Research Paper

The Future of Sustainable, Flood-Resilient Development and Planning in Jakarta, Indonesia

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Abstract

This research examines the nature of planning policy and its impact on the urban form of the kampung and the associated local communities in Jakarta, Indonesia, over more than four centuries of severe flooding. Jakarta offers an informative case due to its unique combination of extensive informal settlement, its situation on a deltaic plain crossed by more than 13 rivers and canals, and some of the fastest land subsidence rates globally. This paper examines how government responses to flooding have shaped, and reacted to, the city's spatial and physical urban form through policies, strategies and flood mitigation measures over more than 400 years – particularly where these have failed to account for local ecology, flood patterns, natural drainage systems and the communities affected by flooding and new flood infrastructure. It proposes policies, development strategies and best practices the Jakarta and Indonesian governments could pursue to deliver more sustainable and resilient flood mitigation without harming local communities. The paper's theoretical approach utilises historical institutionalism to analyse the historical behaviour of government departments responsible for planning flood infrastructure and writing planning policy and the regulations themselves. Primary data comprised workshops with Jakarta infrastructure planning officers, flood engineers, local academics and NGOs working with flood-affected communities in North Jakarta, addressing the appropriateness of current infrastructure, gaps in the planning system, and future policy directions. Secondary data comprised policy documents and a literature review of Jakarta's planning and flood-mitigation history. Findings show institutions and government remain locked into established policy pathways despite decades of worsening flooding. Technocratic solutions remain the preferred response, though nature-based solutions should be promoted where sufficient land availability allows. Bureaucratic and administrative boundaries continue to obstruct watershed-wide, cross-border collaboration, while top-down planning persists and local communities remain largely disenfranchised. New developments on reclaimed land in Jakarta Bay cater to a narrow demographic and lack affordable housing, while bottom-up solutions still lack a viable pathway to implementation. These findings point to a persistent lack of institutional change, consistent with historical institutionalist theory, in which institutional lock-in and path dependency continue to constrain policymakers. This is significant given Jakarta's outsized influence on how other Southeast Asian megacities respond to flooding, and in light of the government's planned relocation of the capita lto Nusantara on the island of Borneo.

Keywords

Flooding, flood resilience, urban morphology, historical institutionalism, urban design, planning, megacities, infrastructure, sustainable development

1. Introduction

This paper examines the relationship between planning policy and urban form in Jakarta in the context of severe flooding and the city's wider development challenges (Elias et al., 2018; Priatmodjo, 2016; Cybriwsky and Ford, 2001; Mathewson, 2018 and 2024). Jakarta is one of the world's most significant urban conurbations and an informative case of flooding occurring across vast areas of informal development, within a rapidly developing megacity. While Jakarta's circumstances are unique, the research approach could inform how other Southeast Asian cities respond to similar development and environmental pressures.

The paper draws on a series of workshops with local experts to consider the policies, strategies and development practices that the governments of Jakarta and Indonesia should adopt to deliver long-term, positive change across the city's communities, and concludes with the study's overall findings. The research question is:

- What policies, development strategies and best practices should the Jakarta DKI and Indonesian central government pursue to improve the flood situation in a more sustainable and resilient manner – one that does not negatively affect residents of flood-prone informal settlements (for example, by restricting fishing communities' access to the sea, or demolishing housing for new sea walls and dykes), but instead improves quality of life across a broad cross-section of the city's inhabitants?

Jakarta is a compelling case given the scale of its flooding and the pressures of rapid urban growth, set against more than 400 years of inundation dating to the start of Dutch colonial occupation in 1617. The research also examines how the governments of Jakarta and Indonesia have repeated the same decisions despite clear evidence of poor outcomes, and proposes planning policies, development strategies and best practices better suited to Jakarta's environmental and social context.

Jakarta is one of the world's largest urban agglomerations, with a metropolitan population exceeding 28 million people[1] (Priatmodjo, 2016; Cybriwsky & Ford, 2001; Mathewson, 2024) built across a deltaic plain crossed by more than 13 rivers and canals, nearly half of it below regional water level and vulnerable to both coastal and river flooding (C40 Cities, 2019). Rapid land subsidence – up to 200mm a year in places- leaves around 90 per cent of North Jakarta below sea level (C40 Cities, 2019) – compounds the risk, along with upstream deforestation, the narrowing of waterways by informal riverbank settlements, refuse dumping, and uncontrolled water hyacinth growth (Priatmodjo, 2016; Steinberg, 2007). A lack of green space[2] and unchecked peripheral development have further reduced the ground's capacity to absorb water (Steinberg, 2007; Priatmodjo, 2016), while historic underinvestment – exemplified by the Dutch-era Eastern Canal, only completed in 2017 – has compounded the problem (Steinberg, 2007; Priatmodjo, 2016).

