# Finance, Water Infrastructure, and the City: Examining the Impacts of Current Financial Practices on Urban Development

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# Eidesstattliche Erklärung

Ich erkläre, dass ich die Dissertation selbständig und nur unter Verwendung der von mir gemäß §7 Abs. 3 der Promotionsordnung der Mathematisch-Naturwissenschaftlichen Fakultät, veröffentlicht im Amtlichen Mitteilungsblatt der Humboldt-Universität zu Berlin Nr. 42/2018 am 11.07.2018 angegebenen Hilfsmittel angefertigt habe.

Fritz-Julius Grafe

Berlin, den 10. Februar 2020

# Zusammenfassung

Diese Dissertation untersucht die Frage, wie sich aktuelle Finanzpraktiken auf die Versorgung mit städtischer Wasserinfrastruktur auswirken und welche Konsequenzen diese Praktiken für Städte haben. Die Arbeit umfasst drei spezifische Ziele, die jeweils in einer separaten Publikation behandelt werden: Die erste Publikation entwickelt den theoretischen Rahmen zur Erarbeitung der Forschungsfrage und prüft diesen in einer ersten empirischen Anwendung. Dabei wird argumentiert, dass durch die Betonung der Rolle von Infrastrukturen und die Entwicklung eines auf "Finanzökologien" basierenden Modells die Auswirkungen der Finanzialisierung auf Städte besser verstanden werden kann. Die empirische Anwendung im Kontext der Einführung von Kommunalanleihen in Großbritannien zeigt erste räumliche Effekte auf. In der zweiten Publikation wird die zeitliche Dimension der Finanzialisierung von städtischer Wasserinfrastruktur untersucht. Sie hebt die soziale Erfahrung von Zeit (temporalities/Zeitlichkeiten) hervor und zeigt am Beispiel des Thames Tideway Tunnels (TTT) in London, wie dessen Finanzialisierung bestimmte zeitliche Charakteristika festlegt. Diese eröffnen und verschließen Möglichkeitsräume, welche abschließend betrachtet werden. Die dritte Publikation wendet das im ersten Artikel entwickelte Modell auf eine vergleichende Analyse der Finanzökologien der städtischen Infrastruktur in London und Mumbai an. Um die sich wandelnde Dynamik der Finanzökologie besser zu verstehen, verfolgt der Artikel einen zweistufigen Ansatz: Zunächst werden Initiativen zur Einführung von Kommunalanleihen als Mittel zur Infrastrukturfinanzierung auf nationaler Ebene untersucht. Sodann wird beispielhaft ein Fall der Projektfinanzierung auf lokaler Ebene herangezogen. Die empirische Analyse dieser Fälle fungiert anschließend als Grundlage für eine vergleichende Untersuchung, welche unterschiedliche Muster der Finanzialisierung identifiziert. Im weiteren Verlauf setzt sich der vorliegende Text kritisch mit den ursprünglichen Zielen und der Methode der Dissertation auseinander und gibt einen Überblick über die geleisteten Beiträge zur einschlägigen Literatur. Der Schlussabschnitt fasst die drei Veröffentlichungen zusammen und bezieht diese auf aktuelle Forschungsergebnisse zur Finanzialisierung der städtischen Infrastruktur. Abschließend wird ein Ausblick auf die Bedeutung des behandelten Feldes für die Herausforderungen des Klimawandels und das Aufkommen von „Smart City“-Konzepten gegeben.

# Abstract

This thesis examines the question of how current financial practices affect urban water infrastructure provision, and the consequences of these evolving practices for cities. The thesis sets out three specific objectives, each tackled by a separate publication: the first aims to establish a theoretical framework capable of addressing the research question, and tests it via a first empirical application. It presents the argument that, by emphasizing the role of infrastructure and developing a conceptual model based on financial ecologies, we can better understand the impacts of financialization on cities. The empirical application, in the context of municipal bond development in the UK, identifies some initial spatial effects. The second publication explores the temporal dimension of finance in relation to urban water infrastructure. It emphasizes the social experience of time as temporalities and shows, by example of the Thames Tideway Tunnel (TTT) project in London, how its financialization establishes certain temporal characteristics. The paper concludes with an analysis of openings and closures for political intervention that result from these specific characteristics. The final publication applies the conceptual model, developed in the first publication, to a comparative analysis of the financial ecologies of urban infrastructure in London and Mumbai. To determine the changing dynamics of financial ecologies, the paper follows a twin approach: firstly, it examines initiatives for the introduction of municipal bonds as a means for infrastructure financing at the national level; secondly, it identifies an exemplary case of project finance at the local level. Data obtained through empirical research allow comparison of the cities' respective financial ecologies, thereby highlighting patterns that emerge as a consequence of financialization. The thesis concludes by reflecting on the original objectives, the method, and by summarizing the contributions to the literature. The conclusion section draws together the three publications and relates them to current research on the financialization of urban infrastructure while providing a perspective on the significance of the field in view of the challenges of climate change and the momentum behind 'smart city' initiatives.

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# 1. Introduction

Beginning in the 1980s, the on-going liberalization of markets and policies has enabled the financial sector to continually expand and increase its economic significance. In doing so, it has outperformed other economic sectors and become the backbone of a modern globalized economy. The financial crisis of 2008 painfully exposed the increasing influence of changing financial practices on urban development. Cities are affected by this financialized economy in numerous ways, most significantly through different forms of investment in the urban fabric itself. Urban redevelopment projects, subprime mortgages, as well as specialized infrastructure funds are just some examples of how the increasingly financialized economy affects what is to be built, where, and why. This thesis aims to further the understanding of how these changing financial practices affect cities by example of urban water infrastructure development.

Research within geography on the interplay of cities and finance has covered a wide range of perspectives, ranging from Saskia Sassen's Global City approach to concepts such as David Harvey's spatial fix (Sassen 2002, Harvey 2006). On the issue of financialized investment in the urban fabric specifically, more recent research has concentrated on the repercussions for the real estate sector and resulting processes of institutional change in urban governance (cf. Weber 2010, Clark et al. 2015, Aalbers 2017). This approach leaves a significant blind spot for other forms of investment in the urban fabric, while at the same time neglecting the wider spatial effects that these changes bring to cities (cf. French et al. 2011). This dissertation makes the argument that in order to understand the wider impacts of these changing financial practices on cities, we must set the focus on urban infrastructure. Infrastructures are at the epicenter between epistemological narratives of economic growth, global urbanization, and the financial mechanics enabling them. Infrastructures are a prerequisite for the functioning of cities and are tied to immense investment costs that are increasingly becoming the subject of financialization (Ehlers 2014). Infrastructures structure the use of urban space; they not just enable, they also constrain; where they fail to connect, they divide; and they lock in long-term path dependencies for urban development (cf. Angelo & Calhoun 2013). Furthermore, they are central to the success of cities as the "main centers of wealth creation and capital accumulation through extending their control and appropriation of labor power and of resources over distant territories, people and ecosystems" (Graham 2010, p.4). Thus, their significance transcends

questions of urban development per se, as they also play an important role in defining the relationship between society and its environment.

This is particularly true for water infrastructure, whose development reaches as far back as the emergence of cities themselves. Today, the relationship of urbanites with their water infrastructures is somewhat schizophrenic: in the Global North they are often taken for granted and become invisible, whereas in the Global South they are often contested and at the center of citizens' everyday lives. Be it visible or invisible, a city's water system has significant influence on urban life and builds a web of power relations with repercussions that extend far beyond the city itself. With aging water infrastructures in the Global North lagging behind their investment schedules, and much of the infrastructure in the Global South yet to be built, the question of finance emerges as a key challenge for the future of billions of urban dwellers.

In order to successfully examine changing financial practices in the water infrastructure sector and their impacts on cities, this thesis utilizes two main strands of literature in addition to recent insights from the discourse on comparative urbanism.

The first strand of literature refers to recent research on infrastructures within urban geography and sociology. Geographers use an infrastructural perspective to embrace a multitude of urban issues such as accessibility and visibility, spatial fragmentation, disruption, as well as non-material infrastructures (cf. Gandy 2011, Graham 2010, Graham & McFarlane 2015, McFarlane & Rutherford 2008, Monstadt 2009, Simone 2004), while sociological analysis mostly emanates from science and technology studies and the role of infrastructures as the material structures underpinning current forms of social organization and interaction (Angelo & Calhoun 2013, Star 1999, Star & Ruhleder 1994, 1995). Common to these debates is a renewed focus on the material structures enabling modern societies, and an analysis of the patterns that result from this reciprocal codependency. This strand of the literature provides the theoretical frame for connecting abstract financial practices to their spatial impacts on cities.

The second body of literature refers to the debate on financialization as a device for framing the changing financial practices employed in the provision of infrastructure. As Christophers states (2010), much of the current debate on financialization reaches back to prescient arguments made by David Harvey, albeit in that case without applying the label of financialization (1989). Current interpretations mostly derive from the work of authors such as Giovanni Arrighi and Kevin Phillips (Arrighi 1994, Phillips 1994), and are applied widely within urban studies (cf. French et al. 2011, Aalbers 2017, Clark et al. 2015, Loftus & March 2016,

Allen & Pryke 2013, Weber 2010, Rutland 2010). Many of these studies refer to Epstein's common definition of financialization as "the increasing role of financial motives, financial markets, financial actors and financial institutions in the operation of domestic and international economies" (Epstein 2005, p.3).

The theoretical frame of this thesis thus also relates to the wider debate on critical infrastructure and urban resilience, less as a contribution to analyzing the interdependence and systemic risk within a particular infrastructural system, but more towards understanding potential vulnerabilities resulting from the economic framing of infrastructure construction and maintenance (cf. Rinaldi et al. 2001, O'Rourke 2007). As mentioned previously, other approaches exist, within geography, for analyzing the relationship between cities and the financial sector: Saskia Sassen's Global City approach emphasizes the significance of the FIRE (Finance, Insurance, Real Estate) sector for a city's economy, but does not provide tools for analyzing the impacts associated with changing forms of investment in the urban fabric of a city; it also lacks a level of sensitivity towards the individual local complexity that is evident in water infrastructure projects (Sassen 2002, Smith 2013). Similarly, Manuel Castells' network society approach provides an interesting entry point for analyzing the changing financial sector and the infrastructures underlying contemporary social organization; however, it is not necessarily well suited to the analysis of water infrastructure, and has been widely criticized in the literature due to several shortcomings (cf. Castells 1996, Crang 2002, Smart 2000). Within economic geography, cluster approaches such as that utilized by Zademach to examine the impacts of global finance on regional clusters (2009), would have provided another interesting perspective on the dynamic, but the viability of a city's water infrastructure system as a cluster is a questionable proposition (cf. Porter 1998). As touched upon earlier, governance-based approaches have been utilized to examine the institutional changes that have resulted from financialization of the real estate sector. This thesis explicitly aims to answer calls to move beyond the scope of governance-focused approaches, and to add to the understanding of wider spatial impacts beyond institutional regulation (cf. French et al. 2011).

Developing a methodological approach that can engage a research object as abstract as financialization and its effects on cities can be a challenge. The primary analytical tool developed specifically for this thesis is the concept of financial ecologies. The approach functions as the central nexus through which the two strands of literature become integrated and the operationalization of the research question is made possible. The discussion of the concept is contained in the first publication. The concept is then further utilized as the basis for a comparative analysis of

the evolving financial practices of water infrastructure provision in London and Mumbai.

After careful consideration of the research question at hand, as well as the strengths and weaknesses of the proposed financial ecology approach, the focus was set on document analysis as the primary means for engaging the subject. Financialization thrives on the formalized information found in different document types, while at the same time producing a significant paper trail of its own practices and ambitions. Legislative and planning documents, expert reports, public statements, legal frameworks, and media coverage provide a layered and nuanced overview of current financial practices while enabling a multitude of perspectives. This approach was extended by expert interviews, aimed both at evaluating the preliminary findings and also filling gaps in the understanding of unwritten practices and assumptions.

# 2. Specific Objectives

This dissertation addresses the question of how financialization affects cities, through the lens of urban water infrastructure provision.

Based on the current literature on this subject, and careful deliberations in the initial phase of the project, three main objectives were identified as being central to the successful analysis of the proposed research question.

## First objective — Establish a theoretical framework to expose the spatial impacts of financialization on cities

The most evident approach to this objective within the literature is the debate on financialization, which provides the necessary framework to begin the investigation; however, the concept remains severely lacking in many regards. Other reviewers on the discourse of financialization (Leyshon & Thrift 2007, French et al. 2011, Clark et al. 2015, Rutland 2010) have pointed out that the current focus is predominantly on the institutional frameworks that enable financialization, especially on the real estate sector. In terms of spatial scale, previous analyses are dominated by the national level, the corporation, and the household/individual (French et al. 2011). If the main interest lies in the spatial effects of financialization on cities, one can conclude that these remain underexposed, therefore encouraging a more holistic debate on the spatial impacts of these practices beyond real estate. French et al. conclude that: "space and place are accorded only a passive role in many accounts of financialization, so that geography is implicitly subordinated either to the status of mere empirical surface, or that of abstract spatial container of socio-economic relations." (French et al. 2011, p.17). If the goal is to present a more nuanced view of the implications of financialization for cities, a more robust framework of analysis is needed. The first objective of this thesis is thus to establish a theoretical framework within which a clearer line can be drawn between complex market mechanisms and everyday experiences of the city.

