Urban Transformations

RESEARCH

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Strengthening transformative capacities for urban sustainability: a case study of waste reform in Battambang, Cambodia

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Abstract

Battambang has been identified as an exemplar for sustainability city development in Cambodia due to its success with the introduction of new programs and planning initiatives, which have led to recognition of its clean and green city status by the Cambodian Government and the Association of Southeast Asian Nations (ASEAN). Limited research has been done to date to investigate how Battambang has achieved these results, compared with other rapidly urbanising cities of Cambodia and Southeast Asia. Through the lens of urban sustainability transformations, our research identifies the capacity strengths and gaps of Battambang city in preparing for and initiating the city's urban transformation of its waste sector, applying the transformative capacities framework of Wolfram (Cities 51:121-130, 2016). Through qualitative coding of semi-structured interviews and document analysis we found that (a) particular transformative capacities provided building blocks for the development of other capacities, (b) award and recognition processes can play a role in developing transformative capacities, and (c) that the city's culture of innovation and relatively stable population and political-economy contributed to strengthening its capacities. This research contributes knowledge for policy and practice on urban transformative capacity strengthening, as it supports a phased 'building blocks' approach in resource-constrained contexts.

Highlights

- 'Inclusive and open governance' and 'transformative leadership' were building block capacities that enabled the initiation of Battambang's transformation processes.
- Committed and trusted intermediaries with long-term and place-based expertise played critical roles in the city's development of these early capacities.
- Capacities for experimentation and learning, and institutionalisation of a multi-stakeholder approach to governing its waste reform, were the next developed.
- Organisation of Wolfram's capacities framework into 'building blocks' more relevant in specific transformation phases – preparation, initiation, navigation and stabilisation

– enables tailoring of learning and reflection to the context and phase of the city's transformation.

Keywords: Transformative capacities, Sustainability transformations, Cambodia, Urban governance, Battambang

Policy and practice recommendations

- Based on Battambang's experiences, capacity development programs should support a phased approach to strengthening urban transformative capacities, especially in resource constrained contexts (such as lower- and middle- income countries).
- Resource constrained cities, for example in lower- and middle-income countries, are likely to require the presence of sustained intermediaries to develop transformative capacities and attract resources for urban sustainability transformations.
- Awards and recognition processes can motivate and inspire urban stakeholders to develop capacities and be frontrunners, for example, through "clean city" contests.
- Based on Battambang's experiences, capacity building is more likely to succeed where there is a culture of innovation and a relatively stable population and political-economy.

Introduction

In Southeast Asia, cities have declining liveability and a rising contribution to climate change due to rapid and unplanned urban development and increasing levels of urban resources consumption (Arfanuzzaman & Dahiya 2019; Dahiya 2014; Lehmann 2018). The sustainability challenges of fast paced urbanisation in Southeast Asia are experienced most prominently in secondary cities, because of their lack of urban planning and infrastructure investment (Arfanuzzaman & Dahiya 2019; Dahiya 2014). These challenges include increasing pollution, flooding, traffic congestion and housing shortages (Dahiya 2014). Within Southeast Asia, Cambodia is still at an early stage of urbanisation, with only around 24 per cent of Cambodia's population living in urban areas in 2020, but has experienced rapid urban growth over the last three decades (United Nations Department of Economic and Social Affairs (UN-DESA) 2018).

Urban development requires a reorientation towards sustainability transformation approaches, which can facilitate system-wide reforms oriented to address the existing ecological, social and economic conditions of cities (Wolfram et al. 2019). A transformation is a deep and sustained, non-linear systemic change, generally involving cultural, political, technological, economic, social and/or environmental processes (Linnér & Wibeck 2020). Within the lens of sustainability transformations, research has demonstrated that transformative capacities are needed to enable transformative planning and practices in cities (Wolfram 2016). However, there is currently limited research on the urban sustainability transformations of cities in Southeast Asia, especially in secondary cities (Lord 2020; Lord & Prior 2024). There is also limited research on urban transformative capacities in rapidly urbanising low-income countries, such as Cambodia (Lord & Prior 2024).

Within Southeast Asia, Cambodia has prioritised seven secondary cities for sustainable development and to manage the challenges associated with urbanisation, through the Sustainable City Strategic Plan 2020–2030 for Seven Secondary Cities (National Council for Sustainable Development (NCSD) et al. 2020). Under this strategic plan, the urban waste sector is prioritised for reform. Battambang city is one of the plan's priority cities, and it has experimented with new transformative planning and practices for urban waste. Battambang has been recognised by the Cambodian government and by the Association of Southeast Asian Nations (ASEAN) as an exemplar "sustainable city" and "clean city", due to its improvements in urban waste management.

In this paper, we aim to analyse the urban transformative capacities within the case study of Battambang's urban waste sector transformation, applying Wolfram's 'urban transformative capacities' conceptual framework, to understand the city's capacity strengths and the capacities to be strengthened to enable a full-scale urban sustainability transformation. We seek to answer the following question: "How are transformative capacities enabling urban stakeholders in Battambang, Cambodia to purposefully prepare for and initiate societal transformation processes for urban sustainability in waste management?".

Theoretical framework

Sustainability transformations involve large-scale societal changes to address major societal and ecological challenges, including urbanisation. Transformation implies fundamental changes in structural, functional, relational and cognitive aspects of social-technical-ecological systems that lead to new patterns of interactions and outcomes (Scoones et al. 2020). Transformation can either result from incremental, carefully planned interventions made by actors, or emerge through large-scale political-economic forces and social mobilisation (Fazey et al. 2017; Scoones et al. 2020). Herrfahrdt-Pähle et al. (2020) argue that transformations often evolve through multiple phases (preparing, navigating, and stabilizing) and across multiple levels (niche, regime to landscape). This theory draws on Moore et al. (2014) who have described the phases of a sustainability transformation as:

- *pre-transformation or triggers*, which can often be a perturbation or crisis,
- *preparing for change*: sense making, envisioning, and gathering momentum,
- *navigating the transition*: selecting, learning, and adopting, and
- *institutionalising the new trajectory*: routinisation, strengthening cross-scale relationships, and stabilisation.

When sustainability transformations are deliberately orchestrated within cities, they require urban transformative capacities to enable city stakeholders to facilitate the transformation processes and achieve the city's desired goals (Wolfram 2019a). "Transformative capacity", according to Ziervogel et al. (2016, p. 2) is "the capacity of individuals and organisations to be able to both transform themselves and their society in a deliberate, conscious way". Within cities, "urban transformative capacity" is defined by Wolfram (2016, p. 126) as "the collective ability of the stakeholders

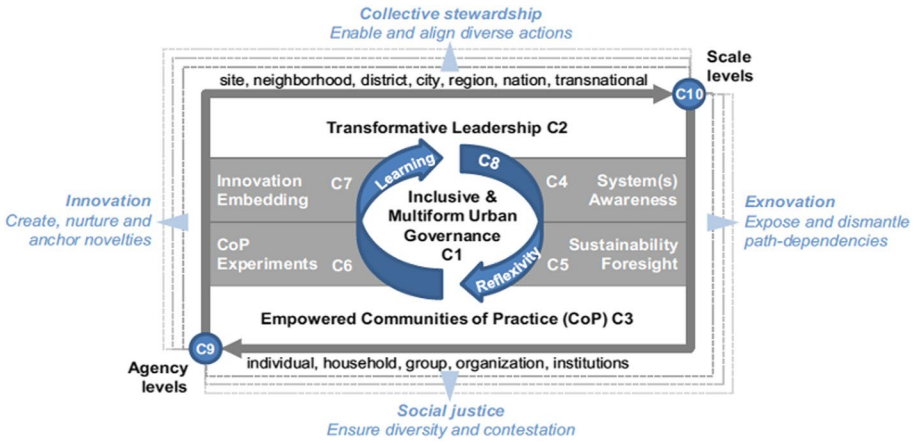

Fig. 1 Urban transformative capacities framework (source: Wolfram et al. (2019), modified from Wolfram (2016))