Climate change is not a major underlying cause of flooding in Jakarta but is expected to increase the frequency and intensity of flood events (Djalante, 2013), compounding Indonesia's vulnerability to natural disasters as a result of its position on the Pacific Ring of Fire (ibid). Up to 40 per cent of Jakarta's land area

[1] Within this urban conurbation is Jakarta DKI, the Special Capital Region, an area of 664 km² inhabited by 12.7 million people by day and 10 million at night and a metropolitan area of 6,400 km² (Priatmodjo, 2016).
[2] Currently only 10%, though the Spatial Planning Act of 2007 requires 20% of total land area in Indonesian cities to be green open space (Priatmodjo, 2016).

is highly vulnerable to tidal inundation, storm surge and future sea-level rise, while rising rainfall intensity and the urban heat island effect add further pressure (The World Bank, 2010).

In response, the DKI administration and central government have pursued major infrastructure programmes, including the Jakarta Coastal Defence Strategy (JCDS) of 2011 and National Capital Integrated Coastal Defence (NCICD) master plans of 2014 and 2022 – unique within Southeast Asia (Kops, 2012) – alongside waterway dredging begun under Governor Joko Widodo in 2012 (Octavianti and Charles, 2018; Priatmodjo, 2016). Without further action, however, significant parts of the city risk permanent submersion (Ward et al., 2010).

2. Methodology

This study follows a mixed-methods approach (Shorten and Smith, 2017), integrating qualitative and quantitative data within the same research design – an approach also used by Ghauri et al. (2020) and Hesse-Biber et al. (2015), in which multiple methods are combined to address research questions that neither quantitative nor qualitative approaches could answer alone, enriching the evidence base (Shorten and Smith, 2017).

The study examines best practices in sustainable, flood-resilient planning in Indonesia and proposes policy solutions for Jakarta. Primary data comprised a series of small-group workshops held in Jakarta during the summer of 2023, in which participants were asked the same semi-structured questions about the appropriateness of current infrastructure solutions, gaps in the planning system, and future policy direction. Participants comprised Jakarta DKI infrastructure planning officers; flood engineers, some involved in designing the JCDS and NCICD; Indonesian academics, including one based at a Dutch university; and NGO officers leading community engagement in flood-affected areas of North Jakarta.

Secondary data comprised document analysis of planning materials from local and central government bodies (including Bappenas, the national development planning ministry, and Bappeda, the Jakarta regional planning authority), supplemented by materials from local NGOs – Rujak Centre for Urban Studies, Rame-Rame Jakarta and Climate Hub Indonesia – and academic colleagues at Tarumanagara University (UNTAR) and the Bandung Institute of Technology (ITB). Key documents included the JCDS (2011), the NCICD (2014) and its 2022 revision, the Local Millennium Ecosystem Assessment (2004) and the Jakarta Spatial Development Plan (2012). Together, these methods support analysis of local bureaucratic and political processes and public discourse, and provide the spatial and contextual grounding needed to critique development plans from a design and planning perspective.

Ethics statement

This research involved human participants and was conducted in accordance with the University of Westminster's ethical guidelines for research involving human subjects (ethics approval was granted in 2016). All participants took part voluntarily, gave informed consent prior to the workshops, and were advised of their right to withdraw at any stage. To protect participant confidentiality, given the sensitivity of discussing government and institutional practice, all participants have been anonymised throughout this paper and are referred to only as 'Respondents 1–7'. No personally identifiable information is disclosed, and workshop data has been stored and processed securely in line with the University of Westminster's data protection requirements.

3. Workshop findings

Workshops held in Jakarta in June and July 2023 identified several consistent themes regarding flood policy and infrastructure, also reported in Mathewson (2024).

Technocratic solutions remain the default response. Academics, government officers and technical specialists continue to favour engineered flood infrastructure. This preference is shared by the DKI administration, as well as several Indonesian central government ministires and departments, as well as the consultancy behind the NCICD and JCDS designs (Respondents 1 and 2). This continuity – from the Dutch colonial period through the post-independence and New Order eras to the present – reflects institutional lock-in and path dependency, despite technocratic solutions having historically proved insufficient to protect the city. Most respondents argued these solutions should be paired with nature-based approaches rather than pursued alone.