## Second objective — Identify the temporal characteristics of the financialization of urban water infrastructure

A particularly important aspect when examining the impacts of financialization on cities is the notion of time. Current financial practices and the myriad of financial products in which they are packaged, are all based on the simple premise that finance, at its most basic, is the management of debt; and debt is, simply put, the deferral of payment. Finance is thus foremost a temporal concept that provides opportunities ahead of time while pushing costs into the future. This dynamic is

incredibly significant when we consider the sums necessary to finance large infrastructure projects and the prolonged timescales along which these operate.

While some literature within the financialization discourse touches upon the subject of time (notably Graham and Thrift 2007; Weber 2010; Martin 2002), most current analyses are limited in that they do not explicitly reflect the temporal dimension of financialization. Kloeckner and Mueller begin a conversation on the relationship between finance and temporality, but do not relate this to issues of financialization or specifically the urban context (2018). Other studies that problematize the social construction of time contextualize the temporal effects of finance (cf. Nowotny 1992). This includes: Marxist readings that focus on capitalism's endeavors to speed up and compress time in order to increase productivity (Thompson 1967, Harvey 2008); geographical perspectives on the interplay of space and time (Hägerstrand 1978, May & Thrift 2001, Cresswell 2004, Massey 2005); sociological analysis of time and its role in social interaction (Elias 1992); an economic psychology of time (Mieg 2005); as well as anthropological readings of a variety of cultural conceptualizations of time (Adam 1994, Fabian 2002). The literature concludes that temporality is not a natural external dimension to society, but that it emerges in social practice (Wajcman 2008). Time is thus socially experienced and consequentially "multiple and heterogeneous" (May & Thrift 2001, p.3). This insight forms the basis for the concept of temporalities, which differentiates itself from the abstract notion of time as a 'physical' externality (LiPuma 2017, p.145). It forms a useful point of departure for this second objective of analyzing the temporal impacts of financialization on urban water infrastructure.

## Third objective — Identify and understand the consequences of the financialization of urban water infrastructure

The third objective is to show how financialization affects cities by means of urban water infrastructure provision. The current literature provides a fragmented view of these impacts, often focusing on the real estate sector and questions of urban redevelopment (cf. Aalbers 2017, Heeg 2013, French et al. 2011, Weber 2010), while only recently have some studies begun to specifically address the financialization of urban infrastructures (cf. O'Neill 2018, Pryke & Allen 2019, Loftus & March 2016, 2019). Infrastructures are the structures that form the material foundation of social organization and interaction, and are thus a key link for understanding the wider spatial impacts of financialization on cities (Angelo & Calhoun 2013). A city's flows, enabled by its infrastructures, become subject to financialization through the financiers' desire to

securitize the associated revenue streams. Analyzing this process would reveal how financialization affects long-term planning and decision making and consequentially show the effects on a city's capacity to adapt to future challenges. Understanding the consequences of this dynamic is therefore the third objective of this thesis.

# 3. Method

Three separate studies were conducted to successfully engage with these three objectives. Each study is documented in the three scientific articles that form the basis of this dissertation. The first of these articles focusses on the theoretical framework and tests it in a first empirical engagement. The second explores the temporal characteristics of current financial practices in an original research paper. The third publication is another original research paper, which examines the impacts of financialization in a comparative manner.

## Main Objectives and Related Publications

1. Establish a theoretical framework to reveal the spatial impacts of financialization on cities (Hypothesis and theory article PI)

   > Grafe, F.-J. & Mieg, H.A. (2019). Connecting financialization and urbanization: the changing financial ecology of urban infrastructure in the UK. *Regional Studies, Regional Science*, 6(1), 496-511. DOI: 10.1080/21681376.2019.1668291

2. Identify the temporal characteristics of the financialization of urban water infrastructure (Original Research article PII)

   > Grafe, F.-J. & Hilbrandt, H. (2019). The temporalities of financialization: infrastructures, dominations, and openings in the Thames Tideway Tunnel. *City*, 23(4-5), 606-618. DOI: 10.1080/13604813.2019.1689730

3. Identify and understand the consequences of the financialization of urban water infrastructure (Original Research article PIII)

   > Grafe, F.-J. (in review). Finance, water infrastructure and the city: impacts of financialization in London and Mumbai compared. *Regional Studies, Regional Science*.

Within each of these papers, particular research questions are addressed:

Paper I

1. What are the limitations of current theory on the financialization of the urban?
2. What can infrastructure theory contribute towards better understanding the spatial impacts of financialization?
3. Are financial ecologies a viable method for integrating these bodies of literature?
4. What are the spatial effects of the changing financial ecology of urban infrastructure in the UK?

Paper II

1. What are the temporal characteristics of financialization in the urban context?
2. How do the temporalities of financialization shape the material production of the city?
3. What are the temporal impacts of the financialization of the Thames Tideway Tunnel?

Paper III

1. How does financialization change the financial ecologies of urban water infrastructure?
2. What are the consequences of these changes?

## The comparative approach

Comparative studies have a long history in urban geography, with recent developments in comparative urbanism critically reflecting on these practices (cf. Robinson 2003, 2011, 2014). The main critique emphasizes the parochialism of theory generation, in which the analysis of very few — mostly Western — cities as empirical sites are taken as a legitimate point of departure for formulating universal insights. This critique has led to new approaches to comparative analysis, which challenge these epistemologically one-sided conventions in favor of a more evenhanded analysis. This debate is led in particular by Jennifer Robinson (Robinson 2011, 2003) and Colin McFarlane (McFarlane 2010, 2006), with a focus on overcoming the parochialism of urban theory by bridging the North–South divide in theory generation and fostering "a revitalized and experimental international comparativism that will enable urban studies to stretch its resources for theory building across the world of cities" (Robinson 2011, p.19). Their suggested approach offers new, valuable means for theory generation that are both regionally embedded and sufficiently sophisticated to allow for theoretical abstraction.

This approach makes it possible to analyze the impacts of financialization on cities — not just in those places that are dominated by formal economies and fixed built environments, but also in those that are shaped by an informal economy. This perspective thus widens the lens when examining finance–infrastructure interactions and allows for theory generation that can flow both ways: insights from the Global North can inform the analysis of processes in the Global South and, crucially, insights from the Global South can inform a better understanding of processes occurring in the North.

Even though this project focusses foremost on the cities of London and Mumbai, it is important to note that this comparative approach aims to move beyond the analysis of case studies and to foster a wider understanding of the impacts of financialization on cities. Thus, the primary aim is not to improve the understanding of these particular places, but to contribute towards understanding the impacts of financialization. Therefore, contextual specificity and the unique attributes of these places are carefully considered and taken into account where they inform this central interest in lieu of an in-depth portrayal of local particularities.

The central aspect to operationalizing the research agenda to this methodology is the selection of appropriate units of comparison: the comparative study is not based on a traditional comparison of 'cities,' but on the comparison of clearly defined units. This is done to avoid territorial definitions of the city, thereby enabling the inclusion of networks and flows within the analysis, an aspect that is crucial when examining the impacts of financialization. The comparison presented in the third paper of this dissertation is therefore based on the concept of financial ecologies of urban infrastructure.

## Operationalizing the Financialization of Urban Infrastructure

Several authors concerned with the finance–infrastructure nexus pick up on the concept of ecologies as a means of approaching the subject (French et al. 2011, Monstadt 2009, Swyngedouw 2009). Many of these perspectives are based on Andrew Abbott's definition: "'Ecology' […] names a social structure that is less unified than a machine or an organism, but that is considerably more unified than is a social world made up of the autonomous, atomic beings of classical liberalism." (Abbott 2005, p.248). Abbott contends that three main components make up these ecologies: their actors, their locations, and their associating relations (id.). In his view, these ecologies interact in a system, thus establishing what he calls "linked ecologies" (id.). Interlinkages between ecologies occur by two different means: either as "hinges," referring to a strategy that provides "results to allies" in a linked ecology (id., p.255), and that functions in more than one ecology; or as "avatars," meaning a "copy or colony" of actors from one ecology within another one (id., p.245).

Financial ecologies specifically are described by French et al., with explicit reference to Abbott (2005) and Nardi and O'Day (1999): "The financial ecology approach, therefore, argues that like all systems the financial system is made up of smaller, constitutive ecologies. These consist of certain arrangements that emerge and that are more or less reproducible over time. These processes unfold across space and evolve in relation to geographical difference so that distinctive ecologies of financial

knowledge, practices and subjectivities emerge in different places." (French et al., p.15).

Drawing on this definition with a clearer reference to Abbott's terminology, we can establish the following definition for financial ecologies: they are a social structure in which actors, locations, and their relations form geographically distinct constellations of knowledge, practices, and subjectivities that enable the provision of financial services. These smaller, partially localized financial ecologies form links with other financial ecologies, constituting the wider financial system.

This financial ecology approach is the main means for the operationalization of the research question, as it allows us to establish and analyze a financial ecology of urban infrastructure. It enables us to show how actors, locations, and their relationships form particular arrangements of knowledge, practices, and subjectivities conducive to the creation and maintenance of urban infrastructures. These specific financial ecologies are in turn interlinked with the wider financial system, while producing specific local outcomes that reverberate in the urban contexts in which they are embedded. This conceptual model helps us understand how financialization affects the development, governance, and maintenance of urban infrastructure, and the spatial patterns that result. At the same time, the financial ecology approach provides a distinct unit of comparison for the comparative analysis: one that is equipped to handle the intricacies and connections of current financial practices. By using financial ecologies, we can connect complex financialization processes to distinct urban constellations and examine their effects. With the conceptual framework established, appropriate means for data generation can be applied.

## The sites: London and Mumbai

With the concept of financial ecologies in mind it becomes obvious that the financialization of urban infrastructure is not a process that is contained within the urban borders of an individual city, but that it engages with the multi-level governance structures of cities on numerous levels. National policy, market dynamics, and local political initiatives all shape the conditions that facilitate this process. If one wishes to explore the distinctly urban dimension of this process, it is crucial to identify appropriate sites — that is, places at the forefront of current financialization processes as well as those that face similar infrastructural challenges.

This thesis follows a twin approach for engaging these sites: firstly, it examines national initiatives for the introduction of municipal bonds as a means for infrastructure financing in new markets; secondly, it identifies exemplary local cases of project finance — that is, highly individualized

financial constructs for the provision of urban infrastructure. These two dynamics form central aspects of current forms of financialization of urban infrastructure and thus form the primary criteria for case selection. Consequently, the selected cases should provide sufficient empirical material to establish an accurate picture of their current financial ecologies of urban infrastructure and the changing dynamics within them.

The long history of municipal bonds begins with Italian city states borrowing from major banking families in the early Renaissance. Today, though, its practice is largely tied to the United States, where it is the most common vehicle for the financing of infrastructures. In recent years the practice has spread beyond the borders of the US, and several countries have considered establishing municipal debt markets as a solution to their lack of liquidity for infrastructure provision. It is these places that prove to be the most interesting, as they provide the possibility to outline how this new method compares to the status quo. Two of the most prominent cases that aim to introduce municipal bonds as the solution to their infrastructural problems are India and the United Kingdom. In India, municipal bonds are considered one of the few viable options for financing the immense demand for new infrastructure in the coming years (Ahluwalia 2011). Between 1997 and 2012 Indian cities issued 25 municipal bonds to finance infrastructures across the country, 17 of which were water infrastructure projects (Sheikh & Asher 2012). The financial crisis has made it increasingly difficult for municipalities to successfully issue bonds and led to a decline of issued bonds in recent years, a development which the Indian state aims to counteract by implementing the Pooled Finance Development Fund Scheme (Banerji et al. 2013). This pooled finance device aims to reduce the risk of investing in single, unstable, and low-rated municipalities by bundling them up and providing state-level credit-enhancement facilities. These developments provide a variety of interesting cases with differing local dynamics. The water infrastructure projects of Nashik, Chennai, Ahmedabad, and Visakhapatnam can be considered as exemplary cases; however, Mumbai's efforts to overcome its water issues are by far the most dynamic on the subcontinent (cf. Gandy 2008). At the same time, Mumbai is India's gateway to the global financial market, exemplifying the schizophrenic state between what some authors would describe as megacity and global city statuses. The multitude of water infrastructure projects introduced to quench the city's thirst have been financed through equally varied financial solutions, offering ample opportunity to examine issues surrounding project finance. Of these, the most relevant is the construction of the Colaba treatment plant as part of Brihanmumbai Municipal Corporation's Mumbai Sewage Disposal Project II.

In the United Kingdom, the development of municipal debt markets progressed somewhat differently. Under current austerity policies, pressures on municipalities to do more with less have led to the desire to establish a completely new UK-wide structure for infrastructure financing by means of creating a Municipal Bonds Agency (termed UKMBA; Local Government Association 2014). The main aim is to provide access to loans at lower rates than those provided by the Public Works Loan Board. Here, London and its borough councils are taking the leading role in pushing for the establishment of a centralized municipal debt market with the aim of replacing Private Finance Initiatives, the UK's method for setting up public–private partnerships.