Table 1 Conceptual framework for urban transformative capacity—components (C1-10) (extracted from Wolfram 2016)

Component/ Capacity development factors	Subcomponents (where applicable)
C1 Inclusive and multiform urban governance	C1.1 Participation and inclusiveness C1.2 Diverse governance modes and network forms C1.3 Sustained intermediaries and hybridization
C2 Transformative leadership (in the public, private and civil society sectors)	
C3 Empowered and autonomous communities of practice (place-based and/or issue-driven)	C3.1 Addressing social needs and motives C3.2 Community empowerment and autonomy
C4 System(s) awareness and memory	C4.1 Baseline analysis and system(s) awareness C4.2 Recognition of path dependencies
C5 Urban sustainability foresight	C5.1 Diversity and transdisciplinary co-production of knowledge C5.2 Collective vision for radical sustainability changes C5.3 Alternative scenarios and future pathways
C6 Diverse community-based experimentation with disruptive solutions	
C7 Innovation embedding and coupling	C7.1 Access to resources for capacity development C7.2 Planning and mainstreaming transformative action C7.3 Reflexive and supportive regulatory frameworks
C8 Reflexivity and social learning	
C9 Working across human agency levels	
C10 Working across political-administrative levels and geographical scales	

involved in urban development to conceive of, prepare for, initiate and perform path-deviant change towards sustainability within and across multiple complex systems that constitute the cities they relate to."

Scholars have developed and applied a range of conceptual frameworks to analyse the transformative capacities required for urban sustainability transformations (Hölscher et al. 2019b; Webb et al. 2023; Wolfram 2016; Ziervogel et al. 2016). A widely used conceptual framework is Wolfram's "urban transformative capacities" framework, which identifies 10 key capacities with 18 sub-components that have been refined through empirical studies (Fig. 1 and Table 1) (Hölscher et al. 2019a; Shahani et al.

2021; Wolfram et al. 2019). The first three capacities (C1-3) refer to "agency and interaction forms" (governance modes), the next capacities (C4—C8) refer to "key development processes" which are applicable to specific sub-sectors/systems within cities, and the final two capacities (C9-C10) are the "relational dimensions" that affect all other capacities and enable transformations across multiple scales, sectors and agency-levels (Wolfram 2019a). We have selected this framework for our research as it is widely used, however it has been largely applied to developed country contexts (Peris-Blanes et al. 2022; Sarabia et al. 2021; Wolfram 2019a, 2019b). Applying the framework to rapidly growing part of the world, such as Southeast Asia, is crucial to determine transformative pathways for urban systems.

Case study context

Cities are prioritised by policy makers, planners and scholars as a key focus of sustainability transformation agendas as urbanisation is perceived as one of the biggest sustainability challenges of modern times (Bai et al. 2017). Cities are a major source of natural resources consumption and greenhouse gas emissions (60–80 per cent of global emissions) (United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP) 2017). Rapid urbanisation has been linked to rising urban economic inequality and has reduced the liveability of many cities, particularly for the poorest and most vulnerable urban residents (UN-ESCAP & UN-Habitat, 2019).

Cambodia has many urban sustainability challenges while still at an early stage of urbanisation. Cambodia's civil war in the 1970s and 1980s resulted in the near total depopulation of urban centres and the genocide of more than 3 million people (Simone 2008). Since 1991, Cambodia has been through a period of redevelopment, including rebuilding its urban infrastructure, institutions and human capital (Khemro 2006). Cambodia's recent urban growth has been the second fastest in Southeast Asia (UN-DESA 2018). Cambodia now has 28 cities including the capital Phnom Penh, which has more than 2 million people (Chan 2020) and around 25 per cent of the population lived in cities in 2023 (World Bank 2023). Secondary cities, such as Siem Reap, Battambang, Poi Pet and Sihanoukville are rapidly emerging, with populations of more than 100,000 (Chan 2020; World Bank, 2018).

Cambodia is an early adopter of urban sustainability policies and planning frameworks but faces some constraints with their implementation. Cambodia has a national policy framework of green growth, having adopted *a National Policy and Strategic Plan for Green Growth* in 2013, with an outlook to 2030. Cambodia developed a *Green City Strategic Planning Methodology* in 2016, with support of the Global Green Growth Institute (GGGI), and applied this planning methodology in the capital city and seven secondary cities (Chan 2020). However, there is a risk of these plans failing because of the challenges Cambodia faces with governance, shortfalls in budgets and insufficient technical capacities (Organisation for Economic Cooperation and Development (OECD) 2016; World Bank, 2018).

Cambodia's governance constraints stem from Cambodia's political history of conflict and the fragile nature of its institutions. Reforms have been initiated in Cambodia to support the decentralisation of government authority to municipalities, aimed at improving the efficiency and effectiveness of government infrastructure and services.

Cambodia's decentralisation processes have broadened municipal responsibilities but have not sufficiently delegated authority to them (Dahiya 2014). A fragmentation of ministerial and municipal responsibilities and overlapping roles has led to weak policy implementation and a low level of public service accountability in Cambodia's cities. Reducing corruption also remains a priority for general governance in Cambodia. In 2022, Cambodia was ranked 150 out of 180 countries by Transparency International's Corruption Perception Index. Scholars noted that corruption is part of the countries' institutional culture (Ong & Smith 2014).

Cambodia's municipalities often have insufficient financial resources to invest in urban infrastructure and urban development strategies. Municipalities do not have the authority to borrow directly from banks and are heavily dependent on financial assistance from central and provincial governments (OECD 2016). Tariffs for sewerage and waste collection services are often set at rate that is too low for the service provider to be financially viable in cities and it is difficult to increase these rates as the urban poor are unable or reluctant to pay (Dahiya 2012). There is a lot of free riding in the payments for the provision of urban services, as for example, only around 100,000 people in Phnom Penh (with a population of over 2,000,000) were paying for waste collection services (World Bank, 2018).

In addition, research has shown that Cambodian cities have significant technical capacity constraints which are contributing to the weak implementation of their city sustainability plans. There is currently poor implementation of urban environmental regulations and policies, because of Cambodia's weak law enforcement capacities and limited administrative feasibility (Arfanuzzaman & Dahiya 2019; Ong & Smith 2014; Spoann et al. 2019).

Battambang's waste sector reform

Battambang is Cambodia's second largest city with a population of around 120,000 in 2019, and has been prioritised by Cambodia's government under its *Sustainable City Strategic Plan 2020–2030 for Seven Secondary Cities (*NCSD et al. 2020*)*. Battambang's *Municipal Solid Waste Masterplan* (2022–2023) identifies several challenges in the sector: limited household and business participation in waste collection and management, weak storage and segregation, insufficient collection of waste and inadequate processing and disposal facilities (Battambang Municipality 2021). However, compared with other Cambodian cities, Battambang is considered a model example of cleanliness having commenced the implementation of waste reforms (UN-ESCAP 2021). In 2014, the city received an eco-town award from ASEAN for the quality of its environment.

