Vol. 150, No. 3 · Review article

DIE ERDE

Journal of the Geographical Society of Berlin

Coastal adaptation through urban land reclamation: Exploring the distributional effects

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Manuscript submitted: 21 May 2019 / Accepted for publication: 17 July 2019 / Published online: 25 September 2019

Abstract

Land reclamation and urban redevelopment is currently underway in coastal regions around the world, as urbanization continues rapidly, and high-value coastal urban land becomes more scarce. Yet coastal hazards will also continue to increase due to sea-level rise, and building flood risk reduction measures into such land reclamation projects appears to be low cost compared to the potential benefits generated. Moreover, land reclamation in high-value urban areas that incorporates such adaptation can generate substantial revenue attractive to governments, particularly in developing countries, which struggle to finance coastal adaptation measures. Yet revenue generation in these projects depends on including some degree of high-value and high-priced developments, giving rise to potential distributional effects. This paper surveys three current coastal urban redevelopment projects incorporating flood risk reduction in the Maldives, Germany and Nigeria, illustrating different modes of urban development projects and the distributional effects that can arise for each of these. The paper explores the equity implications of such projects that arise in planning processes and in implementation. The examples illustrate that inequalities can arise through incentives for corruption, budget imperatives leading to developments that result in gentrification, and shifting of physical risks on to neighboring communities. Finally, I reflect on policy and project design instruments that can address these inequalities, and draw out implications for future research to ensure sustainable and inclusive development of coastal cities in the context of sea-level rise.

Zusammenfassung

In Küstenregionen der ganzen Welt finden derzeit Landgewinnungs- und Stadtumbauprozesse statt, da die Urbanisierung rasch voranschreitet und hochwertiges städtisches Küstenland knapper wird. Küstenrisiken werden jedoch aufgrund des Meeresspiegelanstiegs weiter zunehmen und die Berücksichtigung von Maßnahmen zur Verringerung des Hochwasserrisikos in solchen Landgewinnungsprojekten scheint gemessen an den potenziellen Vorteilen kostengünstig zu sein. Darüber hinaus kann die Landgewinnung in hochwertigen städtischen Gebieten erhebliche Einnahmen generieren. Dies ist insbesondere für Regierungen in Entwicklungsländern attraktiv, da so Maßnahmen zur Küstenanpassung finanziert und gleichzeitig urbanes Land geschaffen werden kann. Hohe Projekteinnahmen werden jedoch vornehmlich mit hochklassigen Bauvorhaben erzielt, die Verteilungseffekte hervorrufen. In dieser Studie werden drei aktuelle Landgewinnungsprojekte auf den Malediven, in Deutschland und in Nigeria untersucht, bei denen Maßnahmen zur Verringerung des Überflutungsrisikos ergriffen wurden. Es werden verschiedene Arten von Stadtentwicklungsprojekten und die Verteilungseffekte dargestellt, die für jedes dieser Projekte auftreten können. Der Beitrag untersucht, welche Auswirkungen auf

Alexander Bisaro 2019: Coastal adaptation through urban land reclamation: Exploring the distributional effects. – DIE ERDE **150** (3): 131-144

DOI:10.12854/erde-2019-453

die soziale Gerechtigkeit sich bei den Planungsprozessen und der Umsetzung solcher Projekte ergeben. Die Fälle veranschaulichen, dass Ungleichheiten, eine Verlagerung von Überflutungsrisiken in benachbarte Gebiete sowie Gentrifizierungsdruck entstehen können. Abschließend werden politische und projektbezogene Instrumente diskutiert, mit denen diese Ungleichheiten angegangen werden können. Abschließend werden Implikationen für die künftige Forschung aufgezeigt, um eine nachhaltige und inklusive Entwicklung der Küstenstädte im Kontext des Meeresspiegelanstiegs zu gewährleisten.

Keywords adaptation, urbanisation, public finance, inequality, coasts

1. Introduction

Coastal development is proceeding rapidly around the world in response to urbanisation of coastal cities, population growth and economic growth. At the same time, many coastal cities around the world are under-protected (*Hanson* et al. 2011) and global mean sea-levels are projected to rise, up to 1.3 m over the course of the century (*Wong* et al. 2014) and possibly as much as 2 m in high-end scenarios (*DeConto* and *Pollard* 2016), increasing coastal risks.

Coastal adaptation can reduce flood risks significantly, e.g. through hard or soft protection, and such coastal protection measures are economically beneficial in many settings (*Lincke* and *Hinkel* 2018). Yet significant barriers to coastal adaptation exist. Coastal protection works require large up-front investments (*Bisaro* and *Hinkel* 2018), while their implementation affects coastal amenities and thus may face opposition from vested interests (*Beatley* 2012), as well as from urban developers with business models focused on short-term revenues (*Taylor* and *Harman* 2015). Indeed, financial barriers to coastal adaptation are ubiquitous around the world (*Hinkel* et al. 2018). Only a small fraction of the currently estimated US$10 billion in annual investment needs associated with coastal adaptation are covered, and these costs are predicted to rise under sea-level rise to as much as US$70 billion annually by the end of the century (*Hinkel* et al. 2014).

