papers than others, it may enhance the precision and effectiveness of initiatives aimed at the achievement of the SDGs. The role of technology in SDG localization is multifaceted, encompassing various applications from environmental monitoring to infrastructure management, each contributing to different SDGs.

ElMassah and Mohieldin (2020) gathered data on progress toward the SDGs, particularly on existing e-governance initiatives and big data initiatives in SDG localization initiatives around the world. They found that localization enabled governments to customize sustainable development strategies at the local level effectively, and this process could be enhanced through digital transformation.

The concept of smart cities is increasingly being promoted to address local sustainability challenges, with smart city strategies supporting urban sustainability transitions. Clement et al. (2023) analyzed 57 smart city strategies from 29 countries using the SDG framework to identify which goals and specific targets are being localized through these initiatives. Their findings indicate that these strategies strongly support the localization of four key goals: SDG 7 (Affordable and clean energy), SDG 8 (Decent work and economic growth), SDG 9 (Industry, innovation, and infrastructure), and SDG 11 (Sustainable cities and communities), along with several individual targets.

However, the specific SDGs that address these strategies can vary based on local contexts. The documents promoting smart city strategies advocate for sustainable development initiatives across various themes. However, for cities aiming to make a significant transition towards a more sustainable urban model, it is essential to also address often overlooked topics associated with SDGs 2 (Zero hunger), 5 (Gender equality), and 15 (Life on land) (Clement et al., 2023).

3.5 Participatory funding

Financial issues can often pose an obstacle to implementing the SDGs. These issues hinder the effective mobilization and allocation of financial resources necessary for achieving the SDGs. The shortage of government funding and trade-offs between different SDGs further complicate financial support, especially in underdeveloped areas, such as mountainous regions (Miao, 2024). The cost of achieving these goals could be as high as 125% of the world's GDP (Cingolani, 2024). This underscores the need for significant public sector involvement and coordination to mobilize the necessary resources (Cingolani, 2024).

Two papers in the Participatory funding theme discuss self-funding in adopting the SDGs. Permatasari et al. (2021) evaluated Indonesia's *Village Funding Program* (VP) by aligning it with SDG activities. They found that the program may help the government promote SDG awareness among village leaders. In another study, researchers examined the Polish *Solecki Fund* (FS), which provides a form of participatory budgeting specifically designed for rural areas (Bednarska-Olejniczak et al., 2020). The program enables the community to determine the percentage of the local budget allocated for specific purposes and ensures that spending is directly aligned with local demands and priorities. Although only a small number of local municipalities have adopted this community participation program, it shows flexibility in meeting local needs. These findings align with the SDG target of improving the living standards of local communities, though implementation depends on political conditions and on whether the local government and communities are willing to engage in participatory decision-making. These studies from Indonesia and Poland offer lessons for other countries considering applying for participatory financing for SDG localization.

3.6 Reporting and accountability

The Reporting and accountability theme includes only two sub-themes: Voluntary national reviews (VNRs) and Voluntary local reviews (VLRs). VNRs provide a structured framework for countries to report on their progress toward achieving the SDGs and can be used to monitor and assess SDG localization. VLRs are reports prepared by local governments on their progress in achieving the SDGs aligned with national-level VNRs. Although VLRs do not have official status, they contribute to improving local and national efforts to achieve their goals. Since SDG localization requires adaptation to local contexts, VNRs and VLRs play a crucial role in this process. These reviews are increasingly being used by cities and local governments to monitor and evaluate their progress toward the SDGs, providing a more detailed understanding of how the goals are being implemented at the local level.

However, this literature review found only two studies that used VNR or VLR approaches to monitor and measure SDG localization. Sharaf (2023) conducted a study to establish a method for assessing and monitoring sustainable development goals at the city level. The focus was on identifying indicators that align with the specific contexts of each city, aiming to update and track progress toward sustainability using a VLR. Moreover, VNRs allow local governments to adapt the global SDG framework to their specific contexts, addressing local challenges and priorities. For instance, cities like Buraidah in Saudi Arabia have developed frameworks to assess their progress toward SDG 11, focusing on making cities inclusive, safe, resilient, and sustainable (Osman et al., 2021).

