This is an Accepted Manuscript for *Global Sustainability*. Subject to change during the editing and production process.
DOI: 10.1017/sus.2024.22

Why Not in My Backyard? (W-NIMBY): The potential of design-driven environmental infrastructure to foster greater acceptance among host communities

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Word count

Main text (including abstract, excluding figures, tables, boxes and references): 2968 words (plus Appendix).

References: 51

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Non-technical abstract (92/100 words max)

While environmental infrastructure is commonly understood as important, there are concerns about issues such as air, noise, and visual pollution, causing "Not In My Backyard" (NIMBY) attitudes. NIMBY-ism can be overcome by minimizing or removing pollution and inviting residents and other stakeholders to enjoy multifaceted benefits of such environmental infrastructure projects. This can foster a new maxim coined as 'W-NIMBY' (Why Not In My Backyard?), which manifests in new infrastructure shaped by community needs and supports sustainability agendas. The present intelligence brief provides insights from Japanese cases into how to promote W-NIMBYism.

Technical Abstract (192/200)

Environmental infrastructure is essential for the common good. Addressing sustainability crises and fostering environmental movements require accelerated deployment of environmental infrastructure. While such infrastructure is necessary, Not In My Backyard (NIMBY) attitudes have remained due to concerns such as air, water, and noise pollution.

We present insights from three atypical cases in Japan and argue for the reimagination of the connection between affected residents and environmental infrastructure. The three facilities were designed to be multifunctional and open for the surrounding community to enjoy. We call for participatory approaches and multifunctional use of space that can account for the interests of affected and concerned citizens.

Such a conceptualization can lead to 'W-NIMBY' (Why-Not In My Backyard), manifesting new infrastructure that is shaped by community needs and supports sustainability agendas. Through such approaches, citizens may accept and even take pride in hosting the infrastructure. In this intelligence brief, we argue that refashioning environmental infrastructure provides broader access for local stakeholders and helps in building a connection between citizens and the environmental infrastructure. Through design approaches that foster W-NIMBY, implementation of environmental infrastructure could be accelerated while supporting community needs and the broader sustainability agenda.

Social media summary (115/120 characters or less)

Why Not in My Backyard? (W-NIMBY): The potential of design-driven environmental infrastructure to foster greater acceptance among host communities.

Keywords

Environmental infrastructure, Renewable, Waste management, Transformation, Design

https://doi.org/10.1017/sus.2024.22 Published online by Cambridge University Press

1. Introduction: NIMBY and a call for W-NIMBY

The scientific community has raised alarm bells for issues associated with climate change and pollution. Future Earth's Global Research Networks have developed numerous scientific publications (Future Earth, 2022, 2023) that highlight a need for system change through policy implementation (Martin et al., 2021, 2022; Pihl et al., 2021) on what should be done in order to preserve planetary and human health (Ebi et al., 2020). Sustainability transitions require enabling policies and their implementation, including the construction of new infrastructure for renewable energy, recycling, and hazard management, among others. Yet, "Not In My Backyard"-ism (NIMBY-ism) has been a challenge in building such infrastructure, as it can be seen to bring fewer benefits and more costs to the community hosting it (Elliott et al., 2004; Ellis, 2004). "Environmental infrastructure" that supports sustainability transformations, such as those for solid waste management and renewable energy production, also elicit NIMBY-ism, as they are seen by the host community to reduce the attractiveness of the area or cause pollution. Consequently, this delays the implementation of sustainability efforts.

NIMBY-ism could be motivated by two concerns: (1) location and (2) technology. NIMBY describes the resistance of communities to changes in land use and construction in their area (Borell & Westermark, 2018; Dear and Taylor, 1982; O'Hare, 1977 and Takahashi and Dear, 1997). Dear and Taylor (1982) and Takahashi and Dear (1997) note that, in many instances, NIMBY refers to resistance to infrastructure in one's own locality or neighborhood, with no qualms about the infrastructure itself. After 2000, Sjöberg & Drottz-Sjöberg (2011) and Wolsink (2006) identified protests due to technological and environmental protection reasons, for example, protests against nuclear plants due to safety and environmental concerns.