Under these conditions, land reclamation that includes adaptation is an attractive adaptation option, particularly in land scarce urban areas, as the creation of new high-value land can generate revenues, and thus help overcome financial barriers to adaptation, i.e. coastal flood risk reduction. Moreover, land reclamation is proceeding rapidly around the world in mega-cities (*Sengupta* et al. 2018) and other historically densely populated coastal urban areas, such as around the North Sea in Europe or in China. Further, land reclamation activities include cities experiencing rapid and recent growth such as, Dubai, Singapore or Shanghai: the latter has seen 590 sq km of land being reclaimed over the last 30 years (*Sengupta* et al. 2018). In small islands, land reclamation is also either underway or being considered, for example, in the Maldives, which is discussed below (*Hinkel* et al. 2018) or Kiribati (*Jacobs* 2019). Thus, while generally only three types of coastal adaptation options – 'protect', 'accommodate' or 'retreat' (*Klein* et al. 2001) – have been considered in the past, the option to 'advance the line' through land reclamation is gaining attention particularly in contexts of rapid urbanisation (*Magnan* et al. 2016; *Bisaro* et al. 2019).

Land reclamation projects enable a land-based financing approach to funding infrastructure and investment costs, which is promising due to small costs of adaptation in such projects (*Bisaro* et al. 2019). Yet while relatively novel as an approach to financing coastal adaptation, experiences in related sectors, such as transportation or urban development, show that land-based finance approaches pose distributional risks due to the high-values of properties at stake. Indeed, the literature on land-based financing of urban development finds divergent distributional effects, e.g. improved access to affordable housing (*Phang* and *Helble* 2016) and public goods (*Wang* et al. 2015), but also gentrification (*Weber* 2002; *Immergluck* 2009), dispossession (*Shin* 2016), or exacerbation of existing vulnerabilities (*Oulahen* et al. 2015). While an extensive literature addresses distributional issues in flood risk management (*Benzie* 2014; *Penning-Rowsell* and *Priest* 2015; *Rufat* et al. 2015; *Anguelovski* et al. 2016), few studies examine how inequalities might be exacerbated through public infrastructure investment. An exception is emerging work on 'climate gentrification', which identifies different pathways through which adaptation investments can lead to increasing inequalities in coastal cities (*Keenan* et al. 2018). Moreover, inequalities may be exacerbated in such projects

by transferring physical risks, e.g. as areas adjacent to land reclamation projects may experience increased erosion or flooding, while sediment extraction for landfills can disturb coastal ecosystems and contribute to increasing sand scarcity (*Bendixen* et al. 2019).

This paper addresses this gap, adding to the 'climate gentrification' literature by surveying three land reclamation projects around the world. The paper explores the different governance modes in which these three projects have been designed, the planning measures that have been included to address distributional effects, and how distributional effects have played out in implementation. I address the question of how land reclamation project benefits are distributed through planning instruments and implementation processes. The examples illustrate different socio-economic and biophysical channels through which land reclamation can affect distributions, and potentially increase inequalities, in urban settings. This is an important question because, as mentioned, land reclamation appears likely to continue around the world. While it appears low cost to protect such developments from flood risk on the time horizon of urban infrastructure (i.e. < 100 years), less is known about its effect on the distributions of benefits and risks, and ensuring inclusive urban development is a core Sustainable Development Goal (SDG 11).

The paper is organised as follows:
The next section reviews the literature on land-based finance and coastal adaptation finance, and distributional effects that emerge in planning and implementation of large scale urban development projects. I then survey three examples of land reclamation incorporating adaptation, currently underway. An example from the Maldives is implemented through a centrally planned state capitalist approach. Hamburg provides an example of a regulated market-based approach. A fully privatised approach is illustrated for Lagos, Nigeria. Finally, I discuss lessons emerging from these examples, and draw out implications for future research.

2. Political economy of land-based financing

2.1 Land-based financing of coastal adaptation

A growing scholarship on adaptation 'barriers' has identified institutional, financial and social barriers hindering the implementation of adaptation (*Biesbroek* et al. 2013). For urban coastal adaptation, institutional barriers include unclear organisational responsibilities (*Storbjörk* 2010), trade-offs from different coastal management priorities (*Brown* et al. 2002; *Hopkins* et al. 2011) and complexity of government organisation routines (*Stojanovic* and *Ballinger* 2009). Financial barriers arise from lack of resources (*Ekstrom* and *Moser* 2014), high opportunity costs (*Cartwright* et al. 2013) and distributional conflicts (*Osberghaus* et al. 2010).