London's continually increasing water needs impose a constant strain on the city's ageing water infrastructure. Leakage rates of up to 25% due to old Victorian cast-iron piping; sewage overflows into the Thames; and lack of reservoirs are just some of the most pressing issues. About 75% of London's water is supplied by Thames Water, a state-regulated private company that was bound to invest £5 billion between 2010 and 2015 into the city's ageing infrastructure. This investment includes projects such as extending the city's entire water backbone system; replacing old cast-iron piping with modern plastic; and huge subterranean tunnel extensions to cope with increased sewage flow during rainfall events. The latter is of particularly crucial importance, as extensive ground sealing has led to a situation in which only 2 mm of rainfall causes the release of raw sewage directly into the River Thames via its overflow protection system, negatively affecting the daily lives of many Londoners. The proposed solution, currently under construction, is the Thames Tideway Scheme, a massive tunnel beneath the Thames, spanning across London from west to east, linking sewage and treatment plants. This project is near ideal for the examination of project finance and its effects on the urban. With regard to the conceptual model, the Indian case of Mumbai and the British case of London provide exemplary settings for examining the wider impacts of the changing dynamics of water infrastructure financing.

The cases differ in several key aspects: Mumbai, similarly to other cities of the Global South, can be characterized as having achieved an "incomplete modernity" with regard to its infrastructural underpinnings (Gandy 2004, p.368). This notion contrasts with the Western infrastructural ideal, which so intricately shaped the grid of a "modern" city like London. Consequentially, Mumbai's water system is characterized by patterns of fragmentation, whereas London's appears as a centrally organized, integrated system. This contrasting notion is immediately understood when examining the relation of the city's inhabitants to water. Water issues are so prominent in Mumbai that they are at the heart of almost all inhabitants' day-to-day lives, whereas in London the question

of water provision is largely a 'black-box' process that is only opened for scrutiny in cases of failure (Graham et al. 2012). The cultural contexts thus differ greatly, with an emerging middle class asserting their political power in Indian cities vis-à-vis more recently arrived citizens. This dynamic has become so significant that Anand describes the implied politics as issues of "hydraulic citizenship" (Anand 2017, p.8). Clearly, the cities' climatic and geographical contexts differ greatly, with Mumbai facing increasing challenges in securing its fresh water supply, which is exacerbated by the annual monsoon season. Interestingly though, both cities face similar challenges concerning future flood risks in relation to climate change.

The question of financing these water infrastructures, both in terms of creation and maintenance, is the crucial chokepoint for sustaining these cities' futures, and features large in their everyday politics. In both cities, municipal bonds are seen as the key to overcoming their infrastructural burdens (Gupta 2013, Brady et al. 2014).

The dynamics within these cities might, on the surface, appear as global city and mega city tensions, but a comparative analysis of the two might show only how Northern practices and theory globalize to the South, but also how theory production in the Global South might transfer back to the Global North and explain, for example, the emerging patterns of fragmented supply that are more commonly associated with the Global South (Robinson 2003).

## Document analysis

The empirical material for this thesis stems from two main sources. The first source is a structured document analysis and recursive abstraction of 297 legislative and planning documents, expert reports, public statements, and legal frameworks from the period 2001 to 2018. These documents can be considered as interacting — and at times competing — with a web of public discourse in the media, blogs, and other publications that were also taken into account (Colomb 2012, p.31). The analysis accounts for the ways in which documents play towards particular ends as tools that may represent vested interests (Sayer 2005, p.7). The analysis is focused on documents that correspond to the discussion of financial dynamics and water infrastructure development in the given ecologies, leaving aside any material on alternative infrastructure projects. The data were analyzed in detail regarding the financial ecologies and the effects of financialization of urban infrastructure, in order to identify patterns and conflicts and derive analytical categories thereof. Based on these categories, the material was re-examined to test observer impressions. The appendix provides a detailed overview of these documents.

## Interviews

The second source of empirical material consists of 22 in-depth expert interviews, which were used to support the document analysis and fill in gaps where their coverage fell short. The interviews were conducted between 2015 and 2018 and focused on infrastructure and financial experts that were active in the respective ecologies. The interviews followed a structured approach with individually prepared guides and lasted between one and three hours (cf. Mieg & Näf 2005). An anonymized list with individualized acronyms is provided in the appendix.

# 4. Summary of Results

The following section summarizes the main results of the three publications. These are kept brief in order to avoid too much duplication of information.

## Paper I: Connecting financialization and urbanization

The first paper is a hypothesis and theory article that establishes a theoretical framework for exposing the spatial impacts of financialization on cities. It begins by reviewing the current state of literature on financialization, and establishes that the current state of theory on financialization in the urban context focusses foremost on the regulatory frameworks and governance structures that enable urban financialization. It then addresses the calls for closer examination of the spatial patterns that emerge from financialization, by introducing infrastructures as a key perspective for understanding the wider spatial impacts of these practices. It proposes financial ecologies as an analytical tool for integrating an infrastructural perspective with the discourse on financialization. The paper concludes by discussing this conceptual model in a first empirical engagement within the context of infrastructure financialization in the UK.

The paper makes three key contributions: Firstly, it introduces infrastructure theory as means for better understanding the spatial impacts of financialization; Secondly, it proposes financial ecologies as an analytical tool for exploring these spatial impacts in different contexts, and; Thirdly, it provides empirical evidence for some spatial effects caused by the changing financial ecology of urban infrastructure in the UK.

The following sections describe the key definitions and insights that link these arguments.

**Defining Infrastructure.** The first part of the article concludes by defining infrastructure and its dimensions as a means to identify the wider spatial impacts of financialization. They are the material structures upon which current forms of social organization and interaction rest; and are characterized by the following dimensions: (1) Infrastructures both enable and constrain; they make certain connections and patterns possible, whereas they in other places they divide and separate; (2) Furthermore, they establish path dependencies by committing inert resources to particular tracks of development; (3) They also act as mediators, by facilitating how we interact with our external environment and each other; (4) They are both investment and endowment, as they represent sunk costs and a fertile environment of opportunities; (5) Infrastructures are

also assets and vulnerabilities, as they allow for ever more complex forms of social organization while also creating exposure to disruptions and standstill; (6) Finally, they create and maintain habits by establishing and reinforcing patterns of daily practices and processes (cf. Angelo and Calhoun 2013, Star 1999, Monstadt 2009).

**Financial Ecologies.** The second part of the article introduces financial ecologies as an analytical tool for integrating this infrastructural perspective with the wider discourse of financialization and provides a starting point for operationalizing the overarching research question. Financial ecologies are defined as a social structure in which actors, locations, and their relations form geographically distinct constellations of knowledge, practices, and subjectivities that enable the provision of financial services. These smaller, partially localized financial ecologies form links with other financial ecologies, constituting the wider financial system. The concept of ecologies has played a prominent role in urban geography since the early efforts undertaken within the Chicago School (Park et al. 1925) and is more recently associated with the works of authors such as Andrew Abbott, Erik Swyngedouw, Nik Heynen, Jochen Monstadt, as well as Susan Leigh Star and Karen Ruhleder (cf. Star & Ruhleder 1995, Monstadt 2009, Swyngedouw & Heynen 2003, Abbott 2005).

**The changing financial ecology of infrastructure in the UK.** The concluding part of the article utilizes this conceptual model in a first empirical engagement. It identifies the UKMBA, local councils, the Public Works Loan Board, investors, and the current government as the core group of actors in the financial ecology, while financial rating agencies, regulators, the European Investment Bank, and other banking institutions form a second order of actors. Their specific configuration and relationships within the financial ecology are detailed within the analysis section of the first paper. The conclusion identifies the following spatial effects in the changing financial ecology of urban infrastructure in the UK:

**Constraining effects of lack of investment in infrastructure**

While the financial ecology still enables infrastructure investment up to a certain level, its current configuration, characterized by the infrastructural gap, has immediate spatial consequences: flood risks keep increasing, the transport sector struggles with overburdened systems, and modernization projects such as decarbonization efforts are stifled, setting up a plethora of long-term problems for the future. Many of these consequences are as yet unfelt, which is largely due to the long timeframes on which the

ecology operates and the buffering effect of institutional debts owed to previous generations of practice.

**Path dependencies with new patterns of interdependence**

Local councils' investments in commercial real estate create massive path dependencies, as they often dominate financial balance sheets and tie the organization's operation of services directly to property market volatility. Going down this path of cross-financing services exposes councils to increasing spatial fragmentation of its interests and exacerbates the complexity of its operations.

**New spatial alliances and patterns of mediation between actors**

Similarly, the UKMBA's joint and several guarantee increases interdependence between signatory councils and widens the realm of financial concern far beyond a council's own borders. This not only increases complexity, but also exacerbates inequality between the "first class, highly rated councils" and the rest (Johnstone 2016, p.1). These new spatial alliances begin to influence how councils evaluate their own position and capabilities, thus increasingly mediating their perception.

**Investment patterns promoting fragmented infrastructure solutions**

The increasing desire of investors to establish effective hinges, paired with regulatory weakness within the financial ecology, bolsters the development of project-finance-based infrastructure investments. This promotes fragmented infrastructure solutions that cater towards investor needs rather than addressing the facts on the ground and providing better-optimized long-term solutions.

**Vulnerability of local infrastructure to market volatility**

As much as infrastructure is an asset, it is also a major vulnerability that is capable of disrupting cities extensively. In the case of the changing financial ecology of urban infrastructure, we have shown how particular constructs favored by the financial ecology expose local infrastructures to market volatility. A systemic breakdown of markets could then directly translate to the local level, where large utility companies often operate under similar moral hazards to the banks that were bailed out during the most recent financial crisis.

**New habits and practices in council operations**

We can identify changes in local councils that partake in the aforementioned property investment schemes: they acquire new knowledge and implement changes to long-standing practices, slowly changing the habits of council operations and with it solidifying the market-oriented trajectory of the financial ecology itself.

## Paper II: The temporalities of financialization

The second contribution is an original research paper that sets out to identify the temporal characteristics of the financialization of urban water infrastructure. It begins by reviewing the literature on the intersection of financial markets, time, and urban development, and establishes the notion of temporalities as a key concept for understanding the temporal impacts of financialization. It then moves on to examine the financialized temporalities of the Thames Tideway Tunnel, a 25-km "super-sewer" project that is currently being constructed across London, beneath the River Thames. The following section describes how the temporal dynamics of financialization shape the development of the Thames Tideway Tunnel. The concluding section provides an analysis of how these dynamics provide closures and openings for intervention in urban development.

The paper makes both conceptual and empirical contributions. Firstly, it contributes to a theoretical conceptualization of the ways in which the temporalities of financialization shape the material production of the city. Secondly and more empirically, the case analysis enables schematizing the different ways in which the financialization of the TTT project shapes the temporalities of its production, with wide-ranging political, economic, and environmental implications. In sum, the paper closes a crucial gap in understanding how different temporalities of finance intersect in the making of contemporary cities. The following section will outline the key concepts and findings presented in the paper.

**Financialized Temporalities.** The first part of the article engages with the literature on finance, time, and urban development, and concludes with a discussion of temporalities. The literature review establishes that temporality does not impose itself on society, but that it emerges in social practice (Wajcman 2008). Consequently, time is socially experienced, thus "multiple and heterogeneous" (May & Thrift 2001, p.3). Thus, the term temporalities is used in its plural form, to differentiate these temporal regimes resulting from social practice and convention from the abstract notion of time as a 'physical' externality (LiPuma 2017, p.145). This plurality of temporalities builds a web of interdependencies we refer to as polychronie. Temporalities become financialized on multiple levels, including: the global technological connections that underpin current financial practices (Hope 2006), the different forms of prognostication utilized in the financial sector to collapse "the future into the now" (Hardin 2014, p.205–206), and various risks that are externalized into the future (cf. Allen & Pryke 2013, Bear 2011).

**The characteristics of the temporal impacts of financialization.** By utilizing financialized temporalities as an analytic, one can identify

temporal characteristics of the financialized production of the Thames Tideway Tunnel:

| |
|---|
| **Moments of opportunity and sudden reconfigurations**<br><br>This describes the flexible and opportunistic nature of financialization in capitalizing on the alignment of different developments and timelines at the right moment, to then create new trajectories that lead to sudden transformations of a project, with severe long-term consequences for other temporal dynamics. |
| **Future-exploitation**<br><br>This characteristic describes the preference for large-scale, ring-fenceable, technocratic infrastructure projects with supporting financial models benefitting pre-emptive extraction of profits for future services, while deferring financial burdens towards unsuspecting citizens long into the future. Some of these citizens do not even benefit from the projects, per se. |
| **Constructing new temporal dependencies**<br><br>The financialized production-logic of the Thames Tideway Tunnel established routines, repetitions, and timeframes that constitute new temporalities, which in turn set the stage for other urban processes. Once various actors committed to long construction periods, the Thames Tideway Tunnel became dependent on pricing volatility and other market dynamics. Committing large amounts of resources further creates path dependencies, thereby structuring the decision space for future interventions. |
| **Diverging perceptions of the future**<br><br>The discrepant time horizons that inform the decision making of financial actors, versus those of the general public, act to skew decision making towards short-termism of profit maximization. This skewing effect is emphasized by economically defined long-term expectations, and by modelling mechanisms of the future that overshadow longer-term conceptualizations such as those based on questions of sustainability or tackling climate change. |
| **Frictions between Temporalities**<br><br>This characteristic describes the friction between the internal temporal logic of the project and those logics imposed by external temporalities. The highly financialized internal logic stands in contrast to external pressures, expectations, and mechanisms that threaten the continuous reproduction of established temporalities within the project. This multitude of temporalities and their frictions we refer to as "polychronie." |

**Closures and openings.** The temporal dynamics instigated by the financialized tunnel development project point towards moments of closures and openings, in which trajectories either become fortified or else windows for intervention allow for course readjustments.