Battambang has a complex network of stakeholders involved in the waste sector, which continues to evolve and has attracted international support for its waste reforms. At the centre is the Municipality and its office of Public Transport, Sanitation, Environment and Public Order, operating under Battambang's Municipal Governors and Council. The Municipality is directed by the provincial office of the Ministry of Environment, and directs commune ('Sangkat') administrations, and is funded through the Ministry of Interior. The Municipality has contracted two waste collectors: Cintri which works in eight Sangkats and Leap Lim which services two Sangkats and public places. There is also a private waste collector at the central market, and an informal waste collection

sector, known as *et chay*, with around 150–200 informal collectors in the city (Battambang Municipality 2021). Battambang has partnered with international development agencies, civil society organisations (CSOs) and academic institutions on these reforms.

Research method

We used a case study approach to analyse urban transformative capacities within Battambang, focusing on transformation of urban waste management. A case study enables the investigation of a contemporary phenomenon within its real-life context (Yin 2009). Our method is framed by an interpretivist paradigm, whereby we assume that our interpretation of the situation and the qualitative data collected can be different from the perspectives of others and is shaped by our own worldviews and experiences (O'donoghue, 2006).

Data collection

For our data collection, we held semi-structured interviews with 36 research participants, complemented by document analysis. Our interviews targeted urban stakeholders with a role in Battambang's urban planning and policy formulation and implementation, and urban program delivery. These stakeholders represented government and non-government organisations (see Table 2). The interviews were co-organised by national government officials from Cambodia's National Council for Sustainable Development (NCSD) within the Ministry of Environment, and an independent research assistant located in Battambang, enabling access to high-ranking officials. The interviews were held online (due to Covid-19 related travel restrictions) for 60–90 min between July 2021 and February 2022, with the assistance of a translator. We transcribed all the interviews, and audio-recorded only the non-government interviews, due to their potential sensitivity for government officials. For the interviews that were not audio-recorded, transcription was done in real time by both the interviewer and a research assistant (from NCSD), and consolidated post-interview, then reviewed by the translator.

As non-Khmer speaking researchers, we relied on the translation processes, and the translator's ability to grasp and communicate the essential meanings of the spoken words. Following the guidance of Björk Brämberg and Dahlberg (2013) on the role of interpreters in cross-cultural interviews, we involved our interpreter in the research cycle from the outset, including in the preparation of the interview discussion guide and in post-interview discussions to evaluate the translation processes and information gathered.

We used our discussion guides flexibly in our interviews and asked interviewees to discuss their role and experience in urban sustainability transformations of Battambang. We explained the concept of urban transformative capacities to the interviewees (using Wolfram's framework) and asked each interviewee to reflect on their experience with these capacities. We asked the interviewees to highlight key transformative initiatives in their city, and the initiatives highlighted by interviewees were focused on the waste sector (Table 3).

We collated and reviewed relevant policy, program, planning, and legal documents related to these initiatives and Battambang's development to complement the data obtained in interviews. We accessed these documents through the interviews and through online publications, using their English-language translations.

Table 2 Organisational categories of interviewees and their city focus (Battambang or national (multi-city))

Organisation category	National government	Provincial government	Municipality	International development agencies	Civil society organisation	Private sector	Cambodian university	TOTAL
Battambang		3	6	1	2		1	13
National role (multi-city)	13			4	1	4	1	23
TOTAL	**13**	**3**	**6**	**5**	**3**	**4**	**2**	**36**

Table 3 Key solid waste initiatives in Battambang (2019–2022)

Battambang Waste initiative	Initiative focus
United Nations Economic and Social Commission (UN-ESCAP) multi-stakeholder partnership for Sustainable Development Goal implementation	Project initiated new networks to address intractable problems in waste, bringing together National University of Battambang, Habitat for Humanity, municipal leadership, funding agencies with knowledge/expertise (UN-ESCAP and UN-Habitat) and Cambodian Education and Waste Management Organisation ('COMPED') They set up a women's entrepreneurship program for waste recycling, a plastics recycling facility, Battambang's Solid Waste Management Masterplan, and provided capacity building
Technology for Green Cities Program	Funded by US-AID, this project provides a smartphone platform for waste reporting, recycling, and greater transparency in waste services, through linking entrepreneurs, government, community and local youth ambassadors, creating improved waste governance
Asian Development Bank (ADB) Urban Sanitation program	This program has funded Battambang's new sanitary landfill site and wastewater treatment infrastructure, in partnership with the Battambang Provincial Government and Battambang Municipality
Konrad Adenauer Stiftung project	Project provided capacity building for design of local regulations in waste management, which introduced penalties, enforcement mechanisms, and empowered the Municipality to implement national waste management laws
GGGI Green Entrepreneur training program	Program provided coaching and facilitation to small recycling businesses, which have become financially viable and improved their operations, including their community education on waste

Data analysis

We de-identified the interview transcripts to protect the privacy of the research participants. We categorised the participants into groups based on their organisation, as per Table 2. We qualitatively analysed the interview transcripts using NVivo. Our coding was both emergent (identifying themes related to sustainability and transformations) and theory-based (coding for the capacities in Wolfram's framework). We compared the insights gained from the interviews to the findings of relevant documents collated, and prior research focused on urban development in Battambang and Cambodia.

The translation of documents and in verbal communications presents some epistemological challenges, due to the differences in the ways that the two languages and cultural systems describe and interpret concepts. Our qualitative analysis is therefore based on an approximation of the meanings and ideas communicated across cultures/languages.

Results

Amongst the ten transformative capacities of Wolfram's framework, Battambang city demonstrated strengths across all areas, particularly in capacities 1–6, which enabled the initiation of the sustainability transformation agenda in urban waste. Some capacity gaps were identified across all areas also, particularly on C4, C7 and C8. Table 4 summarises our key findings and is supported by more detailed analysis of transformative capacities below.

Table 4 Summary analysis of urban transformative capacity strengths and gaps in Battambang city, Cambodia