NIMBY has been noted in waste management infrastructure, the rise in urbanization, and the resultant waste management generation that has led to the construction of landfills and the negative attitudes toward them. The change in consumer trends and increase in recycling have neither negated the need for nor assuaged the negative feelings regarding such infrastructure, as pointed out in various cases from the United States and Japan (Ishimura & Takeuchi, 2018; Tammemagi, 2000; Yachiyo Engineering Co., Ltd. & Japan Environmental Sanitation Center, 2022). Economic forces, such as input factors like land price, waste volume, and availability of infrastructure, shape the location of waste management sites and lead to spatial concentration (Ishimura & Takeuchi, 2018). Recently, renewable energy infrastructure has also been associated with NIMBY, despite beliefs that they may not be seen as "dirty," which shows the complex ways in which residents connect with their surroundings. Table 1 presents factors that contribute to NIMBY-ism, based on Carley et al. (2020), which focuses predominantly on power plants, wind energy installations, pipelines, and other associated infrastructure. Such attitudes are also noted for power lines, hydropower, and shale gas developments (Bohlen & Lewis, 2009; Davis, 2011; Dröes & Koster, 2016; Muehlenbachs et al., 2012; Rosiers, 2002).

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Table 1 – Factors that facilitate NIMBY-ism, adapted from Carley et al. (2020)

Factors	**Past Research**
Perceived and actual environmental impacts	The role of environmental impacts/harm has been cited as an impactful indicator in the perception of all sorts of power plants (Ansolabehere & Konisky, 2009). The idea that the oceans are special and should be free of human intervention elicits unfavorable views of wind power (Kempton et al., 2005). Negative attitudes towards wind power are primarily rooted from values concerning landscape (Wolsink, 2006).
Cast shadows, visual appearance and noise	Johansson & Laike (2007) conducted a survey and reported that negative feelings toward wind power arise due to its impact on environmental integrity, landscape aesthetics, recreation, and the general attitude toward technology. The impact on the quality of life was not reported as a major concern. Krause et al. (2016) found that the fear of reduced property prices due to negative perceptions of aesthetics and fear of property value reductions are major determinants of opposition. Yamashita & Morimoto (n.d.) note complaints by residents regarding spatial discomfort due to the installation of solar PV panels.
Diminished property values and diminished quality of life	Krause et al. (2016) mentioned above. Wolsink (2006) mentioned above. Van der Horst (2007, p. 2705 cited in Swofford & Slattery, 2010) mentioned that "the nature, strength and spatial scale of this effect (NIMBY) may vary according to local context and 'value' of the land". Dröes & Koster (2016) found that the impact of NIMBY-ism impacting property values is present at about 2.2 km from the wind mill. Gibbons (2015) suggested that wind farm visibility reduced local home prices, showing the impact that visible environmental infrastructure has on the surrounding community.
Procedural factors	Mills et al. (2019) showed that when landowners considered the procedural process and financial compensation as unfair, they were not open to the view that environmental infrastructure provides benefits.
Disruption of place attachment	Devine-Wright (2005, 2009) postulated that offshore wind power plants would also evoke NIMBY sentiments arising from disruption to place attachment.

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	Devine-Wright & Howes (2010) showed empirically how NIMBY sentiments arise due to place attachment, and that wind farms are seen as spoiling the scenic beauty, to the residents and visitors, because they are seen to industrialize and fence the bay.
Political preferences	Gravelle & Lachapelle (2015) found that attitudes towards Keystone XL are driven by political party identification and ideology. Spatial proximity (NIMBY effect) to the pipeline especially attenuated the effect of ideology.

NIMBY-associated conflicts have been framed as friction between state planners, who are supposedly rational and civic-minded, and both urban and rural residents, who have been considered to be prejudiced and uninformed local opponents (Borell & Westermark, 2018; Burningham, 2000; Freudenburg & Pastor, 1992; Gibson, 2005; Wexler, 1996). This binary narrative has been criticized by sociologists such as Van der Horst (2007), who argue that objections arising from connections to the landscape or locality are valid and reasonable. Woods (2003) notes that landscapes lead to a 'sense of identity' among the community. This is especially the case among older residents who stay put for many years (Korpela, 1989) or people who have stronger links to the land, such as indigenous peoples and local communities.