Closures include preferences for large-scale, ring-fenceable, technocratic measures involving only limited interactions with existing urban infrastructures, which during the project initiation phase skew public oversight and tend to be presented as the only feasible solution. This early phase is the critical one for interjections, since once financial and political resources are committed, they form a sort of inert obduracy that henceforth hinders rapid interventions. A second closure occurs when future liabilities are pushed onto the public by means of opaque financing strategies: Risk-averse investors maintain control over their futures, whereas the future of the taxpayer is put at risk through government taking on the ultimate financial responsibility for the project, as public utilities are often monopolies that are considered 'too big to fail.' Further closures occur by restricting the future decision space concerning issues such as climate change or sustainability transitions.

Openings occur when intersecting temporal dynamics provide windows for interventions; for example, as poor governance practices are questioned in accordance with election cycles – particularly when they coincide, for instance, with times of financial turmoil. As we are witnessing a certain fatigue following failed privatizations and the longer-term fallout from such deals, as well as a changing political climate toward less liberal policies, the recommunalization of urban infrastructure assets might inspire cities across continental Europe (Beveridge & Naumann 2014).

## Paper III: Finance, water infrastructure, and the city

The third paper is another original research paper that aims to identify how financialization changes the financial ecologies of urban water infrastructure and the consequences of these impacts. The paper begins by summarizing the current state of research regarding the financialization of infrastructure and suggests a comparative approach centered on financial ecologies as a means of contributing towards it. The following section presents the financial ecologies of London and Mumbai through a twin approach that first examines new state level initiatives that introduce municipal bonds into their respective countries, and secondly investigates project finance as a means of realizing water infrastructure projects in the two cities. The findings highlight the importance of local knowledge and its translation between actors in the ecology. Compromised decision making is found to be largely due to asymmetric

translation processes and weak oversight within the ecology. A more transparent tendering process is suggested as a policy tool for overcoming these challenges.

The paper makes several contributions; most importantly, though, it seeks to answer this dissertation's overarching research question of how the financialization of urban water infrastructure affects cities. It thus contributes to the literatures on financialization and infrastructure, and further tests the conceptual model presented in the first paper. Beyond this, it references the discourse on comparative urbanism and illustrates its benefits when engaging with abstract processes such as financialization.

Key concepts, such as the definition of the infrastructural dimensions as well as the analytical approach using financial ecologies, were summarized in the context of the first publication. The summary of this third publication will focus on the outcomes of the comparative analysis.

**Patterns of Financialization.** In using financial ecologies of urban infrastructure as a tool for comparative analysis of increasingly financialized urban water infrastructures, we can abstract certain patterns that occur. These patterns play a significant role in the question of what is to be built, where and why. The following section will present the key findings from the concluding section of the paper:

**The role of local knowledge**

Local knowledge defines the interactions and power relations between the various actors in the financial ecology. The role of avatars as translators of these knowledges is a key dynamic in determining the financialization process. It is new financial market expertise that is introduced via the avatars into the ecologies, in which the same avatars then take on the role of evaluating and abstracting local knowledges about water systems into quantifiable metrics that set the guidelines for determining what sort of project is viable. It is this constant translation of political, financial, social, and environmental risks into categories that the respective actors can understand and evaluate that defines the financial ecologies configuration.

**Unequal translations**

The translation process and resulting informational flow is not equal, transparent, or successful between all actors. This can lead to power asymmetries in the decision-making process, in which particular biases can tilt the project in a preferred direction from its outset. This translation process is particularly compromised in the context of project finance, as here the connections are more akin to hinges than to fully formed avatars, thus resulting in limited access to knowledge for actors on the public side.

**Prioritizing financial risks**

The inherent logic of market-based infrastructure provision prioritizes financial risk assessments over political, environmental, or social risk assessments, which leads to a bias among actors representing the financial sector towards projects that minimize financial risk. This leads to preferences for large-scale infrastructure projects that are ring-fenceable and have limited and clearly defined points of interaction with the existing water system. This makes it easier to calculate, issue, and sell a financial asset that represents the underlying infrastructure. As a consequence, cherry picking of particularly easily securitizable infrastructure projects prevails, and decentralized, highly integrated approaches are less likely to be undertaken.

**Weak regulation and oversight**

The role of oversight and regulation has become compromised: Financial innovation to securitize revenue streams in the infrastructure sector thrives on obfuscation and lack of transparency, as tax optimization benefits from offshore structures and withdrawal from stock exchanges limits reporting obligations. This is further emphasized by the notion that the infrastructure operators are also largely considered to be 'too big to fail' and are thus beneficiaries of the same moral hazard that played a significant role in past financial crises. As a result, operators overleverage their assets, as regulators have no political interest in withdrawing licenses and interrupting the water system, per se.

# 5. General Discussion

## Reflection of Objectives

### *First objective — Establish a theoretical framework to expose the spatial impacts of financialization on cities*

The framework developed in this thesis responds directly to the objective set out at the beginning of the project. By shifting the focus of analysis towards infrastructures, and equipping these with clear dimensions and spatial implications, one can draw clearer conclusions about the spatial impacts of financialization. The connection between this infrastructural perspective and financialization theory is achieved by introducing financial ecologies as an analytical tool. Financial ecologies thus become the key concept in operationalizing the research question and help to identify the shifting relations between key actors and locations. The comparative approach introduced in the final publication adds a level of abstraction to this conceptual model, allowing us to identify more general patterns of financialization.

This approach worked well in the context of this dissertation and provided a clear roadmap for the research project. However, over the course of the project, it became clear that the ambition of linking complex global processes to the local scale requires significant focus on key interactions, as the overall complexity is too great to ever explore exhaustively. Here too, the framework provided openings for inputs from interviewees towards identifying these key aspects.

### *Second objective — Identify the temporal characteristics of the financialization of urban water infrastructure*

The second objective of this dissertation is to understand the temporal dimension of finance with regard to the longevity of water infrastructures. The research described in the second publication successfully characterized the temporal impacts of financialization on the production of urban water infrastructure and thus helped to identify temporal interdependencies and opportunities for intervention.

The objective was approached by relying on the literature on financialization and time, which proved to be productive; however, integration of the concept of temporalities within the framework of financial ecologies could have proven even more elucidating. The theoretical challenges of integrating these concepts would have gone far beyond what would have been possible within the frame of a primarily empirical paper. Nevertheless, the theorization of this approach holds great value for future research.

### *Third objective — Identify and understand the consequences of the financialization of urban water infrastructure*

By employing the financial ecologies of urban infrastructure in conjunction with the comparative approach, this thesis is able to identify patterns that result from ongoing financialization processes in the sector. The first publication tentatively identifies some patterns in the UK context, while the third publication is able to abstract more general impacts. The findings emphasize the significance of local knowledge; its effective translation; and the shift towards a financialized logic of providing infrastructure that thrives in the face of weak regulation and impeding moral hazard. The thesis was thus successful in exposing the impacts of financialization on urban water infrastructure and established certain patterns that result from these practices. The emphasis on the temporal dimension in the second publication provides some additional evidence of how these impacts shape and unfold across time.

Given the complexity and multi-scale nature of the research subject, it is impossible to outline all of the ways in which financialization affects the configuration of the water sector, as many interactions are subtle, indirect, and often intentionally obfuscated. The results presented here are those that are clearly supported by the empirical data, while others will prove to be valuable inputs for future research projects.

## Contributions to the Literature

The following section will discuss how this thesis' different objectives relate to the literature, and where the findings make contributions to current discourses in urban geography. This dissertation contributes towards the literature in four main areas.

### *Financialization*

The main contribution of this dissertation falls within the discourse on financialization, the dissertation focusses its efforts on three main areas.

Firstly, it proposes a shift towards infrastructure as a subject of analysis in order to establish clearer links between financial practices and resulting spatial patterns. The dissertation provides a nuanced definition of infrastructure and outlines its dimensions in terms of specific spatial ramifications. This approach thus extends current debates around financialization, which focus foremost on the real estate sector, regulatory frameworks, and governance structures that enable it (Leyshon & Thrift 2007, French et al. 2011, Clark *et al.* 2015, Rutland 2010). French et al.'s, critique of the discourse, in which: "space and place are accorded only a passive role in many accounts of financialization, so that geography is implicitly subordinated either to the status of mere empirical surface, or that of abstract spatial container of socio-economic relations." (French et

al. 2011, p.17) is thus directly answered by shifting the focus towards infrastructure and providing the theoretical means to draw a clearer picture of the spatial consequences of financialization. Furthermore, the dissertation makes a considerable contribution to those areas of the financialization discourse that have only recently begun to examine infrastructures (cf. O'Neill 2018, Loftus & March 2019). It provides not only a theoretical frame within which the spatial complexities of infrastructure are emphasized, but also new empirical evidence towards our understanding of infrastructures and their specificities as a subject of financialization themselves.

Secondly, this dissertation introduces financial ecologies as an analytical tool, in order to develop a robust methodological framework for analyzing the spatial impacts of financialization. The concept is touched upon briefly within the discourse on financialization specifically (cf. French et al. 2011), while it finds greater attention within the wider realm of urban geography, science and technology studies, and sociology (cf. Star & Ruhleder 1995, Monstadt 2009, Nardi & O'Day 1999, Park et al. 1925, Swyngedouw & Heynen 2003). By pairing these wider insights with Abbott's understanding of ecology (2005), a formalized definition can be developed of financial ecologies that serves as a springboard for the operationalization of research questions covering a wide array of contexts and issues. By not only proposing but also testing the methodological approach, this work provides a valuable contribution towards the toolsets available for engaging with financialization. It further speaks to other approaches such as that developed by Ludovic Halbert and Hortense Rouanet (2011), and can initiate a productive conversation regarding specific strengths and weaknesses.

The final contribution to the literature on financialization is a better understanding of the complexities of time. The second paper specifically raises the issue of finance as a temporal concept and delves into the implications for the financialization of urban infrastructure. It thus draws on a variety of debates on time in relation to financial practices (Arnoldi 2004, Hardin 2014, Hope 2006, 2010, 2011, LiPuma 2017, May & Thrift 2001, Orpana 2017, Thompson 1967) and specifically introduces them into the financialization discourse. By acknowledging the social construction of time and its resulting multiplicity as temporalities, the contribution links the temporal characteristics of financialization to its specific impacts on the production of cities. Empirical evidence underlines this relationship by example of the Thames Tideway Tunnel project in London.

*Infrastructure*

Beyond the contributions to financialization discourse, this dissertation advances the ongoing debate on infrastructures within urban geography. Four main contributions are made.

The dissertation builds upon infrastructural properties discussed by Hillary Angelo and Craig Calhoun (2013), Jochen Monstadt (2009), as well as Susan Leigh Star (1999), and develops a list of infrastructural dimensions as a means for outlining their spatial complexity. As a theoretical concept, this approach facilitates easier bridging of scales between complex global processes, the construction and maintenance of infrastructures, and resulting urban experiences. This effort speaks directly to calls from urban geographers such as Matthew Gandy (2011, 2014), Stephen Graham (2010), or even Neil Brenner and Christian Schmid (2017).

This understanding of the global and local embeddedness of infrastructures is further enabled by linking them to their financial ecologies. By elucidating the underlying financial practices that devise, construct, enable, and maintain urban infrastructures, we improve the understanding of those structures that shape modern urban societies. By expanding the discussion of financialization within that on infrastructure, and by providing financial ecologies as a tool for interlinking them, the dissertation speaks directly to the most recent developments in the field (cf. O'Neill 2013, Ahlers & Merme 2016, Loftus & March 2019).

In this context, the project's comparative efforts further contribute to the literature by outlining how these practices function across contexts, and show for example how Global Northern expectations shape urban development projects in the Global South, and how patterns of fragmentation might become more prevalent in the North (cf. Gandy 2008, Bakker 2013). The comparative perspective further underlines the significance of knowledge in the construction and operation of infrastructure, an issue that has not yet come to the attention of researchers.

Ultimately, the dissertation explores the significance of time with regard to infrastructure. This subject has been widely discussed within the literature over several decades (cf. Hägerstrand 1978, Lefebvre 2004), but has rarely focused on the financial time regimes that are superimposed on the infrastructures themselves. Here, the dissertation provides a more specific perspective that builds upon more recent conceptualizations of time and focusses explicitly on the temporal characteristics of financialization and its consequences for cities.

### *Temporalities*

The second paper of this dissertation explores the temporal dimension of the financialization of infrastructure. The project thus contributes not only to the literature on financialization and infrastructure, but also to the growing literature on temporalities. Here, it makes two main contributions.