Transformative capacity component	Capacity Strengths	Capacity Gaps
C1 – Inclusive and multi-form governance	Battambang's Waste Management Masterplan was considered highly participatory and inclusive	Migrants and informal settlements found it difficult to be consistently engaged
C2 – Transformative leadership	Collective and inclusive municipal leadership was fundamental to progress, rather than being dependent on an individual leader (mayor)	Leaders were perceived as needing to be more adaptive given the current pace of technological change and urbanisation
C3 – Empowered and autonomous communities of practice	Multi-stakeholder partnerships addressed solid waste management challenges, including universities, CSOs, technology companies, Municipality staff, provincial officials, Sangkat officials, youth ambassadors, and international development agencies	Communities of practice have not always had access to the resources they need to meet the social needs, as their initiatives were often reliant on donor-funding
C4 – System(s) awareness and memory	New knowledge and awareness have been developed through open and inclusive dialogue about waste challenges, enabling stakeholders to identify mutually beneficial solutions	Strategic knowledge management needs also to be ongoing, with data being systematically collected and discussed to enable transfers of knowledge
C5 – Urban sustainability foresight	The city's overarching urban masterplan has created a long-term vision for the city's urban waste reform that has inspired and sustained its environmental improvements	The city's analytical capability for scenario analysis and envisioning of future pathways was not developed
C6 – Diverse community-based experimentation with disruptive solutions	Battambang's experiment with smart technology ("Green Cambodia" app) was disruptive in enabling recycling, reliable data, and accountability	Uptake of the smart application was limited by technology access and knowledge and has not addressed systemic problems preventing equitable waste collection services
C7 – Innovation embedding and coupling	A smart city agenda has been initiated providing additional resources towards waste sector transformation. New local regulations have been established and were enforced to provide context-specific solutions for waste challenges	Sustaining access to resources for capacity development has been challenging and remains a priority for system-wide transformations
C8 – Reflexivity and social learning	Open channels of communication were evident between government and non-government actors, enabling diverse formal and informal interactions. Mistakes of previous pilot initiatives were acknowledged, and lessons considered in designing new projects	The city had limited reliable monitoring and data on its waste sector. Partnerships with knowledge providers supporting learning and evaluation were ad hoc
C9 – Working across human agency levels	Public–private-civil society partnerships had formed and were supported by youth ambassadors from each village, systematically linking households, social groups, and different stakeholder organisations	Local administrations did not have strong experience working directly with households, for example, in educating households on waste separation
C10 – Working across political-administrative levels and geographical scales	The Municipality was effective in mobilising engagement at political-administrative levels within government, including at the most local scale and a city-regional scale	Inter-ministerial cooperation, while generally collaborative, did not extend to resource sharing

Capacity one (C1) – Inclusive and multi-form governance

Battambang city's governance of waste was perceived as a key strength by interviewees across each element of Wolfram's framework under C1, as discussed below.

C1.1 Participation and inclusiveness

Battambang Municipality was perceived by most interviewees as fostering inclusive and participatory governance and was generally perceived by donors as more collaborative and accessible than other Cambodian cities. This reputation for good performance was perceived as enabling the participation of international development agencies and CSOs in the city's waste sector transformation. Similarly, national government officials recognised that Battambang, unlike many other Cambodian cities, attracted technical and financial assistance because of its inclusive approach:

> *[In Battambang, their success was because of] participation, [and] the inclusive leadership of the city government; they are like one organisation (community, government, and private sector) that are working together throughout the processes of solid waste management.* ***– Ministry of Environment***

Interviewees highlighted that a tripartite trust-building arrangement underpinned Battambang's improved waste management system. First, community participation in waste management (and payment of waste collection fees) depended on their perceived trust in the quality of government services provided, and second, their confidence in the private waste contractors to fulfill their responsibilities. Third, in parallel, the Municipality and contractors needed to trust that households and businesses would be responsive to guidelines and regulations.

Battambang Municipality had facilitated and empowered a wide range of people to participate in the governance of its urban waste. With technical support from international development agencies, the Municipality designed local regulations on waste collection and management and disseminated these to Sangkats, villages, businesses, and households. The Municipality empowered Sangkat officials to lead the transformation of waste services and become locally responsible and accountable for the improved services. This was initially achieved through a pilot of two 'model Sangkats,' supported by national and provincial government agencies, to demonstrate best practices in waste services.

To ensure women's participation, the Municipality's Council assigned a Council member to be responsible for gender inclusive development and established consultative committees for women in each village. Informal waste workers, who were predominantly women, were proactively represented in the deliberative processes for designing the Waste Management Masterplan. The Municipality had received support from CSOs to engage with poorer communities and migrants in living in informal settlements. One interviewee outlined the engagement process:

> *We have a public forum, so the residents can talk about their feedback and their perspectives on the waste management. How the collection company is performing and how the authority is performing, and how their neighbourhood is performing on waste management. So, we bring this issue together and talk between the key actors, the resident, the company, and the authority, and we find the solution. It works. And we can*

develop more effective ways to hit the right issue. – ***Civil Society Organisation***

Some interviewees did note, however, that traditionally excluded stakeholders, such as migrants and people in informal settlements, found it difficult to be consistently engaged in urban strategic planning and problem solving, without the support of CSOs.

C1.2 Diverse governance modes and network forms

Diverse governance modes and network forms have contributed to the transformation of Battambang's waste management. Both formal and informal approaches to governance were perceived as necessary, as well as both centralised and decentralised networks.

The Municipality established formal structures for coordination across sectors and government levels. Under these structures, multiple stakeholders met regularly to resolve issues and guide the transformation across boundaries and sectors (see C3 below). Informal partnerships formed between the Municipality and informal businesses enabled the progression of key initiatives under Battambang's Waste Management Masterplan. For example, the Municipality provided space and facilities for a plastic recycling facility and an organic waste facility, which operated as unregistered businesses.

The Municipality's open communication style and willingness to work informally was perceived as unusual for official government interactions in Cambodia, which were generally highly restricted. One interviewee noted this approach received top-level support:

Now the environment of cooperation is changing.... The Governor is very open minded. He said it is okay related to waste management and the environment... there is no need to be formal always. Just connect informally. – ***Battambang Municipality***

C1.3 Sustained intermediaries and hybridization

Battambang Municipality attracted the support of intermediaries, including CSOs and local universities, to help them coordinate a wider range of stakeholders. These intermediaries helped to educate local decision-makers and community leaders (e.g., Sangkat Councils) on waste management and recycling options and build a sense of understanding, ownership, and responsibility for waste services. They also became knowledge brokers, bringing key individuals from different sectors and action domains together to consider how to implement a reformed waste management system.

The intermediaries facilitated visioning processes for the city and waste, and the formation of a formal multi-stakeholder partnership on the issue, authorised by the Provincial Governor. The intermediaries also provided direct training to waste workers on waste as a value and business development for recycling and facilitated public forums to enable residents to provide feedback and help resolve problems. These processes created spaces for open discussions between otherwise disconnected stakeholders, which helped to align different actors' interests and create a shared discourse. This led to the convergence of goals between stakeholders, as one interviewee noted:

I think somehow their own goals, when they come to sit down with different stakeholders, evolved into a broader or systematic goal. – ***Civil Society Organisation***

The open discussions enabled through the multi-stakeholder partnerships and facilitated by the intermediaries helped to resolve some of the challenges, as noted by an interviewee:

> *It is a lot of discussion, which builds a lot of understanding among the stakeholders on the issues, rather than just complaining about the waste management providers, rather than just complaining about the local authorities, and complaining about the citizens. When they bring up all of this together, they understand the challenges of each stakeholder in solving these issues. –* ***Civil Society Organisation***

Although intermediaries had relied mostly on ad hoc funding, these organisations managed to maintain a consistent organisational basis and long-term engagement within the city. An informal organic product recycling business, 'COMPED' contributed significantly to capacity strengthening of the local authorities and became a central partner for many international development agencies financing waste sector reforms in Battambang. The key strengths of this organisation were their consistent engagement over two decades and place-based engagement, led by key individuals acting as knowledge brokers and boundary spanners between sectors and action domains.

Capacity two (C2) – Transformative Leadership

Battambang's collective municipal leadership was perceived as a key capacity strength, leading to stable long-term reforms, rather than leadership being dependent on an individual governor or administrator. The Municipality's leadership capabilities of accountability, inclusiveness, open communication styles, and the ability to draw in technical and financial resources were also highlighted by interviewees as key strengths.