Land-based financing in land reclamation projects may enable overcoming these barriers, due to high-value land created, thus enabling governments to finance, for example, coastal protection infrastructure in such projects through the revenues generated (*Bisaro* et al. 2019). Indeed, literature on the relationship between coastal flood risk and real estate value illustrates the potential for adaptation to generate revenues when built into land reclamation projects. Coastal protection infrastructure can increase property values, as, for example, in the US, where beach nourishment investments are capitalised into coastal real estate values (*McNamara* et al. 2015). While it is difficult to disentangle the positive effect of coastal amenities and the negative effect of coastal risk on property values (*Beltrán* et al. 2018), property values are more likely to decrease after flooding events (*Ortega* and *Taspinar* 2017). This can have distributional effects as the negative impacts of flooding events on housing prices tend to be greater for low value properties (*Zhang* 2016).

Land-based financing relies on value capture of infrastructure investments, e.g. in roads, public transit, or flood protection, that increase land values through various instruments, such as, direct land sale, land taxes, special assessment districts, etc. (*Peterson* 2008). While land-based financing of public infrastructure is well-established in the transport sector, most prominently in the US and UK (*Connolly* and *Wall* 2016) it is newly emerging for coastal protection infrastructure. Initial studies have assessed value captured through taxation in nature-based flood defence in the Netherlands (*Kok* et al. 2019) or beach nourishment in the eastern US (*Mullin* et al. 2018) or through lease of reclaimed land in the Maldives (*Bisaro* et al. 2019). Yet while land-based financing offers potential to mobilise investment in coastal adaptation infrastructure, it may give rise to significant distributional issues (see next section).

2.2 Approaches to land-based financing and distributional effects

Land reclamation, particularly in urban settings, involves major land deals in which high-value coastal real estate is at stake (*Shatkin* 2008). Public actors' decision-making authority influences the financial and governance arrangements in such projects (*Bisaro* and *Hinkel* 2018). Governments have responsibility for land use zoning, granting or tendering of development permits, and determining building codes and regulations (*Alexander* 2001). The exercise of these responsibilities effect the distribution of project benefits, and thus give rise to incentives and opportunities for rent-seeking behaviour by private actors, such as, asset owners, real estate development and construction companies, and for corruption of public officials (*Sovacool* et al. 2015).

The urban development literature shows that governments pursue different strategies regarding revenue generation required by the land-based financing approach and these different strategies can have different distributional effects (*Shatkin* 2016). Which type of revenue generation, or 'land monetisation', strategy governments pursue is influenced by government autonomy, i.e. the extent of feedback from democratic processes on land management decisions, and the governments' involvement in land markets, e.g. extent of government land ownership or land tenure arrangements (*Shatkin* 2016).

Relatively autonomous governments with strong involvement in land markets, allow the state to monetise land value directly, e.g. through lease or sale. Such a 'state capitalist' approach may generate sufficient revenues to allow significant social housing allocations or fund other redistributive social welfare programmes, as for example in Singapore (*Phang* and *Helble* 2016). It may also lead to real estate development decisions favouring patron networks within the government (*Shatkin* 2008). Whether distributional effects are equitable depends on the balance between social housing, or social welfare programmes, and distribution to patronage networks. In contrast, autonomous governments that are not large land owners, tend to pursue 'land grab' strategies that appropriate land for clientelist corporate interests, potentially leading to dispossession of poorer segments of society e.g. as in Cambodia or Indonesia (*Abidin* et al. 2015). Less autonomous governments with low land ownership often pursue strategies to increase both of these variables, e.g. moving land use responsibilities to national state agencies or establishing parastatal development agencies to insulate land use decisions from participatory processes. Similar to the 'land grab' strategy, dispossession or displacement may result, e.g. when states prioritise fiscal objectives over social ones.

This literature provides a relevant political economic lens for understanding land reclamation planning decisions, and their potential distributional effects. Note that land reclamation, however, can differ from typical urban development, in that new land is created, as opposed to being redeveloped, and thus the displacement issue may not be salient. We can nonetheless understand land reclamation planning decisions, and the re-distributional instruments included (or not) in these planning decisions, based on experiences in similar sectors, such as urban transport and development discussed above.

2.3 Distributional effects of implementation

While land reclamation projects may include plans for equitable distributions of project benefits, e.g. large social housing allocations, distributional effects are also determined by competition between stakeholders for project benefits during and after implementation. Such processes can lead to divergence between the planned outcomes and those implemented on the ground. In practice, implementation can increase inequalities, as more powerful or influential actors may be better able to appropriate benefits, concentrating newly created goods in private hands (*Sovacool* et al. 2015), or exacerbating existing vulnerabilities (*Oulahen* et al. 2015).