3.7 Collaboration

The final research theme is Collaboration. This theme includes one sub-theme: Country collaboration, with only one paper. In their research, Hao et al. (2024) developed a localized indicator evaluation system to assess the sustainable development of the *China–Pakistan Transportation Corridor (CPTC)*, which has faced significant challenges due to natural disasters. Their findings indicate that Xinjiang has the highest level of sustainable development, while Khyber Pakhtunkhwa has the lowest. This collaborative approach helps identify the best and worst performers and highlights priority SDGs that require greater attention.

4. Trends in research modalities in SDG localization

This section shows that most research offers a framework for adapting the SDGs, followed by tools. Less attention is given to methodology, measurement, and indicator, as shown in the Sankey diagram in Figure 2. The most proposed frameworks are for national development plan policy integration and ES, as shown in Table 1, with seven and five papers, respectively.

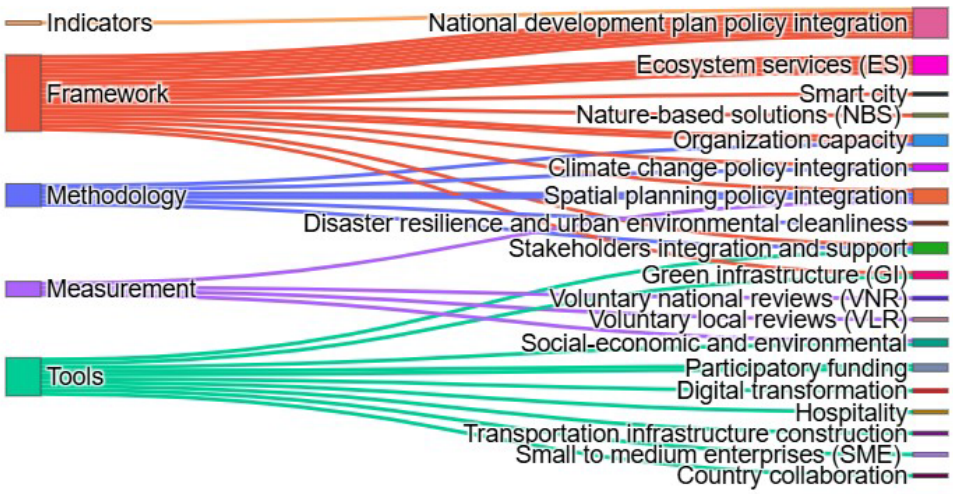

Figure 2: Sankey diagram of research modalities and research sub-themes (*Source*: Authors)

Research Modalities	Sub-themes	No. of Paper
Framework (20 papers)	Climate change policy integration	1
	Ecosystem Services (ES)	5
	Green Infrastructure (GI)	1
	National development plan policy integration	7
	Nature-based solutions (NBS)	1
	Organization Capacity	2
	Smart city	1
	Spatial planning policy integration	1
	Stakeholders integration and support	1
Indicators (1 paper)	National development plan policy integration	1
Measurement (4 Papers)	Social-economic and environmental	1
	Spatial planning policy integration	1
	Voluntary National Reviews (VNR)	2
Methodology (6 Papers)	Climate change policy integration	1
	Disaster resilience and urban environmental cleanliness	1
	Organization Capacity	1
	Spatial planning policy integration	2
	Stakeholders integration and support	1
Tools (10 Papers)	Country collaboration	1
	Green Infrastructure (GI)	1
	Hospitality	1
	Digital transformation	1
	Participatory funding	2
	Small to medium enterprises (SME)	1
	Social-economic and environmental	1
	Stakeholders integration and support	1
	Transportation infrastructure construction	1
Grand Total		41

Table 1: Number of research modalities and sub-themes (*Source*: Authors)