Effective and collaborative communication approaches were perceived by interviewees as a key part of their transformative leadership style. As one interviewee noted that the leaders "keep everyone happy to work with them", and that, "the authority [Battambang Municipality] is very open and has strong support." Municipal leaders expressed that they felt responsible for communicating an inspiring vision of transformation to mobilise public participation in an effective waste system. This leadership style was perceived as unique compared to traditionally top-down approaches in governments of Southeast Asia.

The Municipality's reputation for being a model "clean city" became positively self-reinforcing, supporting continuous improvement in urban governance. Becoming a "model city" changed the perception of the Municipal Council, as one Municipal Councillor noted, "we get the feedback is that our city government pays high attention to the public issues; and we increase our service level". A positive feedback loop had therefore been created.

The city's leadership team actively sought out learning opportunities to strengthen their capacity. Municipal staff interviewed acknowledged the considerable technical assistance they received from development agencies, who supported their skills development through on-the-job training. Interviewees highlighted that Battambang's municipal officials were the first in Cambodia to develop local regulations for the enforcement of laws on solid waste management because of their technical

competencies. One interviewee suggested that overseas education of these competent officials had shaped their leadership qualities:

> *The Deputy Officer [of Battambang Municipality] was educated in Japan, related to solid waste management, and I can see the burning heart to achieve this, from his education. That is why I give so much into the training and capacity itself, because the capacity building is not just the knowledge building but also the inspiration building. We were fortunate to have this guy who is so willing to lead all the challenges."* – **Civil Society Organisation**

One of the constraints highlighted by interviewees to the city's leadership style was the need for the leadership to be more adaptive given the current pace of technological change and urbanisation. Some interviewees noted that the leadership needs to be more responsive to the fast-changing environment, particularly to draw on digital knowledge.

Capacity three (C3) – Empowered and autonomous communities of practice

Empowered and autonomous Communities of Practice (CoPs) were established through multi-stakeholder partnerships focused on Battambang's waste sector reform. Through multi-stakeholder partnerships, the Waste Management Masterplan was designed, and the Technology for Green Cities program was implemented. These multi-stakeholder partnerships were led by the Municipality, and brought together public sector representatives across multiple levels, private sector, CSOs, international development agencies, local university, youth volunteers, and community representatives (including from informal settlements) into the decision-making processes and strategic planning. These CoPs used a combination of private discussions and large group meetings between stakeholders in deliberating options. They are also part of a nested set of CoPs, focused on the waste sector reforms in Cambodia operating at national and sub-national levels, culminating in an annual National Waste Summit to exchange knowledge and experience.

The diverse membership of the CoPs helps to address barriers to transformation of the waste sector through leveraging each organisation's strengths. One interviewee highlighted:

> *The main advantage is that we can bring the public sector, the university, and the private sector together. In the past, the NGO worked with the private sector, or the NGO worked with the public sector.* – **Cambodian university**

However, these CoPs also needed to integrate the waste collection companies that had not actively engaged in the first phase and are central stakeholders in the waste sector.

Elements of C3 under Wolfram's framework are discussed below.

C3.1 Addressing social needs and motives

In designing the Waste Management Masterplan, social needs and motives were analysed and deficits in meeting them were identified through the planning process. The Masterplan and its supporting survey analysis, includes data on, and provisions for,

Battambang's urban poor informal settlements, which were previously excluded from accessing public services.

The process for setting the vision for the Waste Management Masterplan was deliberative and inclusive to address social needs, with representatives from poorer informal settlement communities directly involved in visioning workshops. A local Cambodian university acted as an intermediary and knowledge broker between stakeholder groups in forming the vision and undertaking the strategic planning processes, and its representative interviewed noted:

> *We have a separate meeting with the informal settlement group, community leaders, and for the government and private sector, to ensure that we get all the voices and all the knowledge from the stakeholders, especially from the poor community* **– Cambodian university**

The Masterplan prioritised the establishment of a community-based recycling 'Waste Bank' because of its potential benefits to the city's poor and informal communities. The Masterplan also addressed the waste collection companies' needs, by prioritising improved working conditions for its staff, and enforced payment of waste collection fees.

C3.2 Community empowerment and autonomy

CoPs do not currently have sustained resources to provide full autonomy. Access to resources for the CoP activities has largely been dependent on donor funding, including for events, workshops, capacity development and knowledge sharing. While there was evidence that the CoP continued to engage informally when the resources from donors ceased, it was expected to become more challenging to continue engagement without donor funding in a resource-constrained environment. Interviewees also noted that government funds were difficult to secure for resolving social and environmental problems through CoPs, especially as funds have been diverted to address the COVID-19 pandemic.

Capacity four (C4) – Systems awareness and memory

Systems awareness and memory were being developed amongst city stakeholders in the transformation of Battambang's waste sector, and elements of this transformative capacity (C4) required further development, as discussed below.

C4.1 Baseline analysis and system(s) awareness

Baseline analysis and systems awareness have been supported through several donor-funded studies in Battambang. These studies document the barriers and drivers of ineffective waste management and knowledge about the potential change dynamics. However, one interviewee noted:

> *The development partners are also playing a role to bring evidence… – they have done an excellent job in the past. But some knowledge product needs to be more widely disseminated or circulated and find ways to inject the knowledge into the leader of the Ministry. –* ***International development agency***

Furthermore, in these studies, governance structures, institutions and stakeholder conflicts have not yet been subject to dedicated analysis.

Interviewees noted that the discussion on the waste issues within the CoP had led to a greater system-level awareness, and opportunities to resolve the challenges to be jointly developed. The Municipality had initiated learning processes to improve waste management, and some municipal officials acknowledged the failures of past pilot projects and the lessons they learned from these failures in the interviews. However, the pace of learning was considered by some interviewees as too slow. One interviewee noted:

> *I think they [the Municipality] learn well from the past… But the speed of development in Battambang, with influences from other parts of Battambang, and with national growth, is faster than what they have learned.* – ***Civil Society Organisation***

Strategic knowledge management needs to be ongoing, with data being systematically collected, analysed, and discussed to enable transfers between different forms of knowledge and over time. Battambang's Waste Management Masterplan established a monitoring cycle (see C8), but whether this will be sufficient depends on its implementation and its resourcing. Interviewees noted that more digital knowledge and data is needed to track changes and learn. For example:

> *If we do not use the data and digital knowledge, we cannot cope with the rapid increase of urbanization in Battambang.* – ***Cambodian university***

C4.2 Recognition of path dependencies

Battambang's institutions and regulations were generally considered by interviewees as flexible and could be updated to address the barriers to an effective waste system, based on improved knowledge of path dependencies. A few interviewees said that limited awareness amongst some businesses and communities of the benefits of waste management, was constraining their participation in necessary reforms. However, this was not the majority view, as most interviewees noted that Battambang had strong business and community participation and that their practices were changeable based on their improved knowledge.

Capacity five (C5) – Urban sustainability foresight

Battambang's urban stakeholders demonstrated sustainability foresight through co-producing knowledge about future urban developments, including an explicit future vision for Battambang to become a city with harmonious integration between the economy, culture, and nature. Elements of C5 are further elaborated below.