Nature-based solutions (NBS) are gaining ground but remain constrained. The DKI government has endorsed some NBS, particularly for new reclamation projects along the north coast, where river and reservoir naturalisation is under way at five sites, alongside 13 completed and up to 76 planned polders, infiltration wells, bio-pores, and a new Blue-Green Index requiring 30 per cent green open space (Respondent 3). However, Respondents 1 and 2 noted this 30 per cent target is aspirational rather than regulatory, pointing to the Jakarta Spatial Development Plan (2012), whose comparable requirement delivered only around 5 per cent in practice. Mangrove restoration is under way along parts of the northern coastline and on some reclamation islands, though land constraints limit its scale. Respondent 7 cautioned that NBS can still amount to "greenwashing" unless grounded in Jakarta's specific hydrology, arguing that mapping existing nature should precede new interventions, and that dual-function spaces (for example, parks incorporating sustainable drainage and water retention) offer a practical middle ground.

Despite this, nearly all participants still regarded technocratic infrastructure as necessary. Respondent 3 cited ongoing beach and river embankment works (37km planned, 13.4km complete) alongside the Ciawi-Sukamahi Reservoir, the Ciliwung-KBT diversion, new pumping stations and up to 44 polders – substantial commitments, though respondents questioned whether they would be fully implemented and enforced. This continued reliance on engineered solutions, without meaningful exploration of alternatives at scale, reflects further institutional lock-in and a form of silo thinking among experts and policymakers.

Flooding is treated as a local rather than watershed-wide problem. No evidence emerged of significant cross-boundary cooperation across the Ciliwung River watershed, the only comparable precedent being a pilot project in the Yogyakarta Special Region (Hudalah and Woltjer, 2016). Respondent 5 argued flooding must instead be addressed as a whole-system, watershed-wide challenge rather than one bounded by municipal or provincial administration – a further instance of institutional lock-in.

Top-down planning remains dominant. As with technocratic solutions, top-down infrastructure planning is favoured by the DKI administration, several Indonesian central government ministires and departments, as well as the Dutch consultancy behind the JCDS and NCICD. Most participants (Respondents 1, 2, 3, 5 and 6) argued experts should develop solutions before consulting residents, whom they viewed as lacking the expertise to propose sustainable options – a position disputed by Respondents 4 and 7. Respondent 2 proposed a contrasting approach: investing in rural infrastructure and jobs to reduce migration to Jakarta's waterway-adjacent kampung, paired with the removal of illegal riverside housing and relocation supported by employment guarantees. Other respondents (4, 5 and 7) were sceptical, citing Indonesia's poor record on community consultation and forced relocation – exemplified by Kampung Akuarium – and noting that while community mobilisation has succeeded in isolated cases (Kampung Kerapu, Kongol, Tongol, Lodan

and Kunir in North Jakarta, and Kampung Penas Tunggul in East Jakarta), it has not translated into a wider social or political force capable of shifting government practice (Dovey et al., 2019; Rujak, 2018a and 2018b; Sutanudjaja, 2022; Winayanti and Lang, 2002).

Reclamation-island developments serve a narrow demographic. Site visits by the author in 2012, 2018, 2019 and 2022 to developments including Pantai Mutiara, Regatta and Green Bay Jakarta confirmed a consistent pattern of exclusive, luxury-oriented development along the north coast (Google Earth, 2024). Pantai Indah Kapuk (PIK)[3], the only completed reclamation island, includes no affordable housing. Respondent 1 linked this to reliance on public-private partnership funding models, a point disputed by Respondents 4 and 6, who considered the funding approach unresolved.

Environmental review processes have been circumvented. Respondent 4 described how the Environment Agency initially rejected the reclamation islands' environmental impact assessment, after which the plan was resubmitted at the provincial (Jakarta) level in smaller parcels and eventually approved following revision. Central and DKI governments have since converged in scaling back the reclamation programme (NCICD, 2022), driven by the discovery of natural gas deposits in Jakarta Bay – which then Governor Anies judged made large-scale island construction unsafe – and by the government's decision to relocate the capital to East Kalimantan Province on the island of Borneo, removing the original rationale for the 'Great Garuda' and attendant smaller islands (ArchDaily, 2023). Construction on several islands began in 2013 but halted in 2016 amid a bribery scandal involving a developer and a local parliamentarian, exposing close links between developers and officials (Sherwell, 2016); only Island D and part of Island C (KIP) have since progressed. This history is a poor signal for the reduced reclamation programme set out in the revised NCICD (2022). Governor Anies's intervention stands out as a rare disruption of institutional lock-in, though whether this reflected genuine policy change or political positioning remains unclear.