Indeed, experiences with policy instruments aimed at ensuring equitable access to housing have shown that socio-economic variables, e.g. wealth, education, are positively associated with access to housing (*Dewilde* and *Lancee* 2013). While the relationship is complex, and depends on a range of other contextual variables, measures intended to ensure housing access tend to be counter-productive in conditions of high inequality, exacerbating existing inequalities. For example, influential or powerful actors may be able to outcompete others for project benefits, e.g. below-market housing leases, even when it requires subverting laws or regulations on social housing (*Hedin* et al. 2012).

Regarding exacerbating existing vulnerabilities, I note that land reclamation projects, even when they include plans for flood risk reduction, can also increase coastal flood risk under certain conditions. Land reclamation can intensify ground water extraction leading to higher relative sea-level rise (*Higgins* et al. 2013). Erosion can also be increased locally by lack of sediment due to extractive construction activities that generally accompany land reclamation (*Murray* et al. 2014). Often these physical impacts affect poorer and marginalised communities (*Oulahen* et al. 2015).

A key influence on distributional effects in implementation is state capacity, as state capacity influences the extent to which rule of law prevails (*Soifer* 2016), and balances the strength of incentives for rent-seeking behaviour emerging from the opportunities to profit from high-value real estate (*Goodfellow* 2017). Indeed, the emerging literature on land value capture in developing countries illustrates that low state capacity is a major barrier for revenue generation, particularly for tax-related instruments, which may also reduce the ability for the government to provide social housing or other re-distributional social welfare programmes (*Suzuki* et al. 2015). State capacity also determines enforcement of planning and environmental regulations, which can reduce the shifting of risks to marginalised communities (*Tompkins* et al. 2010).

In Section 3, I present three examples of land reclamation including adaptation. The examples represent different land-based financing approaches, which may have different distributional effects: state capitalist in the Maldives, a mixed regulated market approach in Hamburg, and a privatization approach in Lagos. For each example, based on the foregoing discussion, I explore how distributional effects have been addressed in *planning* decisions, and how distributional effects have played out in project *implementation*.

2.4 Methods

The methodology of this study is a small-n comparative case study. As a representative sample is not feasible given the study design, cases have been selected with the aim of maximizing the differences between cases (*Yin* 2013) along the dimensions of governance arrangements (e.g. level of private involvement) and housing policy instruments (e.g. social housing, rent-control, etc.). This approach is aimed at obtaining a broad sample of the various types of land reclamation projects including adaptation currently underway. This methodology is appropriate given the exploratory research questions addressed, and as a means for identifying future areas of in-depth governance and policy research in this domain. Case study selection was further subject to the following criteria. A first criteria has been that a case includes a coastal land reclamation project that is currently underway. I applied a broad understanding of land reclamation here, thus including projects that redeveloped industrial or unused land for urban development, i.e. HafenCity. A second criteria is that the project include a coastal adaptation component, in the sense that flood risk reduction has been included in the project in a manner that addresses increasing flood risks due to sea-level rise (SLR). Finally, case selection was also influenced by practical considerations, as the qualitative research methodology included personal communication with key informants in the cases to supplement data I collected through desk review. Thus, cases in which I had established contacts with stakeholders were prioritized for inclusion. Regarding data collection, for each case, desk review of key government documents, databases and the scientific literature, and stakeholder interviews (carried out in 2018) were conducted in an iterative sequence to identify governance arrangements and key distributional issues that emerged in planning and implementation.

3. Examples of land reclamation and adaptation

3.1 State capitalist land reclamation

3.1.1 Context

The Maldives consists of around 1,200 low-lying atoll islands, spread across over 90,000 sq km in the Indian Ocean. With the approximately 200 inhabited islands lying at an average elevation of 1.5 m above mean sea-level (MSL), the Maldives are exposed to coastal flood risk that will increase substantially with sea-level rise (*Wong* et al. 2014). Regional mean sea-level rise under high global emissions scenarios could be up to 1.3 m in the Maldives by 2100 (*Kopp* et al. 2014). With a rapidly growing population over 400,000, land is scarce in the Maldives, particularly in the capital of Malé, one of the most densely populated areas in the world (*NBS* 2014). As the Maldives has one of the world's highest coastal-protection-costs-to-GDP ratios, due to the

expense of protecting a population dispersed among many small, often oblong-shaped islands (*Nurse* et al. 2014), migration to the capital has been supported by the government through various initiatives partly aimed at reducing government costs of service delivery (*Magnan* et al. 2016).

Given these trends, land availability and affordable housing in the capital has been concern for over a decade. As early as 2001, rent made up a significant portion of household income (45%) in Malé, and land value was 80% of the price of a dwelling (*Bertaud* 2002). At the same time, land reclamation costs are low, due to relatively plentiful sediment and the shallow atolls (*Naylor* 2015). As all land in the Maldives is owned by the government, new island creation addresses land scarcity, while representing a significant revenue generation opportunity for the government, potentially providing sufficient revenues to ensure equitable development, e.g. through social housing allocations and funding public infrastructure, such as hospitals and schools. The Hulhumalé project, initiated in 1997, foresees three major phases of land reclamation providing a total planned 700 ha of new land in the greater Malé area upon completion. The project provides adaptation to SLR by raising the new island to 2.1 m above MSL, 60 cm higher than average protection levels in Malé.