C5.1 Diversity and transdisciplinary co-production of knowledge

The collaborative processes of co-production in the master-planning processes led to transformative ideas being developed, and innovative interventions becoming financed. One interviewee noted:

> *Before there were no ideas, and no ways that the private sector could contribute…*

> *And at the commune or the Municipality, sometimes they know what the problem is, and they also know what the solution could be, but [they did not know] how to turn that problem into solution, into a project document, into a framework that mobilizes resources… But from this [collaboration], it brings them to open their eyes and see another step of collaboration that they can do together, and see their capacity needs, which they can work on together further. –* ***Cambodian university***

As discussed in C3, the diverse membership of Battambang's waste sector CoP, enabled new knowledge to be co-produced and the vision-setting process for the city to be deliberative and inclusive. This co-production process enhanced the feasibility of the waste interventions prioritised in the masterplan, as one interviewee noted:

> *When they [officials] come to sit down with different stakeholders… they are willing to take extra steps to ensure that their goals can be implemented also by other stakeholders… we call it 'implementable goals.' –* ***Civil Society Organisation***

C5.2 Collective vision for radical sustainability changes

A vision of the city being "clean" and "green" and maintaining its status as a model ASEAN eco-town had sustained its transformative waste reforms and is embedded in its overarching Urban Land Use Masterplan. This vision was widely shared by interviewees and had a motivating effect on stakeholders, especially the municipal officials, who perceived it as their responsibility to ensure the vision inspires behaviour change. One official noted:

> *I would like to stress… that the clean city should start from the city government – we need to ask the citizens what to do to address this vision, as the regulation alone is not enough. –* ***Battambang Municipality***

Interviewees highlighted that the vision-setting process for the Waste Management Masterplan was also influenced by global sustainability agendas. One interviewee noted:

> *We would like to highlight the context of the sustainable development goals for 2030 of the United Nations; this is the vision which we are moving forward towards.* ***–Civil Society Organisation***

Others emphasised that the vision stemmed from the inclusive consultation processes. One interviewee noted:

> *We developed the vision together for Battambang Municipality… We have a separate meeting with the informal settlement group, community leaders, and for the government and private sector, to ensure that we get all the voice and all the knowledge from the stakeholders, especially from the poor community. –* ***Cambodian university***

C5.3 Alternative scenarios and future pathways

The CoP did not explicitly develop scenarios of future urban development in their Waste Masterplan design process; however, they considered and ranked options to improve

waste management using multi-criteria analysis, following their collective root-cause analysis of the waste resource challenges. Developing the analytical capability within the city for scenario analysis and envisioning of future pathways is a potential area to strengthen.

Capacity six (C6) – Diverse community-based experimentation with disruptive solutions

Battambang's increased experimentation over time in its waste sector enabled it to adapt its management approaches to the local barriers/challenges and design innovations that were transforming cultures, institutions, governance, markets, and technologies.

After several unsuccessful interventions seeking to educate the community and businesses on waste management in Battambang, the introduction of the "Green Cambodia" application was considered by interviewees as transformative. The application enables residents to report on whether waste collection is going to schedule and report on illegal waste dumping, so that the Municipality can respond to the feedback. It also created a marketplace for recycled products. It was considered disruptive as it enhanced accountability on waste collection and supported the enforcement of waste regulations.

Through the Technology for Green Cities program, university students and entrepreneurs had been mobilised as volunteers and raised awareness at a village-level on how to use the "Green Cambodia" application. However, the uptake of the application was limited by technology access. Interviewees acknowledged that around 75 percent of residents were not using it at the time, and that it did not address systemic problems preventing equitable waste management services.

Battambang's experimentation with governance (see section C3) was also considered disruptive to traditionally top-down and non-transparent governance structures. It opened the planning processes and resource prioritisation to traditionally excluded stakeholders.

Capacity seven (C7)—Innovation embedding and coupling

A smart city agenda had been initiated to embed the waste reforms in Battambang, providing additional resources, and new local waste regulations were embedded in local enforcement mechanisms. However, it was unclear whether these reforms and the new governance arrangements supporting innovative collaboration on waste will be sustained without ongoing donor funding (see C3.2). Elements of C7 are further elaborated below.

C7.1 Access to resources for capacity development

As a lower middle-income country, government budgets for capacity development in Cambodia are constrained, particularly at the Municipality level. One interviewee noted:

> *"It is a big challenge to obtain the funds to implement the priority activities… we have a very thin budget… [it] is around 10 million riel [~USD 2,420] [in 2021]. It is a small amount to implement the sustainable city program."* **– Ministry of Environment**

With the decentralisation of responsibilities from national ministries to municipalities, interviewees highlighted that budgets have not been sufficiently transferred, and

municipalities had limited budgets to implement their plans and develop capacities. One interviewee noted:

> *According to all the decentralisation rules, everything is supposed to be decentralised to the municipality, except that in real life they don't have much power and they have a very tiny budget. They are not even allowed to manage the budget they receive. When a municipality gets $50,000 from Ministry of Environment for waste management, they are not allowed to touch it. They have to pass it on all to a private contractor. –* ***International development agency***

Compared with other cities in Cambodia, Battambang has been effective in attracting donor funding to strengthen their capacity. However, Battambang's transformation agenda is likely to remain donor dependent without substantial changes in local resourcing models for waste. Some interviewees highlighted that the city's new approach to waste governance, opened opportunities for businesses to provide greater resources through public–private-partnerships, facilitated by intermediaries. One interviewee identified that this capacity needs further strengthening, noting:

> *The challenge is that it needs someone to help the city to generate the ideas and formulate the idea into an attractive proposal for the private sector, otherwise they just donate an amount or donate to an activity.… But the situation is that it is hard for the city to do that. They need someone to turn the city ideas into an attractive proposal for the private sector. –* ***Cambodian university***

Some interviewees emphasised that a "user pays" or "polluter pays" concept has not worked well in Cambodia's resource-constrained environment, as the urban population is reluctant to pay their waste collection fees. Interviewees suggested that waste management is fundamentally an environmental "public good", and this public good is not a financial priority for the residents. With less customers paying fees, the waste collection companies were less financially stable. Therefore, Battambang's waste reforms to date depended to a large extent on public funding, including from international donors.

C7.2 Planning and mainstreaming of transformative action

The city's Waste Management Masterplan, published in 2021, endorsed multi-stakeholder partnerships and inclusive planning processes as the main governance mechanism, mainstreaming transformative governance. Interviewees also highlighted that Battambang Municipality has cleverly linked the city's waste sector transformation agenda to a broader smart city agenda of the Cambodian government and ASEAN, to mobilise additional resources. The Municipality continues to seek donor and technical support to implement its work program and as discussed in C3.2 above, sustaining Battambang's transformation will require ongoing funds for its CoP and the projects prioritised under its masterplan.

C7.3 Reflexive and supportive regulatory frameworks

Battambang developed a model regulatory instrument to clarify responsibilities for waste management and enable enforcement of national environmental laws, which has subsequently been replicated in other Cambodian cities. These regulations align with

the city's transformative vision and have helped to remove some of the barriers to effective waste management. Pilot projects implemented in tandem with the enactment of new regulations and masterplan (e.g., for community-based waste segregation and recycling), have removed the some of the barriers to transformation.