The integration of national development plans with the SDGs has gained attention due to the need for a coherent and integrated policy strategy that effectively addresses interlinked, multifaceted global challenges. Such harmonization of national policies with global goals can help make the achievement of the SDGs more efficient and effective. Despite the benefits, integrating national development plans with SDGs faces challenges, such as limited institutional capacity—especially in the Global South—and the complexity of multi-sector economies. These challenges necessitate tailored approaches that consider local contexts and capacities (Basheer et al., 2022; Viegas Filipe et al., 2021). Opportunities for integration arise from increased awareness and the development of frameworks that facilitate policy coherence, such as the Sendai Framework for Disaster Risk Reduction, which encourages aligning disaster risk reduction strategies with the SDGs (Wamsler & Johannessen, 2020).

Considering the shared interests of ES and SDGs, their high synergy in SDG localization is not entirely surprising. SDGs focus on the interaction between the environment, society, and economy, while ES is the target of the Millennium Ecosystem Assessment (MA), initiated in 2001 and published in 2005 by the United Nations (UN, 2005). The MA focuses on ES as a means to benefit the community through the ecosystems. ES is categorized into four functional groups: provisioning services—providing food, fuel, construction materials, and medical resources; supporting services like nutrient cycling, soil formation, primary production, and preservation of genetic diversity; regulating services which encompass climate control, protection against floods and storms, prevention of erosion; and cultural services that provide recreational, tourism and psychological benefits (UN, 2005). These ES functional categories highlight the critical role of ecosystems in supporting human well-being and the urgent need for sustainable management practices, as is the case for several SDGs. In this literature review, we conclude that the concept of ES encompasses the various benefits humans derive from ecosystems, which are crucial for achieving the SDGs. These services are categorized into provisioning, regulating, cultural, and supporting services, each playing a distinct role in sustainable development.

Tracking the SDGs is crucial for monitoring development progress, ensuring accountability, and guiding policy development toward the SDGs. This key task enables tracking progress over time, identifying areas of success and those needing improvement (González et al., 2023; Ziegler et al., 2023). Moreover, accurate measurement helps prioritize targets and allocate resources efficiently. For instance, a composite assessment framework can help prioritize SDG targets based on national conditions, thereby reducing complexity and costs (Huan et al., 2022). In addition, local data collection and monitoring can help fill gaps between implementation at the local and national levels, allowing for a better understanding of SDG progress (González et al., 2023). The use of big data and open data can also advance SDG monitoring (Liu et al., 2023).

However, the task of measuring the SDGs faces various obstacles, especially regarding data availability, inconsistent methodology, and the complexity of integrating global and local metrics. Many indicators lack data, and individual goals frequently share the same indicators. Previous studies have suggested data

modeling to fill these data gaps (Joosse et al., 2023; Nozaki et al., 2023; Rimba et al., 2024). Moreover, different data sources and methods for prioritizing and measuring the SDGs lead to inconsistent results, complicate the designation of precise priorities, and may lead to poorly informed decisions (Huan et al., 2022; Huan et al., 2023; Silveira et al., 2021). Linking local actions to global metrics is challenging due to differences in data availability and the need for scalable methods that can be applied across different regions and contexts (Ziegler et al., 2023). The extensive scope of the SDGs, with numerous targets and indicators, makes comprehensive measurement complex and costly. Simplifying the measurement process without losing critical information remains a significant challenge (Kubiszewski et al., 2021). Therefore, future research should place greater emphasis on the research modality of *Measurement* – developing more robust methods, datasets, and indicators to trace SDG progress in a consistent and scalable way

SDG indicators are essential for tracking countries' progress towards achieving the SDGs. By providing reliable data, the indicators enable policymakers to identify priority issues, such as health, education and environmental sustainability (Wang et al., 2022). Indicators can also be used to hold countries accountable by providing an open platform to report on progress (Fukuda - Parr, 2019; Gebara et al., 2024). However, in this literature review, only one study in the scientific literature explicitly discusses Indicators as a research modality, suggesting that limited attention has been given in academic research to the development of indicators for localization.