3.1.2 Distributional effects of planning decisions

For developing the land in Hulhumalé, the government developed a master plan zoning areas for social housing, residential and commercial uses. The project planned to provide social housing, specially for those in need in Malé, however, as the project progressed financial viability became an increasing concern, and thus a larger portion of buildings in the 200 ha Phase I were built to higher standard and rents charged were thus higher. Hulhumalé was changed to a mixed development which would "cater for the needs of all sectors of society" (*Ahmed* 2005: 68).

Given the land tenure system, the government is able to directly capture land value through leases. For residential areas, development leases to real estate companies are generally granted for 15 years, and can be renewed, and entail the payment of a development fee to the government. In principle, high revenues from real estate leases for the government can enable the government to devote a large share of the project to social housing, while still recovering initial investment costs, thereby meeting social inclusiveness and equity objectives. In practice, however, the initial large social housing share in Phase I was reduced to meet the high upfront costs of infrastructure provision on Hulhumalé, e.g. schools, hospitals and mosques.

3.1.3 Distributional effects of implementation

While the government planned substantial social housing in Hulhumalé, redistributing revenues generated through its state capitalist approach (*Shatkin* 2016), implementation has given rise to further distributional issues, as social housing applications have far exceeded the available supply since the outset of the project. The high demand for housing in Hulhumalé gives rise to incentives for distortions in the lease allocation process. Securing leases is profitable for private individuals, due to an illicit market for sub-letting which has emerged in Hulhumalé (*MNBS* 2012). Further, the government appeared also to distribute benefits to within their networks to attempt to reinforce their own position. These incentives are further reinforced by the intransparent process through which social housing contracts are awarded. To take an example from November 2017, the government allocated 661 new flats in Hulhumalé to a selection of 15,000 applicants. The scoring system for lease allocating flats was kept secret and 2,900 complaints regarding the allocation process were lodged (*Maldivian Independent* 2017a). Further, in allocation of 7,000 flats to be finalised in 2018, 1,000 were set aside for civil servants without the requirement that they not have other housing in Hulhumalé (*Maldivian Independent* 2017b).

Further, for social housing that has been implemented, competition for valuable social housing leases has led to unequal distributions, as wealthier, or better connected individuals, appear to be more able to attain social housing leases. A particularly important aspect influencing these distributional effects are financing constraints. At the outset of the project the Maldivian Housing Development Finance Corporation was the only institution providing social housing financing, and was only able to provide loans to 25 households per year (*GoM* 2008). Financing for social housing has since been expanded as the government in 2016 launched an initiative requiring major lenders, including private banks to participate in a fund that would allocate 10% of its budget to social housing. However,

financing constraints remain significant on poorer households. For instance, in 2017 more than 100 winners of social housing flat leases in Hulhumalé were required to give up their flats because they could not secure financing. The flats were instead put up for auction, where eligible bidders, of greater financial means, had to meet one requirement only. They were not allowed to already own housing in the greater Malé area (*Maldivian Independent* 2017b).

3.2 Regulated market urban redevelopment

3.2.1 Context

Hamburg is a major German port city located in the Elbe estuary, with a population of around 1.8 million. The city is highly exposed to coastal flood. Following major floods of 1962, the city dikes were raised to a well-protected 7.5 m above mean sea-level (MSL) (*von Storch* et al. 2008), and raised again in 2012 up to 9.3 m above MSL partly in response to sea-level rise (*Bürgerschaft* 2012), which could be up to 1.28 m regional for high global emission scenarios (*Kopp* et al. 2014).

Following the German reunification in 1990, key stakeholders in Hamburg saw an opportunity to position the city as a major port metropolis on the world stage through a mega-project redeveloping central port and industrial area outside the city dike. The HafenCity project, announced in 1997 and initiated in 2000, aims to re-develop and thus reclaim 127 ha of land area for mixed use development with 7,000 new residential units planned for 14,000 residents and commercial units by 2030. The project expands the inner city centre area by around 40%, while providing the same level of flood protection as the main Hamburg city dike (*HafenCity* 2017). Due to flood hazard and flood safety laws in Hamburg, with an elevation of only 4.5 m above MSL on average this area would have been unusable in absence of flood risk reduction incorporating Hamburg SLR allowances, to meet the flood safety standard in the project area (*Restemeyer* et al. 2015).