Capacity eight (C8) – Reflexivity and Social Learning

Battambang was developing the transformative capacity of reflexivity and social learning. Stakeholders demonstrated reflexivity throughout our interviews, by reflecting on their own capacity strengths and gaps. Research participants reflected on why past projects were unsuccessful and expressed a strong interest in systematic data collection and management to improve decision-making. Interviewees also highlighted that the diverse formal and informal interactions between urban stakeholders enabled learning. One interviewee noted:

> *Informally, we always discuss the challenges – even though we have the [formal] framework… So informally we share information that needs to have an innovative approach… to ensure that we can solve these bottlenecks. –* ***Civil Society Organisation***

Battambang's new Waste Masterplan also establishes a framework for reflection and learning – the "Plan, Do, Check, and Act cycle" – and commits to strengthening efforts towards data generation and monitoring, to underpin decision-making and project management. Therefore, while there was limited reliability of existing monitoring processes and data, and partnerships with universities and other knowledge providers were ad hoc, Battambang's key stakeholders were motivated to strengthen this capacity.

Capacity nine (C9) – Working across human agency levels

As discussed in C3, Battambang's new CoP had worked across human agency levels, empowering youth ambassadors, local officials, and technology entrepreneurs to develop capacities on waste separation and management. Interviewees observed that it was the work occurring across multiple agency levels that made Battambang's reforms transformative. When asked about Battambang's key success factors, one official noted:

> *First, I have observed that the leadership is great – the board of governors in Battambang – they pay attention to their duties… Second, they have partners… which help them to succeed. Third… the citizens are active in Battambang… and fourth, the private sector is also good. In short…. They are like one organisation (community, government, and private sector) that are working together… –* ***Ministry of Environment***

Interviewees also highlighted capacity constraints faced at Battambang's village-scale administration, which was tasked to support households to introduce the new waste regulations. Local officials found it challenging to motivate behaviour change and inspire public participation in waste management, whereas the volunteer youth ambassadors and CSOs had more experience in fostering participation. It was therefore only through

multiple stakeholders collaborating across agency levels that transformative results were achievable.

Capacity ten (C10) – Working across political-administrative levels and geographical scales

Transformative capacities are being developed across political-administrative levels in Battambang, and across geographical scales (village-commune-city-province) (see C1). Interviewees highlighted the Provincial Government was important in driving integration. One official noted:

> *We depend a lot on the provincial government for both horizontal and vertical coordination – they are the highest authority, and they can call everyone to cooperate… committees are set up for a complicated work, for technical aspects and get everyone to provide a contribution.* – **Provincial government, Battambang**

Achieving such integration is dependent on the political agendas of the government stakeholders involved, including their willingness to share resources. Battambang city had been held up as a successful case in transferral of the Ministry of Environment's solid waste management functions in 2015 from to municipalities, because of the effective cooperation between political-administrative levels. One interviewee noted:

> *Battambang city was the first the city to receive the budget support from the Ministry of Environment for piloting the model Sangkat… the Department of Environment worked closely with the city to provide the technical support to the local level.* – **Provincial government, Battambang**

Some interviewees highlighted, however, that there were circumstances where cross-sector collaboration had not yet extended to the integration of resources. One noted:

> *I wanted to have one initiative where the ministries would come together. For example, [relevant] Ministries would create a special working group… on solid and wastewater treatment… So far, this idea has not been achieved.* – **Provincial government, Battambang**

Overall capacity development and next steps for transformation

Battambang's waste sector transformation is still underway, having emerged from the preparation phase through to a navigation phase. For the transformation to stabilise, as full-scale transformation, it will require system-wide reforms, scaling out some of the successful initiatives and embedding innovations in governance and practices. Transformative capacities to be developed to enable this in Battambang, include innovation embedding and coupling (C7), capacity for working across human-agency levels (C9), and capacity to work across political-administrative levels (C10). Additional key stakeholders will also need to be more actively involved in the transformation, particularly the city's waste collection companies, strengthening the city's inclusive and multi-form governance (C1).

In the following section we discuss our reflections on the conceptual framework used, and the key policy and practice implications of our research.

Discussion

Overall, first, we found that in applying Wolfram's framework in a resource-constrained context of lower- or middle- income countries, it would be beneficial to have a 'building block' approach to the transformative capacities, with sequencing of capacity strengthening. It is often too challenging in the context of low-income countries for all capacities to be developed simultaneously, and some capacities can become precursors to development of other capacities. Second, we learned that sustainability recognition and reward systems were a key enabler to strengthening of transformative capacities in Battambang, particularly for transitioning from the initiation to navigation phase of the transformation. These recognition and rewards systems could be integrated into the conceptual model for urban transformative capacities, alongside other enablers of urban sustainability transformations (Webb et al. 2023). Third, we found that the relative social-economic and political stability of Battambang city contributed to their success with capacity development and urban sustainability transformation. We discuss these points in more detail below.

Using a 'building block' approach to transformative capacities in lower-income settings

Although we identified a range of capacity strengths in Battambang, we found that Wolfram's comprehensive suite of urban transformative capacities appeared to set a high benchmark for transformative capacity development, for the resource constrained context. Refinement of the framework for lower-income countries, would provide a more nuanced approach. In particular, the capacities could be presented as 'building blocks', focusing on specific capacities needed in each transformation phase, such as preparation, initiation, navigation and stabilisation, aligned to Herrfahrdt-Pähle et al. (2020). A phased approach would help this capacity framework become more meaningfully integrated into systematic review cycles of interventions targeting sustainability transformations, by focusing on different transformative capacities at each phase of learning and evaluation. We have summarised how transformative capacities developed incrementally as building blocks in Battambang, as an example (see Fig. 2).

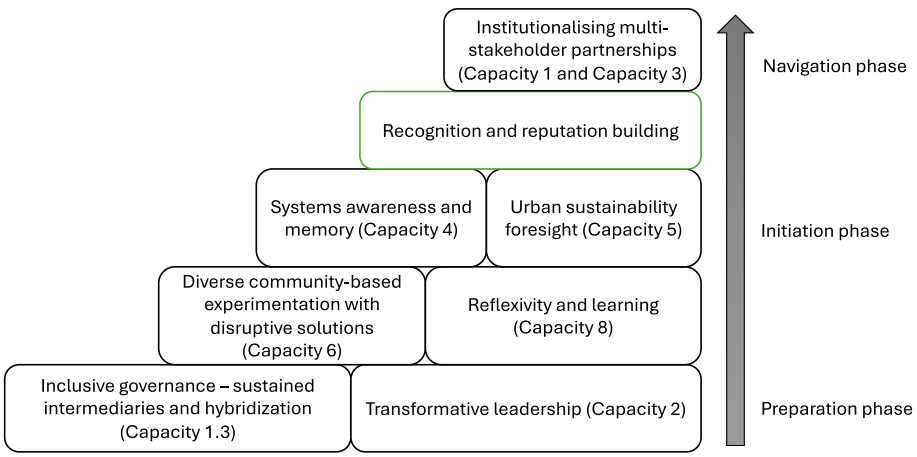

Fig. 2 Building blocks of transformative capacity development in the first phases of urban sustainability transformation in Battambang, Cambodia

There we mapped these capacities to the phases of the transformation (Fig. 2),

Preparation phase – trusted intermediaries and inclusive municipal leadership

The sustained engagement of committed and trusted intermediaries (capacity 1.3) was foundational to the Municipality's strengthening of its capacity and enabled ongoing experimentation and capacity development. Similar to the study of transformation in Philadelphia by Argyriou (2020), we found that the intermediaries in the Battambang case played a critical role as trust brokers between stakeholders to facilitate the transformation processes, and they relied on an inclusive municipal leadership (capacity 2). Wolfram (2019a) also found that nurturing the role of trusted intermediaries was a key leverage point for urban transformations, as these organisations understand the specific needs and value sets of various stakeholders and they have social networks and skills that are often not widely available in the public sector.