There is a limited window of opportunity to facilitate transition away from conventional practices, and rapid deployment of environmental infrastructure is critical; however, this must be done with local acceptance. How can we transform the link between the community and planners and create environmental infrastructure in which specific benefits outweigh the perceived and actual negative externalities for the community? In this intelligence brief, we argue that the environmental infrastructure design processes must be re-imagined. The process to come to environmental infrastructure needs to be co-designed with the community and other stakeholders with a specific focus on enhancing the multifunctionality of the structure. We propose a new maxim that describes the possible turn from syndrome to strength: W-NIMBY.

Why not in my backyard? (W-NIMBY)

W-NIMBY stands for 'Why not in my backyard?', wordplay that encourages discussion of 'why' and the rhetorical question 'why not?', inviting the infrastructure to one's own neighborhood. The 'why not' question in W-NIMBY, in particular, can open discussion to critiques of specific environmental infrastructure and, through a design process, identify ways to ensure that negative properties are removed or minimized, while more positive services are offered to local stakeholders. Participatory processes foster design interventions that promote multifunctional use, which can increase the utility and acceptance of environmental infrastructure for the community. W-NIMBY imagines environmental infrastructure that can be seen as 'cool' and provide multifunctional uses of space that enhance the quality of life in that local area. In doing so, responding to the urgent needs raised by scientific research,

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communities may participate more enthusiastically in the accelerated transformations needed for sustainability.

Another maxim, coined YIMBY (Yes In My Backyard), is associated with housing and is a social movement linked to millennials and tech industry professionals. It is a technocratic movement that supports building more housing, including high-end premium housing. YIMBY advocates are not typically concerned with environmental infrastructure (Holleran, 2022). Such positive YIMBY feelings is also applicable to other infrastructures, including environmental infrastructure, and can be channelled to support acceptance of environmental infrastructures.

Policymakers and practitioners have been trying to find ways to overcome NIMBY-ism. We propose the use of participation and design-based intention strategies, which we refer to as leading to W-NIMBY. While YIMBY and NIMBY represent opposite ends of the spectrum, W-NIMBY is a transitional process that fosters engagement and participation of the public with project proponents, designers, and city managers. We wish to stress that it is the responsibility of city managers and designers to provide the conditions and space for the residents to consider the projects and involve them in the design of environmental infrastructure.

2. Our approach

The main research question is as follows: What design-based approach can be used to make environmental infrastructure usable and friendly to the community to overcome NIMBY-ism? To investigate this, we used a case-based approach. We identified three atypical cases in Japan, where environmental infrastructure incorporated participatory decision-making, leading to the multifunctional use of facilities. The Waste Management Act in Japan mandates that municipalities manage the waste in the area of their own jurisdiction. The Act also mandates "preserving the living environment," and, since usable land is limited, the unique context has led city planners and designers to come up with innovative solutions (Waste Management and Public Cleaning Law, 1970). The cases were identified initially serendipitously through field visits and subsequently explored via desk research. Although one limitation of the selected case study approach is that it is borne out of inductive logic and the results cannot be applied to all the cases, atypical or extreme cases can be used to capture specific information (Flyvbjerg, 2006). Kraus et al. (2022) note that such approaches are based on the 3Es - 'Exposure, Expertise, and Experience' - of researchers and that this literature is collected through a process of 'discovery and critique'. Based on this strategy, the criteria to select the cases were as follows:

1) Site with environmental infrastructure, particularly waste management sites, as these have been historically associated with NIMBY-ism;
2) Sites whose development was driven by designers and architects; and
3) Sites that encouraged community involvement.

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Based on the criteria, we highlight three cases from Japan and show how the sociological concept of NIMBY-ism has been mitigated through a design-led approach by architects. We improve the theoretical discussion of sociological NIMBY-ism by incorporating co-design processes and a practitioner-led design approach that lead to attractive functions of environmental infrastructure.