3.2.2 Distributional effects of planning decisions

Planning documents and legislative activities at the time of HafenCity's inception show that the project's main aim was not to address Hamburg's flood resilience per se, but rather to rapidly position the city as a major port metropolis. The Master Plan of HafenCity is based on a flood risk management concept that raises individual building plots ('*Warften*') ca. 3 m (*HafenCity* 2006), instead of a competing idea also considered of connecting the project to the main dike line (*Restemeyer* et al. 2015). The step-by-step development would allow areas of the project to be completed in the relatively short-term, bringing Hamburg onto the international stage, and generating revenues to fund further components of HafenCity. The raised building solution had public balance sheet benefits, as it enabled the City to pass some flood protection costs on to private developers (*Bisaro* et al. 2019).

Further, legislative measures undertaken also show the primacy given by city policy-makers to the development opportunities offered by HafenCity. The City Senate legislated an exception to the Hamburg Flood Safety Law to ensure that residential use could be included in the area outside the main city dike line (*Restemeyer* et al. 2015). Further, a special purpose vehicle, the HafenCity GmbH, was established, and took on all City land assets and responsibility for land transactions and project implementation, establishing some distance from political decision-making processes (*Bruns-Berentelg* 2011).

The project was also a major issue in the 1997 mayoral campaign. At the time, the commitment was made that the project would not negatively influence the City's balance sheet (*Restemeyer* et al. 2015). This constrained the extent to which non-market housing could be included in the project, because of the need to generate sufficient revenues to offset investment costs. As HafenCity was conceived as a prestige project meant to attract both tourism and international business, with high associated investment costs, e.g. from the Elbphilharmonie, significant revenue generation was required from land sale. This constrained planners' ability to include social housing. Instead, planners aimed to achieve a 'social mix' in development by establishing a land sale process based on fixed prices. Rather than selling to the highest bidders this alternative bidding model focuses on integrating community goals of HafenCity with the economic objectives, and allowed the city to 'pre-select' developers in order to ensure inclusive development (*Bruns-Berentelg* 2011).

3.2.3 Distributional effects of implementation

Despite plans aiming at a 'social mix', implementa-

tion of HafenCity led to further distributional issues. First, the high costs of building development, driven by flood protection costs and transaction costs of the tendering process, hindered joint ventures, and co-operatives, from competing in the fixed-price bidding process. Second, major cost overruns led the City in 2010 to end the fixed-price bidding process and once again restrict development to revenue-prioritising land sales.

Implementation in a brief initial phase prioritised revenue generation in land sales in order to fund the major infrastructure investments required in order to adhere closely to the projects' commitment to city budget neutrality. Following this initial phase developing the Sandtorkai area, from 2003 HafenCity GmbH sold land to developers at fixed prices (below market value) provided they engaged in a two step bidding process showing they could meet a range of social objectives, including that of achieving 'social mix' (*Bruns-Berentelg* 2011). This 'developer pre-selection' enabled some joint ventures, including co-operatives, to win bids by prioritising 'social entrepreneurs' committed to the social vision of the city. However, despite co-operatives winning bids, the rental prices they offer are more expensive than comparable co-operative housing arrangements outside of HafenCity. These higher prices can be attributed to the higher cost of building on swampy land, and the costs of the mound flood protection technology (*Warften*) required (*Stefanovics* 2016).

From 2010, the fixed-price approach to tendering land plots was blocked by the City Senate, which took a strict interpretation of budgetary law and thus prevented land being sold below its market value (*Stefanovics* 2016). Indeed, financial pressure was increasing, due to cost overruns of the Elbphilharmonie, and further financial constraints. In particular, the global financial crisis in 2008 induced a change in global credit conditions, which had knock-on effects for the project due bankruptcies of some developers, leading to delays, and thus costs to the government, from negative impact on further investment in the project and lost tax income.

In 2011, after a switch back to a centre-left SPD government following 10 years of CDU, the city pledged to include a social housing quota of 30% in all future residential development. However, this was a voluntary pledge, rather than statutory, and has led to varying interpretations in implementation. Given above-average rents for co-operative housing, and a low share of social housing in HafenCity overall, the project has been criticised regarding lack of inclusiveness (*Vogelpohl* and *Buchholz* 2017), which remains difficult to address given the public budget imperatives of funding the project's major investment costs (*Bruns-Berentelg* 2011).

3.3 Privatized land reclamation

3.3.1 Context

Lagos, on Nigeria's Atlantic coast, is one of the world's fastest growing cities with an estimated population of 15 million. While Lagos is one of Africa's largest ports and financial centres, around 70% of its population currently live in slum-like conditions, while more than half of the Nigerian population living on less than one dollar a day (*Ajibade* and *McBean* 2014). Basic housing needs are not met for a large portion of the population, and these households face disproportionate flood risks, due to being located in risky areas, with inadequate water drainage and sanitation infrastructure (*Ajibade* and *McBean* 2014). Indeed, urban infrastructure has historically been concentrated in wealthy areas dating back to colonial times (*Abosede* 2006). Moreover, Lagos is among the world's cities most exposed to coastal flood hazards under sea-level rise (*Hanson* et al. 2011), with a potential for regional sea-level rise of up to 1.4 m by 2100 under high global emission scenarios (*Kopp* et al. 2014). Lagos' southern coast has experienced severe coastal erosion, with shoreline recession estimated at up to 30 m per year (*Rosenzweig* et al. 2011), largely resulting from disruption of sediment transport following the construction of port infrastructure at the beginning of the 20th century (*Okude* and *Ademiluyi* 2006).