Bottom-up solutions lack a viable route to implementation. Respondents 4 and 7 agreed that Jakarta urgently needs mechanisms, institutions and processes capable of translating community-level solutions into practice. This gap perpetuates the pattern of lock-in evident across central government, DKI, engineering and academic circles, despite international evidence that community empowerment improves outcomes in large-scale urban development. Addressing it should be a priority for both levels of government, to ensure planning better reflects the needs of Jakarta's wider population rather than those able to afford segregated, gated developments.

4. Conclusions

The workshops confirm a persistent pattern of top-down, technocratic, infrastructure-driven responses to flooding in Jakarta, consistent with the historical institutionalist accounts of Ford (1993), Silver et al. (2001), Steinberg (2007), Priatmodjo (2016) and Octavianti and Charles (2019). This pattern traces back to the Dutch importation of the *Waterstad* typology in the early seventeenth century, in preference to indigenous solutions that existed before the city's destruction and rebuilding in 1619, and it continues to shape policymakers, planning officers, engineers and academics today. Neither the DKI nor the Indonesian central government have meaningfully adopted bottom-up, community-based or locally empowered solutions at a scale sufficient to shift the status quo. This matters because of Jakarta's outsized influence over planning

[3] Pantai Indah Kapuk (PIK) is so far the only completed island constructed from land reclamation in Jakarta Bay.

and infrastructure practice elsewhere in Indonesia: what is adopted in Jakarta is likely to be replicated, for better or worse, by other local and regional authorities (Mathewson, 2024).

Nature-based solutions (NBS) remain under-utilised despite being more cost-effective than conventional infrastructure in many contexts (UN, 2023; American University, 2023). Restoring or preserving coastal wetlands sequesters carbon and protects biodiversity (American University, 2023; Wisconsin, 2023), while technocratic solutions typically move water away from land rather than allowing it to be absorbed or stored. NBS and ecosystem-based management, by contrast, retain water near its source and buffer against tidal inundation and storm surge (Vuik et al., 2016; Van der Nat et al., 2016), while avoiding the reduced sediment transport associated with dikes and sea walls (Van den Hoven et al., 2022).

The argument that Jakarta lacks land for large-scale NBS, such as mangrove forests, is difficult to sustain given that the government previously proposed up to 47 new reclamation islands. Where such land is unsuitable for habitation, it could instead support nature preserves incorporating blue-green water systems and mangroves at a scale not yet attempted – an opportunity for Jakarta to position itself as a world-leading example of adaptive flood management (Mathewson, 2024).

Realising this would require a significant shift in thinking among government and experts alike, given the largely ineffective history of engineered approaches to Jakarta's flooding over four centuries. The benefits of NBS and ecosystem-based management need wider dissemination in Indonesia, backed by adequate resourcing and international cooperation through bodies such as ASEAN, the World Bank and the UN, alongside the creation of substantial new land for wetlands and similar habitats (Mathewson, 2024).

More broadly, Jakarta offers a cautionary tale for other Southeast Asian and Javanese cities: a history of unsuccessful community consultation, broken promises, and eviction, alongside mega-infrastructure projects that treat the symptoms of flooding – land subsidence and upstream flooding – rather than their root causes. Flooding continues to be treated as a local rather than watershed-wide problem (ibid).

Affordable housing remains a critical gap, as reflected in the continued growth of kampung communities on precarious or flood-prone sites – evidence that the formal planning system does not adequately serve the roughly two-thirds of Jakarta's population living in informal settlements. None of the reclamation islands built to date, including KIP, include affordable housing, reinforcing the impression that policy favours private developers over residents. Addressing this will require both stronger affordable housing provision and formal recognition of kampung within the regulatory system, alongside pathways for migrants to secure residency and access to services (Mathewson, 2024).

Ultimately, the DKI government needs a strategy that addresses the root causes of flooding – land subsidence, overdevelopment, deforestation, and the loss of land for natural water absorption – rather than treating symptoms alone. This also requires central government investment in economic development beyond Jakarta, to ease migration pressure on the capital and other major cities across the archipelago (Mathewson, 2024).

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