Table 2. Selection of case studies where environmental infrastructure was developed despite the risks of NIMBY-ism

	Hiroshima Naka Incineration Plant	Kamikatsu Zero Waste Center	Musashino Clean Center
Location	Urban - coastal	Rural	Urban - residential
Construction completion year	2004	2010	2017
Architect / Design entity	Yoshio Taniguchi	Hiroshi Nakamura	Kajima Corporation
Intended primary function	Waste management (incineration)	Reduction, reuse, and recycling of materials	Waste management (incineration)
Local government policy context	Hiroshima 2045 Vision ("peaceful and creative city")	Kamikatsu City's zero waste declaration	Musashino City's Fourth Long-Term Strategy and Plan
Multifunctionality: Design (explained in the Annex)	The part of the plant that is open to the public is made of glass to highlight the machinery, which fosters greater awareness of waste management.	Predicated on making the structure visible, it was designed as a space for local residents to manage their own waste under the principles of the 3Rs.	The structure has an open space made available for the community to use for local events.
Multifunctionality: Community Amenities and Open Space	Noise and human activity are kept to a minimum within the waste-to-energy infrastructure. The facility is also popular with local inhabitants who use the open space to fish, do physical activity, or enjoy the beauty of the Bay of Hiroshima.	The facility is equipped with a store that encourages the residents to bring, take, and exchange goods for free within and beyond the community; a coin laundry; a restroom; an office space; a hotel; and a hall.	Open space is made available for the community to use for local events.

Further case descriptions can be found in Appendix. These cases show that it is possible to transform environmental infrastructure with a risk of eliciting NIMBY-ism and sometimes considered 'dirty' (Yachiyo Engineering Co., Ltd. & Japan Environmental Sanitation Center, 2022) into a structure that is 'cool.' The cases show the power of innovative design to neutralize negative effects and address the needs of the impacted party and other stakeholders.

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3. Why not in my backyard? (W-NIMBY): From Dirty to Cool

Based on insights from the case studies, we argue for the role of design in alleviating some of the risks of NIMBY-ism and helping the community shape the infrastructure through a co-design process that enables multifunctional use. Such infrastructure, which may have more than one function, can be found in limited numbers to date, and can provide lessons for a new way of thinking about environmental infrastructure. We explain the role of the participatory process and the creation of multifunctional use of space to make infrastructure that is attractive to the local community, inviting W-NIMBY sentiments (see Figure 1).

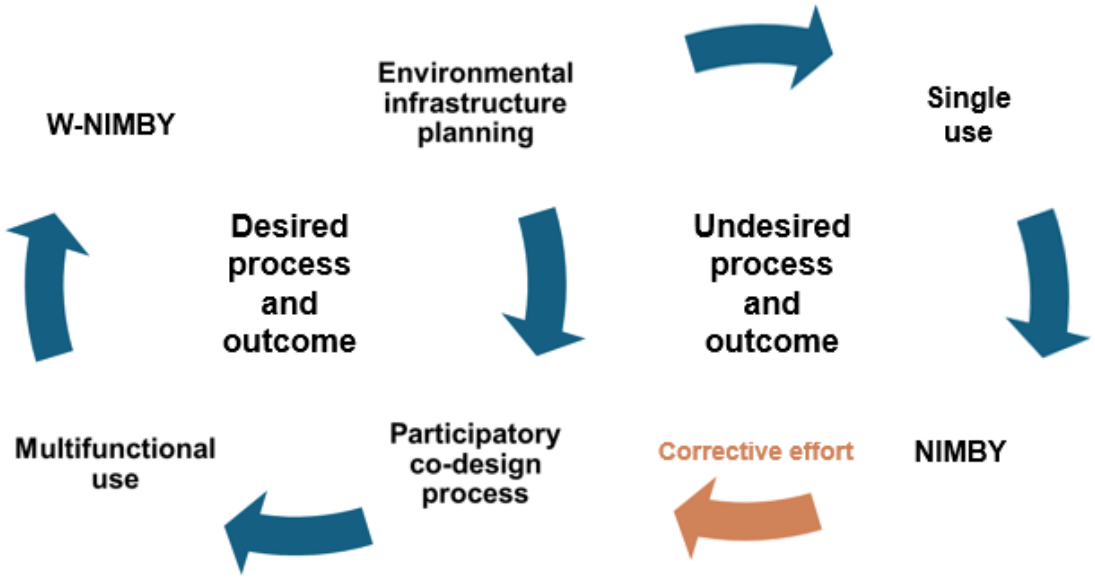

Figure 1: The rate of acceptance of environmental infrastructure in a community may increase by expanding its purpose to multifunctional use. Single-use environmental infrastructure does not always fulfil the needs of the immediate-community and may lead to NIMBY feelings. Participatory co-design process can serve as a corrective effort to increase the functionality for a local community. The W-NIMBY process can change the perception of environmental infrastructure and facilitate positive discussions. The three case studies described in this manuscript were designed to have multifunctional use, which appears to be the critical factor in making facilities desirable in the eyes of residents. Although environmental infrastructure may still be built without these design interventions, such infrastructure may be eschewed by the community.