Firstly, it contributes to a theoretical conceptualization of the ways in which the temporalities of financialization shape the material production of the city. It was found that temporal conflicts in the financialization of urban infrastructure can lead to a certain loss of temporal authority of citizens, which directly reflects current debates (cf. Hope 2010). Extending these debates are the findings of five critical characteristics of the temporal impacts of financialization.

Secondly, the paper elaborates a more precise empirical understanding of the workings of these temporalities. This enables further insights into possibilities for intervention and change, thus responding to several debates within the literature (Hope 2011, LiPuma 2017, Wajcman 2008).

### *Comparative Urban Studies*

The final contribution is to the literature on comparative urban studies. The project directly answers Jennifer Robinson's call to overcome the North–South divide in theory generation, and to establish "a revitalized and experimental international comparativism that will enable urban studies to stretch its resources for theory building across the world of cities" (cf. Robinson 2011, p.19). It speaks specifically to efforts to show how practices and perceptions from the Global North are received in the Global South and shows how phenomena and insights from the South are transferred back and become manifest in the North. The study has shown how patterns of fragmentation in infrastructure supply, which are more commonly associated with the Global South, could well represent the future for cities in the Global North under similarly financialized regimes; and the extent to which more common public scrutiny of infrastructure projects in the South would aid practices in the North. By examining the nexus of water infrastructure, finance, and urban development, the dissertation directly answers questions raised in recent comparative works such as those by Matthew Gandy (2014).

Beyond this empirical contribution towards the literature, the dissertation provides a formalized concept for new units of comparison to successfully analyze the impacts of financialization on cities. The financial ecologies approach can be implemented across the world of cities, to develop a nuanced understanding of the evolving practices of the financial

sector, and provides a valuable new tool for scholars invested in the comparative study of financialization (cf. Engelen et al. 2010).

## Revisiting the Methodological Approach

### *Financial Ecologies as a Method*

Utilizing financial ecologies as an analytical tool worked well for reducing the multi-scale problem-set to a manageable research project for an individual researcher. By focusing on the actors, their locations, and their relations, a clear strategy for data generation and its analysis emerged; the subsequent implementation proved to be work intensive but also successful in identifying the different tiers of actors and the strengths of their connections. The financial ecology approach also helped immensely in linking the impacts of financialization to spatial patterns, as spatial considerations are already inherent to the approach. Here, the dissertation makes a direct contribution to Abbott's concept by expanding the understanding of spatial configurations and their implications for ecologies (Abbott 2005).

However, by focusing the analysis on financial ecologies and their multi-scale configurations, it was necessary to shift focus across scales at the cost of detail regarding the individual and particular trajectories of London and Mumbai. Detail has been provided where it refers directly to the financial ecologies, but wider urban dynamics and historical processes have been intentionally left aside to focus the analysis on understanding the spatial impacts of financialization. A deeper contextualization of the cultural and historical idiosyncrasies of the case cities would most certainly contribute towards translating the findings into recommendations for action that could aid local policy making.

### *The Comparative Gesture*

One of the main benefits of the financial ecology approach is the clear definition of units of comparison for the comparative analysis, as proposed by Jennifer Robinson (2003, 2011, 2014). The comparative perspective has added considerable value in abstracting the findings from mere case studies towards informing theory building and providing ample opportunities for cross-pollinating the research progress in both cases. Furthermore, it provided an excellent starting point for engaging other researchers examining similar issues in other places, and greatly aided the success of conference presentations on the dissertation project.

A disadvantage of a comparative approach is the immense workload and logistical challenge it generates for the individual researcher. It requires the researcher to become the subject expert in two distinct geographic contexts with two mostly separate challenges for data generation. Moving back and forth between these two realms and achieving a similar level of

understanding can be demanding. For this dissertation project the benefits definitely outweighed the costs; however, it should be a factor of careful consideration for future research endeavors.

### *The Document Analysis*

The document analysis proved to be highly productive for identifying key actors and their relationships within the financial ecologies. Financializaton as a research subject proved to mainly manifests in the paper trails that it creates. Documents where thus often at the center of the conversations, with many interviewees constantly referring to key texts and quoting passages in response to particular interview questions. This relates directly to the findings of the third publication, which identifies knowledge and its translation as key aspects of financialization. This knowledge becomes formalized and translated in the documents it produces.

Processing these documents through the lens of financial ecologies — with its emphasis on actors, locations, and their relationships – turned out to be work intensive but also quite clear, as every document could be positioned within the financial ecology and thus read in the context of its relations. The resulting analysis thus provides a reading that does justice to both the content and the intentionality of the documents (cf. Sayer 2005).

The largest part of the document pool is publicly available; however, some documents were provided on condition of confidentiality, whereas in regard to the banking sector certain documents where held back as they were considered trade secrets or subject to non-disclosure agreements. Overall, access was very good and interviewees where a helpful resource in procuring relevant texts.

### *The Interviews*

Preparing the individualized interview guides to match the respective interviewees' expertise and background turned out to be work intensive, but paid off, often with very productive and unexpectedly long interviews. Most interviewees were highly interested in the subject and made extra time to accommodate the conversations within their schedules, with most interviewees requesting a copy of the forthcoming publications. This sentiment confirmed the relevance of the research question to practitioners and greatly aided further acquisition of relevant documents. However, obtaining confirmation for the first interviews was difficult, particularly within the banking sector, as many initiatives lead nowhere and several potential interviewees did not see any value in engaging in such conversations. These problems are commonly identified in the literature as issues of "studying up"; that is, being dependent on research

subjects who are in socially advantageous positions relative to that of the researcher (cf. Nader 1969, Gusterson 1997, Marx & Treharne 2018). This dynamic added to some scheduling complications, where dates for potential interviews where frequently cancelled or postponed at short notice, often creating additional travel and logistical complications. Overall, this additionally requested flexibility was often worthwhile to supplement the strategy of conducting in-depth interviews with key actors in the financial ecologies.

# 6. Conclusion

This thesis endeavors to show how current financial practices affect urban water infrastructure provision and what the consequences of these impacts are for cities. By emphasizing the role of infrastructure and developing a conceptual model based on financial ecologies in the first publication, the project is able to discern some first spatial effects of financialization. The second publication examines the temporal dimension of infrastructure financialization and identifies temporal characteristics that occur in the financialized production of London's Thames Tideway Tunnel. The final publication applies the conceptual model in a comparative analysis of the financial ecologies of urban infrastructure in London and Mumbai, and is able to outline particular patterns resulting from their financialization.

If we relate the sum of these insights to O'Neill's dimensions of infrastructure financialization (2018), we can corroborate his findings on how capital, organizational, and regulatory structures are at the center of the financialization process; however, we also find that these do not cover the whole picture. They presuppose the groundwork that establishes an environment in which these dimensions can interact in a meaningful way: parsing local complexity, establishing secured knowledge, and translating it between actors defines the configuration of the financial ecology and establishes the ground rules upon which the interplay of capital, organizational, and regulatory structures unfolds. These findings support the arguments made most recently by Michael Pryke and John Allen, who argue for the significance of translation processes in the financialization of urban water infrastructure (Pryke & Allen 2019). The patterns identified in this dissertation characterize the resulting financial ecology, which not only enables the flow of investments but also — given the right circumstances — builds potentiality towards future changes. Thus, next to successful occurrences of project finance, the unsuccessful establishment of a municipal bond market is still a significant event in the wider financialization process.

Here, we see the value of this theoretical approach vis-à-vis other theoretical frames: not only is it able to discern particular patterns of financialization, but it also can provide insights into cases where investment does not flow. This stands in contrast to David Harvey's spatial fix, which relies on analyzing cycles of investment in the built environment (cf. Harvey 2006). Furthermore, it complicates the debate on critical infrastructures by outlining vulnerabilities that result from changing economic conditions of infrastructure formation and maintenance (cf. OECD 2019). By shifting the focus away from a

governance-based perspective, the study was further able to outline the relative weakness of regulatory bodies, and how emerging blind spots are employed in tactics of obfuscation and financial innovation in 'the dark.'

Both the argument for openings and closures in the second publication as well as the patterns identified in the third publication point toward the central role of the tendering process for maintaining effective oversight and control over infrastructure projects and their long-term implications. Establishing a robust and transparent tendering process both facilitates a more sustainable urban development trajectory, and also allows investors to parse local complexity more effectively to propose more appropriate solutions. A key aim of this thesis is to not only criticize the process of financialization, but to present conclusions that help cities struggling with the provision of water infrastructure to navigate their changing financial environments more effectively. This thesis shows that the more proactive approaches of the UKMBA and SEBI sustain some level of oversight and capacity building, whereas the project-finance-based approaches tend to externalize their costs towards customers and thrive on the leverage provided by moral hazard and obfuscation.

This latter process is further amplified by the lack of public scrutiny in the British example. Here, cities in the Global North can learn from the Global South: The public holds decision makers accountable much more frequently, and infrastructural issues are an integral part of the public discourse. This level of awareness is sorely needed to inject greater transparency into the decision-making processes and would further advance the evaluation of infrastructure projects beyond economic metrics into a wider discussion that entails the environmental and social dimensions of infrastructure development discussed in the literature (Angelo & Calhoun 2013, Graham 2010).

The project is thus able to show some of the spatial effects that financialization has on our cities. It does so particularly in an area that is, as yet, under-researched yet of immense significance to the urban experience of billions of urban dwellers. If we consider infrastructures as the essential material structures underpinning the functioning of modern societies, then the question of how we pay for them determines to a large degree what is to be built, where, and why. The question of the financialization of urban infrastructure is thus central to understanding how this process shapes urban trajectories in the face of increasing globalization, urbanization, and climate change. The new European Research and Innovation framework program '*Horizon Europe*' defines "climate-neutral and smart cities" as one of the core mission areas next to issues such as cancer research and food production (European Commission 2019, p.16). With infrastructural issues featuring so prominently in the coming research agenda, questions regarding their

financial realization and the potential implications outlined here should be the focus of future research projects among urban geographers. The argument presented here is that sustainable financial solutions based on transparent practices make for more sustainable, adaptable, and livable cities that are better equipped to address future challenges that are yet to come.

# Literature


Aalbers, M. B. (2017). The Variegated Financialization of Housing. *International Journal of Urban and Regional Research* 41 (4), 542–554.

Abbott, A. (2005). Linked Ecologies: States and Universities as Environments for Professions. *Sociological Theory* 23(3), 245-274.

Adam, B. (1994). Perceptions of Time. In: *Companion Encyclopedia of Anthropology*, edited by T. Ingold, 503–526. New York: Routledge.

Ahlers, R. & Merme, V. (2016). Financialization, Water Governance, and Uneven Development. *WIREs Water*. doi: 10.1002/wat2.1166

Ahluwalia, I. (2011). Report on Indian Urban Infrastructure and Services. In: *The high-powered expert committee for estimating the investment requirements for urban infrastructure services*. Ministry of Urban Development India.

Allen, J. & Pryke, M. (2013) Financialising Household Water: Thames Water, MEIF, and Ring-Fenced Politics. *Cambridge Journal of Regions, Economy and Society* 6, 419-439.

Anand, N. (2017). *Hydraulic City: Water and the Infrastructures of Citizenship in Mumbai*. Durham: Duke University Press.

Angelo, H. & Calhoun, C. (2013). Infrastructures of the Social: An Invitation to Infrastructural Sociology. [unpublished manuscript].

Arnoldi, J. (2004). Derivatives: Virtual Values and Real Risks. *Theory, Culture and Society* 21 (6), 23–42.

Arrighi, G. (1994). *The Long Twentieth Century: Money, Power, and the Origins of Our Times*. London: Verso.

Bakker, K. (2013). Constructing Public Water: The World Bank, Urban Water Supply, and the Biopolitics of Development. *Environment and Planning D: Society and Space* 31, 280-300.

Banerji, S., Gangopadhyay, K., Thampy, A., & Wong, Z. (2013). Constraints and Prospects of Financing via Municipal Bonds in India: An analysis with Case Studies. *International Growth Centre Working Papers*, CPR-INC-INF-2012-CPP-35037.

Bear, L. (2011). Making a River of Gold: Speculative State Planning, Informality, and Neoliberal Governance on the Hooghly. *Foocal*, 61: 46–60.

Beveridge, R., & Naumann, M. (2014). The Berlin Water Company. From "Inevitable" Privatization to "Impossible" Remunicipalization. In: *The Berlin Reader. A Compendium on Urban Change and Activism*, edited by M. Bernt, B. Grell, and A. Holm. Bielefeld: Transcript.

Brady, A., Andersson, L., & Breedon, F. (2014). *The UK Municipal Bonds Agency: Establishment of a Local Government Collective Agency for the Issue of Local Authority Bonds*. London: Local Government Association.

Brenner, N., & Schmid, C. (2017). Planetary Urbanization. In: *The Globalizing Cities Reader*, 479-482. New York: Routledge.

Castells, M. (1996). *The Information Age: Economy, Society and Culture* (3 volumes, 1997, 1998). Oxford: Blackwell.