In 2005, a large-scale storm surge leading to flooding, damaging several coastal neighborhoods and resulting in 16 fatalities, brought greater attention to the increasing flood risk caused by erosion on Victoria Island in Lagos. Subsequently, the government announced the Eko Atlantic initiative, an urban development and land reclamation mega-project aimed at addressing both coastal erosion by reclaiming land in front of exposed areas on Victoria Island and economic development goals through high-end real estate and commercial development. The project plans to reclaim 10 sq km of land and adaptation is addressed by including flood protection by a 8.5 km sea wall that

is built to withstand a 1-in-1000 year water level design height (*Eko Atlantic* 2017).

3.3.2 Distributional effects of planning decisions

One of Eko Atlantic's stated primary goals is to mitigate flood and erosion risk for the upscale Victoria Island neighborhood. It is designed for both residential and commercial use. Residential use focuses on luxury accommodations that is separate from crowded central Lagos. The project aims to accommodate over 300,000 residents upon completion and to house a substantial commercial district. Costs for the entire project have been estimated at US$6 billion (*Eko Atlantic* 2017). Dredging began in 2009, and by 2013, more than 5 sq km had been reclaimed. The first residential building was completed in 2016.

Eko Atlantic is arranged as a public-private partnership between the Lagos State government and South Energyx Nigeria Limited (SENL). All flood protection, infrastructure and real estate development costs are financed by private actors, which include largely foreign and many European financial institutions, coastal engineering and dredging companies, architecture firms and real estate development companies. For the project, the government awarded SENL sole land reclamation rights in 2006, and a 78-year occupancy lease agreement (*Ajibade* 2017). Thus, the government has no costs associated with the project, but within the lease agreement, no arrangements for social housing have been included. Further, while protection for Victoria Island is achieved at no cost to the public, there is a potential to shift flood risks to adjacent communities.

The project's economic rationale, creating regional growth, has largely resonated in public discourse, while the hazard reduction rationale is more contested, with opposing views on the hazard impacts of the project presented in the media (*Ajibade* 2017). In particular, concerns regarding the distributional issue of shifting risks have been voiced. While the project addresses erosion risks for affluent Victoria Island, because the project also affects sediment transport, there is concern it could exacerbate erosion downstream of the project, where poorer communities are also at lower elevation and thus face greater flood risks (*van Bentum* et al. 2012). The initial project design aims to minimize these risks. However, managing erosion risks requires continual monitoring and maintenance, and there is concern that this will not occur due to the private nature of the project and weak regulatory environment (*Ajibade* 2017).

3.3.3 Distributional effects of implementation

In contrast to the two other projects reviewed here, no allocation for social housing has been included in Eko Atlantic. As a purely private development, the project can only positively affect housing affordability or availability by increasing the overall housing supply in Lagos and releasing pressure on the housing market. Indeed, prices in the project are inaccessible to middle or lower income residents, e.g. 3-bedroom flats have an average sale price of over US$1 million (*Abijade* 2017). Currently, it is difficult to ascertain the effects of the project on housing availability, and in particular its distributional effects, in part because the first residential real estate has only recently been completed.

As land reclamation started much earlier, however, some observations on the distributional effects regarding flood risks in adjacent communities outside the project are available. For instance, in 2012, storm surge flooding led to 16 deaths in the Kuramo area adjacent to the project. Many local residents were subsequently evicted from the area by the government, which argued that it was protecting these largely poorer households from likely future damages. In other wealthier adjacent neighborhoods that also experienced flood damages, however, eviction did not occur, and in fact, in some areas the number of building permissions granted increased following the flood event (*Ajibade* 2017). This illustrates that exclusive reliance on private flood risk reduction can shift risks onto poorer segments of society. Alternatively, it can also reduce access to valued coastal amenities for poorer populations, as they are displaced from high exposure areas if they cannot afford to take private risk reduction measures.

Finally, another distributional effect of the project has been to enclose public spaces, such as, the beach in front of Victoria Island, which had been a major site of tourist activity prior to the project (*Adelekan* 2013). Such enclosure can threaten local tourism-based livelihoods, particularly if beach tourism is substituted with visits and expenditure within Eko Atlantic itself, rather than shifted to other public beach areas in surrounding areas.