Participatory approaches and multifunctional use

Sustainability requires the participation of stakeholders. Despite institutional tensions that require careful navigation (Harris et al., 2024), the fields of sustainability and science, technology and society (STS) emphasize the importance of co-design processes to address community concerns and needs (Asokan et al., 2019; Jasanoff, 2021, 2022; Kates et al.,

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2001). This means that social and individual contexts and physical elements are essential for sustainability transformations to occur.

The cases we introduce have transformed what could have resulted in NIMBY-ism to what we label as "W-NIMBY." In all three cases, they did so, firstly, through community engagement and decision-making. Such a participatory process allows the community to articulate their needs and expectations from the infrastructure, in contrast to conventional environmental infrastructure, which tends to move forward through the path of least resistance, leading to construction of polluting facilities in marginalized and impoverished areas (Mohai & Saha, 2015). The community concerns were addressed via consultation, and they were made part of the discussion.

The second common thread is that of multifunctional use of space. Multifunctional use brings in other functions for the structure that can be enjoyed by the community or visitors, in addition to the infrastructure's main (environmental) purpose. Conventional environmental infrastructure often minimizes community access to the premises for safety purposes, eliciting NIMBY attitudes. W-NIMBY infrastructure does the opposite: the space is designed specifically to welcome the community and visitors with various functions.

In the case of the Musashino Clean Center, community engagement greatly shaped the ultimate architectural design of the plant, including height restrictions and the motifs used for the façade. The facility has an open space that the community uses for events. In the Hiroshima case, instead of narrow single-purpose engineering, its multifunctional design focuses on providing various functions, such as the use of the space for recreation and environmental awareness. In the case of Kamikatsu, the facility has a recycling station, a coin laundry, a restroom, an office space, a hotel, and a hall, providing many alternative uses. In each of these examples, we see the use of design to improve the use of the facility for multiple purposes and create an inclusive space that invites the community and increases the visible benefits while minimizing the costs of hosting the infrastructure. The three cases thereby overcome the negative connotation of 'dirty' infrastructure to build 'cool' facilities that move ahead as per the community's wishes. In addition to the aesthetically pleasing nature of these structures, they are open, easy to access and used for community engagement on environmental issues. As a result, community members are given the opportunity to understand the value of environmental infrastructure and take pride in its presence in their neighborhoods. The role of design in creating this space is therefore critical.

Both form and function need to be given importance. The presented cases can be interpreted as stakeholders' expression of balancing form and function to attain multifunctional use, with community, local government, and architect involvement in the project at each step of the way.

We intend to highlight the links between design and NIMBY and note the role of practitioners (designers and architects) in fostering W-NIMBY-ism. In the cases presented, environmental infrastructure has resulted in a 'sense of identity', a source for community

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branding, which manifest in popular facility tours and events to further community-building and sustainability principles. The development turns the meaning of 'dirty' NIMBY infrastructure on its head, paving the way for 'cool' W-NIMBY infrastructure.

Environmental Infrastructure for the Local Community

Various designers have attempted to increase the adoption of infrastructure by maximizing the aesthetic component of design. (Sioen et al. (2016) argue that this comes from their training and focus on morphology, typology, and other physical aspects of design. In contrast, when developing environmental structures that face NIMBY attitudes, the planner/designer needs to overcome NIMBY sentiments, not only through improving the aesthetics of the physical structure. Based on the cases, we argue the need for what we call an 'aesthetics plus' (aesthetics+) strategy. This strategy utilizes the design process as a tool to combine aesthetics that are appealing and pleasing to the community, in conjunction with participatory processes and the provision of multifunctional use to users.