Christophers, B. (2010). On Voodoo Economics: Theorising Relations of Property, Value and Contemporary Capitalism. *Transactions of the Institute of British Geographers* 35, 94-108.

Clark, E., Larsen, H. G. and Hansen, A. L. (2015). Financialisation of Built Environments: A Literature Review. *FESSUD Working Paper Series* 114, 1-56.

Colomb, C. (2012). *Staging the New Berlin: Place Marketing and the Politics of Urban Reinvention Post-1989*. London: Routledge.

Crang, M. (2002). Between Places: Producing Hubs, Flows, and Networks. *Environment and planning A* 34(4), 569-574.

Cresswell, T. (2004). *Place: A Short Introduction*. Malden: Blackwell.

Ehlers, T. (2014). Understanding the Challenges for Infrastructure Finance. *Bank for International Settlements Working Paper* 454, 1-29.

Elias, N. (1992). An Essay on Time. *The Collected Works of Norbert Elias*, Vol. 9. Dublin: University College Dublin Press.

Engelen, E., Konings, M. & Fernandez, R. (2010). Geographies of Financialization in Disarray: The Dutch Case in Comparative Perspective. *Economic Geography* 86(1), 53-73, DOI: 10.1111/j.1944-8287.2009.01054.x

Epstein, G. A. (ed.) (2005). *Financialization and the World Economy*. Cheltenham: Edward Elgar.

European Commission (2019). *Horizon Europe - Investing to Shape our Future*. Retrieved from https://ec.europa.eu/info/files/horizon-europe-investing-shape-our-future_en

Fabian, J. (2002). *Time and the Other: How Anthropology Makes its Object*. New York: Columbia University Press.

French, S., Leyshon, A. & Wainwright, T. (2011). Financializing Space, Spacing Financialization. *Progress in Human Geography* 35(6), 798-819. doi: 10.1177/0309132510396749

Gandy, M. (2004). Rethinking Urban Metabolism: Water, Space and the Modern City. *City* 8(3), 363-379. doi: 10.1080/1360481042000313509

Gandy, M. (2008). Landscapes of Disaster: Water, Modernity and Urban Fragmentation in Mumbai. *Environment and Planning A* 40, 108-130.

Gandy, M. (2011). Landscape and Infrastructure in the Late-Modern Metropolis. *The New Blackwell Companion to the City,* edited by G. Bridge and S. Watson. Chichester: Blackwell.

Gandy, M. (2014). *The Fabric of Space: Water, Modernity, and the Urban Imagination*. Cambridge: MIT Press.

Graham, S. & Thrift, N. (2007). Out of Order: Understanding Repair and Maintenance. *Theory, Culture and Society* 24(3), 1-25. doi: 10.1177/0263276407075954

Graham, S. (2010). *Disrupted Cities: When Infrastructure Fails*. New York: Routledge.

Graham, S., Desai, R., & McFarlane, C. (2012). Water Wars in Mumbai. *Public Culture* 25(1), 115–142.

Graham, S., & McFarlane, C. (Eds.) (2015). *Infrastructural Lives: Urban Infrastructure in Context*. New York: Routledge.

Gupta, S. (2013, July 20th). Time Indian Cities Woke up to Municipal Bonds. *Times of India.* Retrieved from http://timesofindia.indiatimes.com/business/india-business/Time-Indian-cities-woke-up-to-municipal-bonds/articleshow/21179285.cms

Gusterson, H. (1997). Studying up Revisited. *PoLAR: Political and Legal Anthropology Review* 20(1), 114-119.

Hägerstrand, T. (1978). Survival and Arena: On the Life History of Individuals in Relation to Their Geographical Environment. In: *Human Activity and Time Geography*, edited by T. Carlstein, D. Parkes, and N. Thrift, 122–145. London: Edward Arnold.

Halbert, L. & Rouanet, H. (2011). Filtering Risk Away: Global Finance Capital, Transcalar Territorial Networks and the (Un)Making of City-Regions: An Analysis of Business Property Development in Bangalore, India. *Regional Studies* 48(3), 471-484.

Hardin, C.J.F. (2014). Neoliberal Temporality: Time-Sense and the Shift from Pensions to 401(k)s. *American Quarterly* 66 (1), 95–118.

Harvey D. (1989). From Managerialism to Entrepreneurialism: The Transformation in Urban Governance in Late Capitalism. *Geografiska Annaler Series B* 71(1), 3-17.

Harvey, D. (2006). *The Limits to Capital*. London: Verso.

Harvey, D. (2008). T*he Condition of Postmodernity: An Enquiry into the Origins of Cultural Change*. Malden: Blackwell.

Heeg, S. (2013). Wohnungen als Finanzanlage: Auswirkungen von Responsibilisierung und Finanzialisierung im Bereich des Wohnens. *Sub\Urban Zeitschrift für Kritische Stadtforschung* 1 (1), 75–99.

Hope, W. (2006). Global Capitalism and the Critique of Real Time. *Time and Society* 15 (2–3), 275–302.

Hope, W. (2010). Global Financial Crisis: Time, Communication and Financial Collapse. *International Journal of Communication* 4, 641–669.

Hope, W. (2011). Crisis of Temporalities: Global Capitalism after the 2007–08 Financial Collapse. *Time and Society* 20 (1), 94–118.

Johnstone, R. (2016). First Local Government Bond Agency Issue set for Autumn. *Public Finance*. Retrieved from: http://www.publicfinance.co.uk/news/2016/05/first-local-government-bond-agency-issue-set-autumn

Kloeckner, C. & Mueller, S. (2018). Financial Times: Competing Temporalities in the Age of Finance Capitalism. *Finance and Society* 4 (1), 1–14.

Lefebvre, H. (2004). *Rhythmanalysis: Space, Time and Everyday Life*. London: A&C Black.

LiPuma, E. (2017). *The Social Life of Financial Derivatives: Markets, Risk, and Time*. Durham, London: Duke University Press

Local Government Association (2014). *Establishing a Municipal Bonds Agency*. London: Local Government Association. Retrieved from www.local.gov.uk/finance/-/journal_content/56/10180/3684139/ARTICLE

Leyshon, A. & Thrift, N. (2007). The Capitalization of Almost Everything: The Future of Finance and Capitalism. *Theory, Culture and Society* 24(7-8), 97-115.

Loftus, A., & March, H. (2016). Financializing Desalination: Rethinking the Returns of big Infrastructure. *International Journal of Urban and Regional Research* 40(1), 46-61.

Loftus, A. & March, H. (2019). Integrating What and for Whom? Financialization and the Thames Tideway Tunnel. *Urban Studies* 56(11), 2280–2296.

Martin, R. (2002). *Financialization of Daily Life*. Philadelphia: Temple University Press.

Marx, J. & Treharne, G.J. (2018). Introduction: Researching 'Down', 'Up', and 'Alongside'. In: *The Palgrave Handbook of Ethics in Critical Research*, edited by Macleod, C., Marx, J., Mnyaka, P., Treharne, G.J. London: Palgrave Macmillan.

Massey, D. (2005). *For Space*. London: SAGE.

May, J., & Thrift, N. (2001). *Timespace: Geographies of Temporality*. London: Routledge.

McFarlane, C. (2006). Crossing Borders: Development, Learning and the North–South Divide. *Third World Quarterly* 27(8), 1413-1437.

McFarlane, C., & Rutherford, J. (2008). Political Infrastructures: Governing and Experiencing the Fabric of the City. *International Journal of Urban and Regional Research 32*(2), 363-374.

McFarlane, C. (2010). The Comparative City: Knowledge, Learning, Urbanism. *International Journal of Urban and Regional Research* 34 (4), 725–42

Mieg, H. A. (2005). Themenheft ‚Faktor Zeit' Editorial. *Wirtschaftspsychologie* 7 (3), 4–21.

Mieg, H. A., & Näf, M. (2005). Experteninterviews. Institut für Mensch-UmweltSysteme (HES), ETH Zürich.

Monstadt, J. (2009) Conceptualizing the Political Ecology of Urban Infrastructures: Insights from Technology and Urban Studies. *Environment and Planning A* 41, 1924-1942.

Nader, L. (1969). Up the Anthropologist: Perspectives Gained from Studying up. In: *Reinventing Anthropology*, edited by D. Hymes, 284-311. New York: Random House.

Nardi, B.A. & O'Day, V.L . (1999). *Informational Ecologies: Using Technology with Heart*. Cambridge: MIT Press.

Nowotny, H. (1992). Time and Social Theory: Towards a Social Theory of Time. *Time and Society* 1 (3), 421–454.

O'Neill, P. (2013). The Financialisation of Infrastructure: the Role of Categorisation and Property Relations. *Cambridge Journal of Regions, Economy and Society* 6, 441-454. doi:10.1093/cjres/rst017

O'Neill, P. (2018). The Financialisation of Urban Infrastructure: A Framework of Analysis. *Urban Studies Special Issue: Funding, financing and governing urban infrastructures* 56(7), 1-22.

O'Rourke, T. D. (2007). Critical Infrastructure, Interdependencies, and Resilience. *BRIDGE-Washington-National Academy of Engineering* 37(1), 22-29.

OECD (2019). Good Governance for Critical Infrastructure Resilience. *OECD Reviews of Risk Management Policies*. Paris: OECD Publishing. doi.org/10.1787/02f0e5a0-en

Orpana, S. (2017). Freedom 2044? The Temporality of Financialization and Scenario Planning in Looper. In: *Time, Globalization and Human Experience: Interdisciplinary Explorations*, edited by P. Huebener, S. O'Brien, T. Porter, L. Stockdale, and Y. R. Zhou, 68–87. London: Routledge.

Park, R.E., Burgess, E.W. & McKenzie, R.D. (1925). *The City*. Chicago: The University of Chicago Press.

Phillips, K. (1994). *Arrogant Capital: Washington, Wall Street, and the Frustration of American Politics*. New York: Little, Brown and Company.

Porter, M.E. (1998). Clusters and the New Economics of Competition. *Harvard Business Review* 76(6), 77-90.

Pryke, M. & Allen, J. (2019). Financialising Urban Water Infrastructure: Extracting Local Value, Distributing Value Globally. *Urban Studies* 56(7), 1326-1346.

Rinaldi, S.M., Peerenboom, J.P., & Kelly, T.K. (2001). Identifying, Understanding, and Analyzing Critical Infrastructure Interdependencies. *IEEE Control Systems Magazine* 21(6), 11-25.

Robinson, J. (2003). Postcolonialising Geography: Tactics and Pitfalls. *Singapore Journal of Tropical Geography* 24 (3), 273–289.

Robinson, J. (2011). Cities in a World of Cities: The Comparative Gesture. *International Journal of Urban and Regional Research* 35 (1), 1–23.

Robinson, J. (2014). Introduction to a Virtual Issue on Comparative Urbanism. *International Journal of Urban and Regional Research*. doi:10.1111/1468-2427.12171

Rutland, T. (2010). The Financialization of Urban Redevelopment. *Geography Compass* 4(8), 1167-1178.

Sayer, A. (2005). *The Moral Significance of Class*. Cambridge: Cambridge University Press.

Sassen, S. (2002). *The Global City: New York, London, Tokyo*. Princeton: Princeton University Press.

Sheikh, S., & Asher, M.G. (2012). A Case for Developing the Municipal Bond Market in India. *ASCI Journal of Management* 42(1), 1-19.

Simone, A. (2004). People as Infrastructure: Intersecting Fragments in Johannesburg. *Public Culture 16*(3), 407-429.

Smart, B. (2000). A Political Economy of New Times? Critical Reflections on the Network Society and the Ethos of Informational Capitalism. *European Journal of Social Theory* 3(1), 51-65.

Smith, R.G. (2014). Beyond the Global City Concept and the Myth of 'Command and Control'. *International Journal of Urban Regional and Research*, 38(1), 98-115. doi:10.1111/1468-2427.12024

Star, S.L. (1999). The Ethnography of Infrastructure. *American Behavioral Scientist* 43(3), 377-391. doi: 10.1177/00027649921955326

Star, S.L. & Ruhleder, K. (1994). Steps Towards an Ecology of Infrastructure: Complex Problems in Design and Access for Large-Scale Collaborative Systems. In: *Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work*, 253-264. ACM.

Star, S.L. & Ruhleder, K. (1995). Steps Toward an Ecology of Infrastructure: Design and Access for Large Information Spaces. *Information Systems Research* 3280(217), 1-39.

Swyngedouw, E. & Heynen, N.C. (2003). Urban Political Ecology, Justice and the Politics of Scale. *Antipode* 35(5), 898-918.

Swyngedouw, E. (2009). The Political Economy and Political Ecology of the Hydro-Social Cycle. *Journal of Contemporary Water Research & Education* 142(1), 56-60.

Thompson, E.P. (1967). Time, Work-Discipline, and Industrial Capitalism. *Past and Present* 38(1), 56–97.

Wajcman, J. (2008). Life in the Fast Lane? Towards a Sociology of Technology and Time. *The British Journal of Sociology* 59 (1), 59–77.

Weber, R. (2010). Selling City Futures: The Financialization of Urban Redevelopment Policy. *Economic Geography* 86(3), 251-274.

Zademach, H.M. (2009). Global Finance and the Development of Regional Clusters: Tracing Paths in Munich's Film and TV Industry. *Journal of Economic Geography* 9(5), 697-722.