5. Conclusions

5.1 Summary of findings

This literature review found that Policy integration—especially National development policy and ES—was the top research area in the SDG localization. Integrating national development plans with the SDGs is becoming more widespread due to the need for coherent policies to tackle global challenges. This alignment makes achieving the SDGs more efficient, but faces challenges, such as limited institutional capacity and the complexity of multi-sector economies. Tailored approaches that consider local contexts are necessary. Opportunities for integration include increased awareness of climate change and disaster frameworks like the Sendai Framework for Disaster Risk Reduction, which promotes aligning disaster risk strategies with the SDGs. The concept of ES encompasses the various benefits humans derive from ecosystems, which are crucial for achieving the SDGs. These services are categorized into provisioning, regulating, cultural and supporting services, each playing a distinct role in sustainable development.

5.2 Implications for policy and practice

This literature review found that developing a framework was the top research modality used in developing SDG localization, mainly related to national development plan policy integration and ES. Harmonizing national development plans with the SDGs presents both opportunities and challenges,

requiring reforms of strategies, policies and practices. Institutional capacity needs to be improved by policymakers to manage the complexities of harmonizing national plans with the SDGs, as well as to invest in human resources, infrastructure, and technologies tailored to local contexts. Policy coherence through frameworks can ensure that national strategies align effectively with global goals. Additionally, emphasizing sustainable management practices that integrate ES into development plans is crucial for supporting human well-being and the SDGs. Furthermore, developing localized indicators that reflect local priorities and conditions will enable accurate prioritization—especially in crucial issues such as health, education, and environmental sustainability, thereby increasing accountability through transparent reporting platforms. By tackling these areas, policymakers can develop a more integrated and pragmatic approach to implementing the SDGs.

5.3 Recommendations for future research

The research gaps identified in this literature review regarding the adaptation of the SDGs to local contexts relate to the measurement of SDG localization and the development of indicators. Hence, one potentially fruitful area for future research is the development of SDG localization indicators responsive to different national and sub-national contexts and capacities. As a first step, case studies on good practices for SDG localization and appropriate indicator development could be conducted to understand how central and local governments are addressing SDG localization. Furthermore, there is an urgent need for studies that focus on creating scalable solutions for integrating local data with global data with global metrics, surmounting data availability limitations and inconsistent methodologies. In addition, examining the synergies between ES and the SDGs can provide insights into how ES can be leveraged to enhance SDG localization and implementation. By undertaking research to map ES values into SDG targets, the scientific community may contribute to more cohesive and sustainable policy interventions. Finally, studies could also examine how big data and open data could improve SDG monitoring and tracking to ensure that development is appropriately measured and resources are allocated effectively.

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Appendix: A list of papers identified in the Web of Science Database