Design is ultimately a tool, and the end goal must be to create environmental infrastructure that is functional for local people and/or visitors beyond its primary purpose. The danger of simply 'beautifying' infrastructure is that it obfuscates the true value and cost of hosting the environmental infrastructure. It makes it harder for community members, especially those with limited knowledge or opportunity to engage with consultation processes, to know whether or not they should accept the infrastructure, and diverts attention away from the purpose of the infrastructure itself and instead toward its aesthetics. Design should never be a tool used (or abused) only to 'convince' stakeholders that this structure should be in their neighborhood. We emphasize that design of environmental infrastructure should be driven by the needs and wants of stakeholders: the employment of an aesthetics+ strategy. This would necessitate providing multifunctional use of environmental infrastructure, including its primary purpose and associated benefits such as access to community facilities, open spaces, and other uses. These aspects require going beyond aesthetics and involve anticipating community needs through engagement and participatory processes, potentially leading to changes in planning processes like zoning and more stakeholder engagement.

The aesthetics+ strategy helps support W-NIMBY process, however existing policies and planning laws can also hinder such processes and city planners and designers need to work to overcome such barriers. As Adil & Ko (2016) highlighted how policies overlook the dynamics of new energy technologies and associated social response, affecting local infrastructure. We acknowledge that this is often the case because of practical reasons or urban planning regulations; however, attempts can be made to overcome these barriers, especially with cities that can set their own planning regulations or by accommodating processes where local rethinking of urban planning policies (e.g., zoning) are possible on a case-by-case basis. The process must start with accepting multifunctional use that can fulfil the community's needs.

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We argue that the rigorous implementation of participatory processes that lead to multifunctional use as part of designing environmental infrastructure can foster W-NIMBY-ism, transforming a structure that could have been considered a 'local menace' into something 'cool' that serves society locally and as a whole. Moving beyond creating a 'façade' or simply increasing the aesthetic appeal, environmental infrastructure should ensure access and usability of the facility for multiple purposes by local residents and visitors.

Redevelopment

Still, for incineration plants such as the Hiroshima Naka Plant and the Musashino Clean Center, some concerns have been raised regarding the overall operational shelf life of the structure (arch-hiroshima, 2006). When the incineration plant infrastructure reaches the end of its shelf life, it is unclear whether the surrounding beautifully designed structure will remain or be demolished, bringing into question the amount of resources that should be devoted to the architectural design of such infrastructure. However, it is easy to imagine that when these currently operational structures are decommissioned, the surrounding community may have a different vision and set of priorities for local waste management, which may not involve incineration. The community, whose environmental awareness has increased over time, may opt for more circular approaches to resource management and a new kind of environmental infrastructure may be in place. In any case, incorporating the needs and vision of the community is critical in not only the construction of new infrastructure, but also its renewal.

4. **Conclusion**

Scientific research has shown the evidence for and the need to address issues such as climate change and pollution; yet, the implementation of environmental infrastructure projects is often delayed due to local NIMBY-ism based on a diverse set of concerns. The present intelligence brief discussed three case studies in Japan where participatory processes led to multifunctional designs of environmental infrastructure. While we refer to cases that focus on solid waste management, the ideas presented are applicable to other forms of environmental infrastructure such as those needed for the energy transition.

Insights from the intelligence brief can serve to inform the future construction of environmental infrastructure around the world. The approach we highlight here can help stakeholders overcome some of the NIMBY-related challenges observed in conventional environmental infrastructure projects. We hope that the new maxim—W-NIMBY—can improve policymaking at the city level, improve public acceptance, and foster a greater communal affinity to sustainability. W-NIMBY can encourage city governments and designers to co-create environmental infrastructure that also caters to the various needs of the host community and elevates their consciousness on the role that environmental infrastructure plays in pushing the sustainability agenda forward.

https://doi.org/10.1017/sus.2024.22 Published online by Cambridge University Press

Author contributions

AV & SG designed and initiated the project. AV & KE conducted desk research on the case studies and wrote case study descriptions. AV & SG wrote the manuscript. All authors, read, edited, and approved the final manuscript.

Financial support

Nothing to declare.

Conflict of interest

No author has declared a conflict of interest.

Acknowledgements

We thank the anonymous reviewers and are grateful for their suggestions. We also thank the editor of the journal. We also thank also Dr. Mark Elder and Dr.. Yasuhiko Hotta for providing support and guidance.

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