4. Discussion

This paper has explored current trends in land reclamation projects including adaptation, and the distributional effects through three examples in the Maldives, Germany and Nigeria. Given that land reclamation is proceeding around the world in a wide range of political-economic settings, under a range of different project designs, our small sample has only provided an exploration of three different development models underlying the projects, i.e., state capitalist (Maldives, Hulhumalé), mixed regulated market (Germany, HafenCity), and full privatisation (Nigeria, Eko Atlantic), and the respective channels through which they can lead to distributional effects. We can thus draw some lessons from these examples, both comparing across them, and individually, by setting them in the context of current literature, while noting that the transferability of these lessons must be limited, as there is a range of other political-economic settings in which such land reclamation is occurring (*Sengupta* et al. 2018).

Comparing across the cases, I find two broad patterns across the different political economic contexts analyzed. First, land reclamation in land-scarce urban areas presents challenges for ensuring equitable distributional outcomes across different political-economic contexts. Generally, land reclamation involving adaptation is seen as a significant opportunity for governments to finance investment in coastal cities, and yet in each example, equity concerns have emerged. Second, I find that our examples are consistent with the emerging literature that land reclamation projects have relative small adaptation costs and can produce significant revenue streams (*Bisaro* et al. 2019), thus representing a 'low-regret' adaptation strategy (*Hallegatte* 2009). However, taken these two patterns together, such 'low-regret' strategies raise concerns about who will benefit from such adaptation. Indeed, each of our examples has been associated with ‚prestige' developments, which often have the goal of raising cities' global status raising questions about the motivations of public decision-makers, and their ability to ensure project benefits for the most vulnerable (*Broto* and *Bulkeley* 2013). This is particularly important in the context of pressure on housing affordability and availability around the world.

Another pattern that emerges from comparing our cases is that land tenure arrangements and state capacity are highly influential in achieving equitable outcomes. Land tenure arrangements significantly influence the government's ability to ensure inclusive development, either directly in new developments, e.g. through social housing, or indirectly by funding social welfare programmes. Where the state is the principle land owner, redistribution should in principle be achievable. Because of the high revenues accruing to the government, social welfare programmes can be funded and significant affordable housing can be provided. Singapore is a quintessential example of such a strategy, whereby the government ownership of land has remained extremely high, even as it has implemented and financed significant land reclamation (*Phang* and *Helble* 2016). Our example of land reclamation in the Maldives is consistent with this view, in that revenue generation was projected to be significant enough to ensure substantial social housing in the project and to ensure equitable access. However, the Maldivian example also illustrates that the high stakes of such projects, due the high-value land, can lead to deviations from plan, and thus highlight the importance of state capacity in enabling equitable distributions.

When land tenure arrangements include moderate private involvement, even when state capacity is high, distributional challenges also emerge, as illustrated by the HafenCity case. While the City did pursue policy instruments aimed at ensuring accessibility to project benefits, and thus equitable distributions, it was only able to effectively implement some of these for a limited time, up to 2010. Budget imperatives arising from the significant project investment costs, subsequently led the City to revert to relying on private land sales for revenue generation. Moreover, even housing that was implemented under the 'fixed-price' bidding process were not entirely successful. For example, increased costs of building flood protection into the co-operative building projects led such co-operatives to increase their rental prices, which in turn were met by the higher demand for attractive locations within the project area, compared to similar developments in the rest of Hamburg.

Finally land reclamation with high private ownership of land also presents concerns regarding shifting of physical risks, particularly to more marginalised communities. When state capacity is low, high private involvement can lead to trade-offs between enabling funding for adaptation, and negative effects on adjacent areas and populations, often more marginalised, as illustrated in the Lagos example. This is also con-

sistent with the broader literature as, for example, in Jakarta a coastal mega-project aimed at addressing flood risks through attracting private finance for high-end development has led to increased flood risks for marginal communities (*Abidin* et al. 2015).

Our cases thus illustrate the need for further comparative governance research to understand institutional arrangements under which such public investments in coastal adaptation and land reclamation can be mobilised, while also ensuring that equitable distribution of benefits is achieved. This is particularly relevant given the propensity for policy-makers to favour prestige projects as a means to attract finance for urban development, and the amenity of coastal areas to such projects. Investigating the interactions and incentives that emerge for private and public decision-makers at different levels of governance in the context of coastal urban land development is a key emerging research need, in the context of ongoing and accelerating coastal urbanisation, and increasing coastal risks due to sea-level rise.

Other open research questions concern the negative environmental impacts of land reclamation, e.g. on coastal ecosystems such as coral reefs, and the extent to which land reclamation can fit into longer term sustainable adaptation strategies, overcoming potential lock-ins (*Magnan* et al. 2016). These are important questions because, on the one hand, land reclamation is happening all around the world and building adaptation into such measures makes economic sense from the perspective of an individual project. On the other hand, such projects tend to privilege particular development pathways, which may not turn out to be sustainable over the long-term, particularly given the high uncertainties associated with sea-level rise, and the inequitable distributional effects that may ensue.

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