**First Publication**

# Connecting financialization and urbanization: the changing financial ecology of urban infrastructure in the UK

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# Connecting financialization and urbanization: the changing financial ecology of urban infrastructure in the UK

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**ABSTRACT**

This paper discusses a conceptual model for critically engaging with the effects of financialization on contemporary cities. The current state of theory on financialization in the urban context focuses foremost on the real estate sector activities, regulatory frameworks and governance structures that enable urban financialization. The paper addresses the calls for a closer examination of the spatial patterns that emerge from these practices. By combining financial ecologies as an analytical tool with infrastructure as a perspective, it provides a conceptual model in order to understand the impacts of financialization on cities. The paper discusses the conceptual model in the context of the introduction of the UK Municipal Bonds Agency. It concludes by outlining some of the spatial effects of the UK's changing financial ecology of urban infrastructure.

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## INTRODUCTION

In the aftermath of the 2008 financial crisis, the impacts of financial practices on urban development became all the more apparent. In an ongoing liberalization of markets and policies since the 1980s, finance has continually accumulated power, influence and economic significance, outpacing all other economic sectors and establishing itself as the backbone of the globalized economy (cf. Epstein, 2005). This financialized economy affects the urban on multiple levels, most powerfully though via the different forms of investment in the urban fabric itself. Where do these investments flow, and where not? What are the roles of different investment vehicles in shaping spatial patterns? How do these abstract financial practices translate into different experiences of the city? These are all central questions for exploring the effects of financialization on contemporary cities.

These questions become particularly significant when we examine infrastructures, as they are the key link between global finance and the rapidly urbanizing planet. Infrastructures not only enable but also constrain; they divide where they do not connect; and lock in long-term path

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dependencies. They are the structures upon which current forms of social organization and interaction rest (Angelo & Calhoun, 2013). The examination of infrastructures in relation to financialization allows one to link complex global practices to the local, and to begin a conversation between theories, focusing on processes at an abstract global scale and their effects on the particular. This paper presents a conceptual model that links these discourses, thereby enabling a more thorough and nuanced understanding of the impacts of financialization on contemporary cities. Current debates around the financialization of cities focus foremost on the real estate sector, regulatory frameworks and governance structures that enable this process. Thus, this paper provides two main contributions to the literature: first, it adds to the discourse on financialization of cities by introducing the concept of financial ecologies as an analytical tool for addressing the calls for a closer examination of the spatial patterns of financialization (cf. French, Leyshon, & Wainwright, 2011); and second, it contributes to the discourse on infrastructure by applying the financial ecology concept to the infrastructure sector, establishing a clearer understanding of how it is affected by financialization. The topic of financialization has only recently entered the discourse on infrastructure and still faces many open questions (cf. Loftus & March, 2019; O'Neill, 2018). By using financial ecologies as a tool and infrastructure as a perspective, we can develop a more nuanced understanding of the spatial impacts of financialization on cities.

The paper is structured as follows. The next section overviews the recent work on financialization in the urban context, which will be used as the basis from which to extend the reach of these approaches by means of infrastructure theory, which is summarized in the third section. The fourth section discusses the concept of ecologies as an analytical tool for integrating financialization and infrastructure theory. The concluding section discusses how this conceptual model can be put to practice in the context of infrastructure provision in the UK.

## FINANCIALIZATION OF THE URBAN

Historically, the fates of cities and their relationships with the financial practices of their time have posed many interesting points of departure. From the relationship of Italian city-states with their wealthy trading families to the American gold rush economy and the role of banks in translating this wealth into cities, finance in its early forms had significant influence on what these cities look like today. In more recent times, the question of how financial practices influence our cities has been somewhat overlooked in favour of more general debates about the impacts of capitalism on urban development (cf. Harvey, 1989). As Brett Christophers rightly observes (Christophers, 2010), much of Harvey's farsighted deliberation was only later given the label of financialization, the current understanding of which mostly derives from the work of authors such as Giovanni Arrighi and Kevin Phillips (Arrighi, 1994; Phillips, 1994). The emergence of the term 'financialization', however, reclaims the particular issue to examine the impacts of contemporary financial practices on urbanization.

Financialization in itself is most commonly described as 'the increasing role of financial motives, financial markets, financial actors and financial institutions in the operation of domestic and international economies' (Epstein, 2005, p. 3). Rutland (2010) expands on this and outlines four different approaches to financialization in the current literature: (1) the increasing significance of financial institutions and financial activities; (2) a certain mode of corporate governance that emphasizes shareholder value; (3) a shift in corporate dependence from bank-based capital to market-based capital; and (4) the new role of finance, empowered by its innovations in the neoliberal era. This basic notion of financialization has been expanded and complicated in recent years within the geographical literature, particularly where research on urban questions has exposed the multiple levels and areas on which financialization has had profound impacts. The literature on the financialization of the urban investigates a wide array of issues, roughly delineated as research into institutional and political change, social change, cultural practices, and

environmental impacts. Note that much of this debate is still focused on the Global North, with some notable exceptions (e.g., Chattopadhyay, 2012; Halbert & Rouanet, 2014).

The first of these categories is the most prominent among current contributions. Institutional change is detailed exemplarily in recent work on the role of local governments in preparing the ground for financialized urban development (Ashton, Doussard, & Weber, 2014; Weber, 2010), while the same authors outline the significance of financial engineering for externalizing market risk to cities (Ashton, Doussard, & Weber, 2012). Allen and Pryke (2013) outline the effects of these practices on the political process, and how ring-fencing depoliticizes critical urban issues. O'Neill (2013) emphasizes the role of the state as a guarantor of property rights when financialization of infrastructure is to occur. The real estate sector appears particularly prone to the inroads of financialization, as evidenced by the subprime loan meltdown of 2007–08 (Gotham, 2009). The emergence and diffusion of increasing financial innovations, such as real estate investment trusts (REIT), collateralized debt obligations (CDO), collateralized mortgage obligations (CMO), tax increment financing (TIF) and municipal bonds emphasizes the need to create 'liquidity out of spatial fixity' not only in the real estate sector (Gotham, 2009, p. 357); and shows how this changes the playing field for urban development per se (Clark, Larsen, & Hansen, 2015; Harvey, 2010; Leyshon & Thrift, 2007).

The category of social change mostly elaborates on the changing real estate market and how this affects the social fabric of the city. Much of the research on gentrification draws on political economy perspectives, but largely overlooks financialization as a frame of reference, although Slater's (2017) work on planetary rent gaps is a notable exception. The logic and consequences of investment shifting from 'use value' to 'exchange value' -based decisions are portrayed by Sayer (2012). Wyly et al. extensively explore the connection between exclusion, subprime lending practices and class-monopoly rent in US cities (Wyly, Moos, Foxcroft, & Kabahizi, 2008; Wyly, Moos, & Hammel, 2012; Wyly, Moos, Hammel, & Kabahizi, 2009). Other work emphasizes the impacts of financialization on everyday life (French & Kneale, 2009; Martin, 2002), while Bojadzijev (2015) focuses on housing struggles, migration and their connections to financialization in the context of Berlin. In sum, this literature makes an important contribution towards understanding the social impacts of financialization, while at the same time exposing the real estate sector as the singular vehicle for the analysis of these impacts. Thus, it points towards the analysis of an as-yet-overlooked entry points of financialization into the urban.

Research on changing cultural practices mostly emphasizes the emergence of a shareholder-value maximization credo (Froud, Haslam, Johal, & Williams, 2000; Pike, 2006), and the resulting eternal reshuffling of asset ownership that divides those in the know from those who fail to conceive of the significance of the mechanisms that are black-boxed in modern finance (Eturk, Froud, Johal, Leaver, & Williams, 2007). This pushes to the fore questions regarding the transparency of these practices (Clark & O'Connor, 1997), where local cultural evaluation and determination of risk in the process of anchoring global financial capital becomes of central significance (Halbert & Rouanet, 2014).

Many environmental debates on financialization and urbanization settle around questions of sustainability and climate change (Sullivan, 2013). Christian Limbach (2013) outlines the potential of climate bonds for a sustainability transition in German energy supply, while 'green finance' emerges as a lucrative investment vehicle in the latest financial innovations around the bundling of energy-efficient housing within green investment products (BerlinHyp, 2016; Zademach, 2015).

As other reviewers on the discourse of financialization have noted (Clark et al., 2015; French et al., 2011; Leyshon & Thrift, 2007; Rutland, 2010), the current focus is predominantly on the institutional frameworks that enable financialization, and their relationships with the real estate sector. In terms of spatial scales, the national level, the corporation and the household/individual predominate (French et al., 2011). Consequently, if our main interest lies in the spatial effects of

financialization on the urban, we conclude that it remains underexposed, therefore justifying a more holistic debate on the spatial impacts of these practices beyond real estate. French et al. (2011). conclude that 'space and place are accorded only a passive role in many accounts of financialization, so that geography is implicitly subordinated either to the status of mere empirical surface, or that of abstract spatial container of socio-economic relations' (p. 17).

## FROM BUILT ENVIRONMENT TO INFRASTRUCTURE

As we learned above, the spatial dimension of financialization has as yet many blind spots. To elucidate these issues, we must develop theoretical tools that allow the bridging of scales, namely the connection of complex global financial practices and their translation into spatial urban patterns and experiences. A common denominator when discussing the way in which global financial capital becomes anchored in the city – and thus an embodiment of financialization – is the term 'built environment'. This section explores the shortcomings of this term as a spatial concept, and how an alternative concept, namely that of infrastructure, might be able to expose the spatial impacts of financialization more thoroughly.

In this context, the term 'built environment' becomes prominent through David Harvey's conceptualization of a 'vast, humanly created resource system, comprising use values embedded in the physical landscape which can be utilized for production, exchange and consumption' (Harvey, 2006, p. 233). Clark et al. (2015) expand on this conception of built environment and explicate its changing significance – from secure, long-term investment haven to full exposure to volatile market practices. Yet here, as in most other cases, the conceptualization of built environment remains merely an empirical surface, which French et al. (2011) aim to challenge. Even Harvey (2006) continues to complicate the notion of built environment, expanding on the networked nature of the concept:

> but since the usefulness of individual elements depends, to large degree, upon the usefulness of surrounding elements, complex patterns of depreciation and appreciation (with ramifications for value relations) are set in motion by individual acts of renewal, replacement or transformation. The spillover effects of individual investment decisions are localized in space. Similarly, disinvestment in one part of the built environment is likely to depreciate surrounding property values. (p. 234)

Even if this expands on what we conceive of as built environments and their importance for a city, it still fails to address other dimensions of impact besides investment valuation. It is here that the shortcomings of the concept become most apparent, and where a different conceptualization – of how financial capital becomes anchored in space – proves useful. Recent developments in sociology and geography focus on the concept of infrastructure as a vehicle for connecting spatial dynamics with complex processes. We contend that this particular approach proves especially useful in the context of financialization.

According to Matthew Gandy, 'the term infrastructure has been used since the 1920s to refer to the basic physical and organizational structures such as roads, power lines, and water mains needed for the material and organizational aspects of modernity' (Gandy, 2011, p. 58). Studies associated with infrastructure cover a wide area, from engineering aspects of creation and maintenance to governance and administrative challenges such as planning and legitimization. More recent studies in sociology and geography expand the use of the term to explore the wider impacts of the underlying material structure of modern societies. This includes exploration of both vertical and horizontal spatial dimensions, questions of accessibility and visibility, spatial fragmentation, disruption, as well as non-material infrastructures (Gandy, 2011).

Within sociology, the term 'infrastructure' is most closely associated with science and technology studies (STS), most prominently in the work of Susan Leigh Star and Karen Ruhleder

(Star, 1999; Star & Ruhleder, 1994, 1995). Hillary Angelo and Craig Calhoun aim to steer away from the technology-centred definition used in STS and extend it to the material structures underpinning modern societies. For them, infrastructure is an enabling condition that is 'material, durable, multifunctional and powerfully shaping' (Angelo & Calhoun, 2013, p. 3). They also expand on the infrastructural dimensions introduced by Star, as follows, contending that infrastructure: '(1) lays out paths and pathways for what does and doesn't happen; (2) is investment and endowment; (3) enables and constrains; (4) makes habits; (5) mediates; (6) makes patterns; and (7) is asset and vulnerability' (p. 1).

This definition integrates well with the wealth of recent developments in urban geography, in which many researchers began to embrace an infrastructural perspective on current urban issues (cf. Gandy, 2011; Graham, 2010; Graham & Macfarlane, 2015; Heynen, Kaika, & Swyngedouw, 2006; McFarlane, 2008; Monstadt, 2009; Simone, 2004). Note that much of this debate emanates directly from the longstanding discourse on splintering urbanism within the field (cf. Coutard, 2008; Graham & Marvin, 2002). Their work exposes how such structures shape and dominate our cities on a multitude of spatial dimensions, and explores issues such as disruptions and their repercussions (Graham, 2010), sites of contestation and repurposing of infrastructures from their originally intended uses (Chattopadhyay, 2012), our own metabolic dependencies in relation to urban space (Heynen et al., 2006; McFarlane, 2008), and the pacing and channelling of urban rhythms and everyday experiences (Graham & McFarlane, 2015; Graham & Thrift, 2007).