Preparation transition to initiation phase – piloting and meta-learning

Systems awareness (capacity 4) and sustainability foresight (capacity 5) were developed in Battambang's initiation of its sustainability transformation through a wide range of pilot projects on waste (capacity 6). Through reflections and internal learning (capacity 8) on these projects the Municipality and its key partners became increasingly knowledgeable on their place-based constraints and opportunities for sustainability transformation and integrated this knowledge into their Waste Management Masterplan. As found in Wolfram (2019b), developing social learning processes for governance learning ("meta-learning") was important for building systems awareness, and integrating knowledge gained from these pilots into new policies and initiatives. As seen in Keeler et al. (2019), the local universities' involvement in multi-stakeholder governance, was important for creating a space for meta-learning to become systematic and more effectively integrated into the waste reform planning processes.

Navigation phase – Institutionalising multi-stakeholder partnerships

The Battambang case study demonstrates that the institutionalising of complex multi-stakeholder governance arrangements (capacities 1 and 3) was critical for the navigation phase of its urban sustainability transformation. These partnerships often require a diversity of actors and multi-level governance structures that are supported by tools for collaboration and knowledge transfer (Borgström, 2019). Where pilots or innovations are occurring in isolation without connectivity to wider web of stakeholders, it becomes difficult to shift regimes across organisational, institutional and technological dimensions (Argyriou 2020). On the other hand, while governance often becomes more complex with transformations, governance arrangements should not become more incoherent and fractured, as this can create overlapping roles and responsibilities, and ad hoc short-term solutions (Yasmin et al. 2018). A fine balance needs to be struck in these governance structures, allowing a diversity of actors' representation, while still creating connection and coherence between them.

Recognition and reputation building as a trigger for regime change

Battambang's recognition by the Cambodian government's "Clean City" award, and the ASEAN "eco-town" awards became a motivating force for ongoing transformative reforms in Battambang, particularly in the transition from the initiation to navigation phase (see Fig. 2). This recognition shaped the city's vision, strengthening their capacity for sustainability foresight and transformative leadership, and was perceived as motivating behaviour change of the Municipality and the community. Battambang's ranking as one of Cambodia's cleanest and most sustainable cities, and its reputation as a pioneer for national policy reform and innovation, shaped it overall approach to urban planning and waste management (Diepart et al. 2016; Han & Lim 2019). In Battambang, where the Municipality was motivated to be a frontrunner and were willing to innovate, they were more likely to embed innovation and achieve transformative changes at a regime level.

There are potential advantages and disadvantages of recognition and award systems in inspiring transformative urban capacity development. On the one hand, drawing from entrepreneurship literature, reward systems have been useful in business, as they have been found to strengthen the competitive advantages of firms in strategic management (Correia et al. 2023). Similarly, recognition and reward systems for urban sustainability have the potential to help to inspire a city's motivation to transform, across multiple governance levels – community scale, municipal, national, and trans-national. On the other hand there can be a dark side of award and recognition systems for both individuals (reducing post-award performance) (Li & Lu 2022) and for cities (when the awards are lacking credibility and the reality of the city is not reflective of the award) (Avery & Moser 2023). For example, the labelling of Cambodia's capital, Phnom Penh as a "green city" has been found not to reflect the reality of urban planning practices (Bertrais & Beckwith 2024). Similarly, in Battambang, our research found that that despite the city's innovation and progress, there are still capacity gaps and constraints, making the reality different from its model 'sustainable/eco city' status. In particular, while CoPs have been established, key actors in the waste sector, such as the waste collection companies, are not actively participating in these, and they do not have sustained resources to continue outside of donor funding.

Noting the potential downsides, we found that from a motivating and behaviour change perspective, sustainable/eco city awards have served a useful function in the case of Battambang. Such award systems can be recognised as a trigger or enabler for urban systems transformations, and integrated into frameworks such as Wolfram (2016) and Webb et al. (2023). Further research should draw on Avery and Moser (2023), and consider how these award systems can ensure credibility, while inspiring behaviour change.

Importance of relative political-economic stability in enabling capacity development

Local factors and place-based conditions shape urban transformative capacities, including the city's previous historical trajectory, culture, identity and narratives (Peris-Blanes et al. 2022). With an agricultural-based economy, the province of Battambang has had a more stable population and is less impacted by an influx of tourists and migrants and, compared with Cambodia's border towns (e.g., Poipet and Bavet) and tourist cities (e.g., Siem Reap and Sihanoukville). The city's political economy was also perceived as stable

by interviewees, who noted that even with changes in governors, the administration maintained responsiveness and accountability to deliver public services. Hence, this overall stability – in population and political-economy – became an enabler for Battambang's transformation. This finding contrasts with that of Herrfahrdt-Pähle et al. (2020) whose research highlights that socio-political shocks can provide opportunities for sustainability transformations, in cases where the niche level has innovative solutions being developed in parallel with new pressure from the landscape level to address unfavourable developments. We found instead that the relative social-political stability of Battambang enabled the city to attract partners, innovation and resources for experimentation and transformation.

Research limitations

A limitation of our approach was that we were not able to directly interview urban residents, including those from marginalised groups. Further, many of the research participant's organisational resources were also tied to financing from national and international programs for sustainable city development, which could mean that they had exaggerated their successes (in some cases, unconsciously). Other studies in Battambang have shown that marginalised communities have been excluded from formalised governance institutions and planning processes (Thuon 2021; Thuon & Cai 2019). While we note that we sought to include a balanced mix of research participants in our study, our data collection could be strengthened through inclusion of a wider range of participants and in-country data collection which would enable access more marginalised communities.

Conclusion

In this study, we have applied Wolfram's transformative capacities framework to analyse the preparation and initiation of the sustainability transformation of Battambang's urban waste system. We found that early building blocks for transformation were the city's inclusive governance and leadership, and the presence of committed and trusted intermediaries supporting the transformation processes. The next building blocks to initiate the transformation were: increased experimentation and learning, recognition and reputation building as a model city, and institutionalising communities of practice. Navigation and stabilisation of the Battambang's urban waste system transformation will require strengthening of most transformative capacities, particularly innovation embedding and coupling (C7) and reflexivity and social learning (C8). Battambang's capacity strengths were underpinned by its administration's culture of being a frontrunner and appetite for innovation, and by its relatively more stable population, economy, and political settings.

We found that a phased approach to reviewing transformative capacities could better support the application of Wolfram's framework as a tool for learning and evaluation, especially for capacity constrained contexts, such as low-income countries. Moreover, we found that the framework could be expanded to incorporate more enablers of transformative capacities. We have highlighted the enabling role of sustainability recognition and reward systems, in supporting transformations, as a key example from Battambang. The paper offers direction in how to expand the framework of transformative capacities towards a building blocks approach to support research and policy into urban transformations.

Abbreviations

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
COMPED	Cambodian Education and Waste Management Organisation
CoP	Communities of Practice
CSO	Civil Society Organisation
GGGI	Global Green Growth Institute
NCSD	National Council for Sustainable Development
MoI	Ministry of Interior, Government of Cambodia
OECD	Organisation for Economic Cooperation and Development
UN-DESA	United Nations Department of Economic and Social Affairs
UN-ESCAP	United Nations Economic and Social Commission for Asia and the Pacific

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Declarations

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