Authors	Article Title	Selected (Yes/No)	Year	DOI
Sarkar, et al.	Localisation of Sustainable Development Goals (SDGs) in Bangladesh: An Inclusive Framework under Local Governments	Y	2022	10.3390/su141710817
Masuda, et al.	SDGs mainstreaming at the local level: case studies from Japan	Y	2021	10.1007/s11625-021-00977-0
Bonsu, et al.	Beyond Agenda 2030: Future-Oriented Mechanisms in Localising the Sustainable Development Goals (SDGs)	Y	2020	10.3390/su12239797
Liu, et al.	Measuring SDG 15 at the County Scale: Localization and Practice of SDGs Indicators Based on Geospatial Information	Y	2019	10.3390/ijgi8110515
Leavesley, et al.	Cities and the SDGs: Realities and possibilities of local engagement in global frameworks	Y	2022	10.1007/s13280-022-01714-2
ElMassah, et al.	Digital transformation and localizing the Sustainable Development Goals (SDGs)	Y	2020	10.1016/j.ecolecon.2019.106490
Hu, et al.	The localization of SDGs in China: System construction, status assessment and development reflection	Y	2023	10.1016/j.ecolind.2023.110514
Tan, et al.	Systems approaches for localising the SDGs: co-production of place-based case studies	N	2019	10.1186/s12992-019-0527-1
Ciambra, et al.	Localizing and Monitoring Climate Neutrality through the Sustainable Development Goals (SDGs) Framework: The Case of Madrid	Y	2023	10.3390/su15064819
Wang, et al.	China's poverty assessment and analysis under the framework of the UN SDGs based on multisource remote sensing data	Y	2024	10.1080/10095020.2022.2108346
Clement, et al.	Smart city strategies-A driver for the localization of the sustainable development goals?	Y	2023	10.1016/j.ecolecon.2023.107941
Malekpour, et al.	Transformative localization to accelerate the 2030 Agenda	Y	2024	10.1038/s41893-024-01324-8
Rauf, et al.	The challenges and opportunities of localizing the sustainable development goals in Canadian cities - a subsidiarity check	Y	2024	10.1007/s10668-024-04720-4
Sharma, et al.	Circular economy approach in solid waste management system to achieve UN-SDGs: Solutions for post-COVID recovery	N	2021	10.1016/j.scitotenv.2021.149605
Dube, K.	Sustainable Development Goals Localisation in the Hospitality Sector in Botswana and Zimbabwe	Y	2021	10.3390/su13158457

Xu, et al.	An Improved Indicator System for Evaluating the Progress of Sustainable Development Goals (SDGs) Sub-Target 9.1 in County Level	Y	2019	10.3390/su11174783
Kulonen, et al.	Spatial context matters in monitoring and reporting on Sustainable Development Goals Reflections based on research in mountain regions	Y	2019	10.14512/gaia.28.2.5
Gang, et al.	Machine Learning-Based Prediction of Node Localization Accuracy in IIoT-Based MI-UWSNs and Design of a TD Coil for Omnidirectional Communication	N	2022	10.3390/su14159683
Masuda, et al.	Exploring the role of local governments as intermediaries to facilitate partnerships for the Sustainable Development Goals	Y	2022	10.1016/j.scs.2022.103883
Osman, et al.	Voluntary Local Review Framework to Monitor and Evaluate the Progress towards Achieving Sustainable Development Goals at a City Level: Buraidah City, KSA and SDG11 as A Case Study	Y	2021	10.3390/su13179555
Dai, et al.	Sustainable Development Goals, Sports and Physical Activity: The Localization of Health-Related Sustainable Development Goals Through Sports in China: A Narrative Review	N	2020	10.2147/RMHP.S257844
Trane, et al.	Progress by Research to Achieve the Sustainable Development Goals in the EU: A Systematic Literature Review	Y	2023	10.3390/su15097055
Ningrum, et al.	Transformative potential in sustainable development goals engagement: Experience from local governance in Australia	Y	2023	10.1016/j.gloenvcha.2023.102670
Mortimer, et al.	Localizing Sustainable Development Goal 13 on Climate Action to Build Local Resilience to Floods in the Hunter Valley: A Literature Review	Y	2023	10.3390/su15065565
Butcher, et al.	Leaving no urban citizens behind: An urban equality framework for deploying the sustainable development goals	Y	2021	10.1016/j.oneear.2021.10.015
Koh, et al.	Developing an index of sustainable development goals for local governments: the case of Gyeonggi province in korea	Y	2021	10.1080/20964129.2021.1980437
Bimrah, et al.	Ecosystem Services of Mangroves: A Systematic Review and Synthesis of Contemporary Scientific Literature	Y	2022	10.3390/su141912051
Husain, et al.	Review and assessment of the potential restoration of ecosystem services through the implementation of the biodiversity management plans for SDG-15 localization	Y	2024	10.1016/j.heliyon.2024.e29877

Mabibibi, et al.	Successes and Challenges in Sustainable Development Goals Localisation for Host Communities around Kruger National Park	Y	2021	10.3390/su13105341
Tremblay, et al.	A Systemic Approach for Sustainability Implementation Planning at the Local Level by SDG Target Prioritization: The Case of Quebec City	Y	2021	10.3390/su13052520
Asekomeh, et al.	Optimally Clocking the Low Carbon Energy Mile to Achieve the Sustainable Development Goals: Evidence from Dundee's Electric Vehicle Strategy	Y	2021	10.3390/en14040842
Sharaf, FM	Assessment of Urban Sustainability-The Case of Amman City in Jordan	Y	2023	10.3390/su15075875
Schmidt, et al.	Advancing Sustainable Development Goals with localised nature-based solutions: Opportunity spaces in the Lahn river landscape, Germany	Y	2022	10.1016/j.jenvman.2022.114696
Yin, et al.	Ecosystem carbon sequestration service supports the Sustainable Development Goals progress	Y	2023	10.1016/j.jenvman.2022.117155
Permatasari, et al.	The Village Fund Program in Indonesia: Measuring the Effectiveness and Alignment to Sustainable Development Goals	Y	2021	10.3390/su132112294
Dong, et al.	Diversification and evolution of the SDG gene family in Brassica rapa after the whole genome triplication	N	2015	10.1038/srep16851
Mejia-Dugand, et al.	Touching Down in Cities: Territorial Planning Instruments as Vehicles for the Implementation of SDG Strategies in Cities of the Global South	Y	2020	10.3390/su12176778
Li, et al.	Genome-wide analysis of SET-domain group histone methyltransferases in apple reveals their role in development and stress responses	N	2021	10.1186/s12864-021-07596-0
Wang, et al.	A Novel Evaluation Approach of County-Level City Disaster Resilience and Urban Environmental Cleanliness Based on SDG11 and Deqing County's Situation	Y	2019	10.3390/su11205713
Winans, et al.	Sustainable value mapping and analysis methodology: Enabling stakeholder participation to develop localized indicators mapped to broader sustainable development goals	Y	2021	10.1016/j.jclepro.2021.125797
Bednarska-Olejniczak, et al.	How a Participatory Budget Can Support Sustainable Rural Development-Lessons From Poland	Y	2020	10.3390/su12072620

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要約

2015 年に国連で採択された持続可能な開発目標（SDGs）は、2030 年までに対処が必要な、社会、経済、環境の課題に関する 17 の全世界的目標で構成されている。SDGs の現地化（ローカリゼーション）は、これらのゴール、ターゲット、指標を地域の文脈に適応させることである。SDGs の現地化に関連する文献は、各国が様々なアプローチと様々なレベルの取り組みを採り入れていくにつれて、関連文献が増加している。この文献レビューは、SDGs の現地化に関する研究テーマと手法に焦点を当て、SDG の実現に向けた努力と研究ギャップを特定し、政策立案者、研究者、関係者が効果的な戦略を検討する一助となるような今後の研究分野を模索し提示しようとするものである。研究テーマに関しては、SDGs の「政策、計画、能力開発」（特に国レベルの開発政策）への統合が最も人気のあるテーマであることが分かった。次に人気のあるテーマは、「環境と気候のレジリエンス」であり、中でもそのサブ・テーマのひとつ「生態系サービス（ES）」が注目されている。研究手法に関しては、SDGs を適応させるための「枠組み」の開発が研究者から最も注目を集めているが、SDGs 達成に向けた進捗の「計測」とそのための「指標」にはあまり注目が集まっていないことが分かった。政策立案者には、SDGs を、環境（特に ES）や気候変動などに関する国の政策に統合し、SDGs を地域の文脈に適応させるプロセスを加速することを著者らは推奨する。また、科学コミュニティには、SDGs の達成度計測の鍵となる良い指標の開発に着目しつつ、SDGs の進捗をより効果的に測定する方法を開発することを、著者らは提案する。