Another valuable insight of these efforts is in identifying differing political implications of infrastructures in the Global North and South. The literature discusses several issues in this regard: infrastructure in the North appears largely invisible and black-boxed, and obscures the ever larger scales of social organization (cf. Graham, 2010), whereas in the Global South, it is often a constant subject of contestation (cf. Coutard & Rutherford, 2015; Shamir, 2013), blurring the lines between public and private (cf. McFarlane, 2008), and identifying the imaginaries that superimpose Western notions of infrastructure provision that cease to work under globalization in contemporary megacities (cf. Bakker, 2013; Gandy, 2008).

In step with these developments in urban geography is an increasing use of the concept of assemblage both as descriptive tool and as a foundation for theory creation in a Deleuzian and Guattarian sense (Latour, 1993; McFarlane, 2011; Sassen, 2006; Shamir, 2013). This development is widely debated in both Anglophone and continental urban geography, and reflects the tensions between current research trends on the micro- and meso-scales and the political economy approaches at the macro-scale (Brenner, Madden, & Wachsmuth, 2011; Färber, 2014; McFarlane, 2011; Robinson, 2011; Simone, 2011). As important and relevant as that discussion is, this paper will eschew the term and its ambiguities in favour of the concept presented below.

While some authors expand their understanding of infrastructure beyond the material into the body and political structures (cf. McFarlane & Rutherford, 2008; Simone, 2004), we will remain with the material dimension because it is most directly related to the concept of built environment that we wish to expand upon. If we are to return to how financialization engages with infrastructural issues, we must conclude that the concept of infrastructure is as yet somewhat undertheorized. Efforts have been made by O'Neill (2013) to rectify this situation, because he identifies infrastructure as its own category, with particular properties that differ markedly from other subjects of financialization processes. More recently O'Neill (2018) outlined how the underlying flows occurring within urban infrastructures are central to their successful financialization. He emphasizes three dimensions through which this process is mediated: capital structure, organizational structure and regulatory structure. Ahlers and Merme (2016) detail the changing dynamics in the water infrastructure sector under financialization writ large and warn of the long-term consequences of interest-driven, undemocratic processes that are increasingly implemented.

In order to develop a fixed understanding of infrastructures as a subject of financialization, we consider them as the material structures upon which current forms of social organization and interaction rest; and as being characterized by the following dimensions: (1) Infrastructures both enable and constrain; they make certain connections and patterns possible, whereas they divide and separate in other places. (2) Furthermore, they establish path dependencies by committing inert resources to particular tracks of development. (3) They also act as mediators by facilitating how we interact with our external environment and each other. (4) They are both investment and endowment as they represent sunk costs and a fertile environment of opportunities. (5) Infrastructures are also assets and vulnerabilities because they allow for ever more complex forms of social organization, while also creating exposure to disruptions and standstill. (6) Finally, they create and maintain habits by establishing and reinforcing patterns of daily practices and processes (Angelo & Calhoun, 2013; Monstadt, 2009; Star, 1999). These dimensions are, of course, not exhaustive, but they represent a perspective on how an infrastructural lens might allow one to cut across scales; how we could connect concepts such as Harvey's spatial fix to the formation of specific material structures and examine their impacts on urban societies; and how, in turn, these societies shape their infrastructures reciprocally (Harvey, 2006). Infrastructure is thus crucial for exploring the ever-changing nature of cities, and it establishes the opportunity to contribute in a meaningful way to understanding cities under financialization. The following section will explore how we can connect urban infrastructures with the changing financial practices that shape them.

## FINANCIAL ECOLOGIES OF URBAN INFRASTRUCTURE

Building on the theoretical concept developed in the previous section, we will elaborate on how infrastructure acts as a conduit between cities and financialization. Both Kathryn Furlong and Jochen Monstadt draw on the theoretical developments in STS and urban geography in a similar vein, and show how the approach to infrastructures can help understand the reciprocal relationship between contemporary urbanization and its underlying material structures (Furlong, 2011; Monstadt, 2009). Furlong argues for the increasing malleability of what we perceive of as fixed, black-boxed infrastructure, and how this development affects existing socio-technological and socio-environmental relationships. Monstadt argues in the same vein, and elaborates how, if taken separately, the current state of theory development is insufficient to overcome the challenges of ensuring more sustainable development of urban infrastructure. Nonetheless, in combining the discourses, Monstadt derives a convincing conceptualization of a political ecology of networked urban infrastructures by outlining two avenues of inquest for empirical projects. First, the study of urban infrastructure regimes, which focuses on 'stable urban configurations of institutions, techniques, and artifacts' (Monstadt, 2009, p. 1937); and second, the study of the governance of urban infrastructure, which concentrates on how we 'develop, govern and renew our networked urban infrastructures' (p. 1938). His concept of relating the study of infrastructures to the urban proves especially useful not only in the context of answering environmental questions but also when examining the impacts of financialization on urban infrastructure and its inherent sustainability. Monstadt's approach also directly relates to the concept of financial ecologies, advocated by French et al. (2011) to help refocus the analysis of financialization on its spatial implications.

Note that, in both cases, 'ecology' refers to Andrew Abbott's use of the term, where he contends, that "'Ecology" […] names a social structure that is less unified than a machine or an organism, but that is considerably more unified than is a social world made up of the autonomous, atomic beings of classical liberalism' (Abbott, 2005, p. 248). In particular, the concept of ecology involves 'three components: actors, locations, and a relation associating the one with the other' (p. 248). In any city of sufficient size, we find a political ecology, composed of

local politicians; their parties, political clubs and networks; the local parliament, municipal administration, etc. The concept of ecologies routes back to the studies by the Chicago School, on urban phenomena (cf. Park, Burgess, & McKenzie, 1925). The concept has also been adopted within STS, where Star and Ruhleder (1995) and Nardi and O'Day (1999) discuss the role of ecologies vis-à-vis traditional systemic approaches. Within the realm of urban studies, the term is often associated with the concept of political ecologies as a means to analyse socioecological relations (Swyngedouw & Heynen, 2003).

For Abbott, ecologies interact in a system, therefore he speaks of 'linked ecologies' (Abbott, 2005, p. 248). In combination with the concept of ecology, Abbott introduces two mechanisms or forms of interlinkages between ecologies: 'hinges', referring to a strategy that provides 'results to allies' in a linked ecology (p. 255), and works in more than one ecology; and 'avatars', meaning a 'copy or colony' of actors from one ecology within another one (p. 245, abstract).

French et al. (2011), with explicit reference to Abbott (2005) and Nardi and O'Day (1999), define financial ecology as components of an overarching system.

> The financial ecology approach, therefore, argues that like all systems the financial system is made up of smaller, constitutive ecologies. These consist of certain arrangements that emerge and that are more or less reproduceable over time. These processes unfold across space and evolve in relation to geographical difference so that distinctive ecologies of financial knowledge, practices and subjectivities emerge in different places. (p. 15)

For them, the concept of financial ecologies helps explain how places are connected to financial networks.

We can integrate these arguments into a working definition of financial ecologies: they are a social structure in which actors, locations and their relations form geographically distinct constellations of knowledge, practices and subjectivities that enable the provision of financial services. These smaller, partially localized financial ecologies form links with other financial ecologies, constituting the wider financial system.

Applying this concept to urban infrastructure development, we can derive a financial ecology of urban infrastructure. This allows one to show how actors, locations and their relationships form particular arrangements of knowledge, practices and subjectivities conducive to the creation and maintenance of urban infrastructures. These are in turn interlinked with the wider financial system, while producing specific local outcomes that reverberate in the urban contexts in which they are embedded. This approach provides a conceptual model for understanding how financialization affects the development, governance and maintenance of urban infrastructure, and the spatial patterns that result. In this manner we can connect complex financialization processes with urban constellations and their long-term impacts. The following section will explore this concept by example of the changing financial ecology of urban infrastructure in the UK.[1]

## THE CHANGING FINANCIAL ECOLOGY OF INFRASTRUCTURE IN THE UK

### The current situation

As a significant consequence of the financial meltdown of 2007–08, austerity policies became widely adopted within affected countries. Particularly tough measures were adopted in the UK, where the 2010 budget proposed cutbacks equivalent to 4.5% of projected gross domestic product (GDP), severely affecting public life across a broad swathe of measures. Local councils were particularly hard hit, as they effectively lost 60p out of every £1 the government provided between 2010 and 2020 (Local Government Association, 2019). Among the changes proposed to reduce government spending was the introduction of municipal bonds as a new means to finance infrastructure development. These changes to the public financing of infrastructure

provision further affect the changing dynamic of infrastructure investment in a climate of struggling public–private partnerships, common knowledge asymmetry between public offices and specialized infrastructure funds, and a general re-evaluation of the attractiveness of infrastructure investment per se (Ashton et al., 2012; Gandy, 2004). These developments have direct implications for the quantity and quality of infrastructure investments, and stand in stark contrast to the Organisation for Economic Co-operation and Development's (OECD) recent intervention to abate the effects of austerity on infrastructure development and increase public spending while favourable interest rates prevail (OECD, 2016). This is especially important because much of the UK's infrastructure is in poor condition, especially roads, energy and flood management (Institution of Civil Engineers, 2014). The current state of the infrastructure and the lack of investment therein is often referred to as the 'infrastructure gap' (cf. Barwell, 2018; KPMG, 2019; Merna, 2019). As a consequence, the government has formulated the ambitious National Infrastructure Assessment (National Infrastructure Commission, 2018) to fill this void, laying out a widespread investment strategy heavily focused on private sector investment.

These pressures on municipalities, to do more with less, have led to the creation of an entirely new UK-wide structure for infrastructure financing by means of creating a Municipal Bonds Agency (UKMBA) to help facilitate the establishment of a municipal debt market (LGA, 2014). The main aim, by its own definition, is to provide access to loans at lower rates than those traditionally provided by the Public Works Loan Board (PWLB), whose interest rates were hiked significantly after the crisis (cf. O'Brien & Pike, 2015). This is to be achieved by issuing municipal bonds to capital markets, and by increasing their attractiveness to investors by pooling borrowing requirements and actively engaging in risk management by establishing a robust credit assessment process (UKMBA, 2015). Beyond this, the UKMBA helps facilitate inter-council borrowing, provides expertise to councils in negotiations with lenders and further aims to act as an aggregator for councils to qualify for European Investment Bank (EIB) loans. The agency itself is owned by the councils and the Local Government Association (LGA). The legal and financial risks of borrowing from the capital markets are to be mitigated by a joint and several guarantee from signatory local authorities, of other signatories' borrowing, and by a proprietary credit process to establish borrowing metrics (UKMBA, 2015). So far, 57 local authorities (out of a total of 433) have signed up as shareholders of the agency (Public Finance, 2016). Note that not all councils are eligible for bond issuances: they are vetted for the state of their finances, and only 'first class, highly rated councils' can participate (Public Finance, 2016, p. 1). The establishment of a municipal bond market, however, has proven to be a more complicated endeavour than was first anticipated: in January 2016, *The Financial Times* reported: 'Multibillion-pound municipal bond market stuck at zero' (Moore, 2016, p. 1). This still holds true today in August 2019. Improving interest rates at the directly competing PWLB, together with underestimated administrative and legal complexities, appear to be the main reasons for the delay of a first bond issuance since the first initiative in 2014.[2] Furthermore, investors are still hesitant when considering the credit quality of councils, as few ratings have been made public, and the ongoing political situation introduces yet more uncertainty into the markets.[3] Brexit could have one positive side effect for the UKMBA, though if the UK loses access to the EIB for infrastructure financing and an institutional void results, the UKMBA is likely to rise in significance.[4] Despite the slow take-up, the municipal bond market in the UK is something that both government and investors want to establish urgently to ensure that structural changes to public finance still allow for reasonable funding of local councils, and to establish new investment opportunities for long-term investors such as pension funds.

On the receiving end of these evolving dynamics between the PWLB and UKMBA are the local councils with their legal obligations to provide infrastructural services. The persistent pressure on councils to provide locally sourced revenue towards infrastructure investments has led towards a skewed investment strategy where cheap PWLB loans were used to invest in

commercial real estate, often outside their own jurisdictions, to cross-finance the maintenance of services. This effectively turns councils into property companies and builds a significant credit bubble with disaster looming on the horizon as traditional retail markets continue to decline (Plender, 2017). This practice has become so concerning that the National Audit Office (NAO) has taken up the issue (Marrs, 2019).

On the side of the investors, a central point of friction lies between the lifespan of the average infrastructure project and the often significantly shorter time horizon of financial calculus and resulting portfolio strategies of even infrastructure investors.[5] Allen and Pryke (2013) provide interesting evidence on how the Maquarie Group's model of infrastructure financing during their stint as owners of Thames Water affected their balance sheet (2013). Besides these changes in infrastructure investment strategies, a more general caution towards the infrastructure sector is born out of late 1990s' privatization experiences and a general desire to avoid the politicization of potential investment sites.[6] The situation around the Heathrow Airport expansion is just one prominent example. This has led to a blanket ban by many investors on UK infrastructure assets, citing a '"negative" and "hostile" political and regulatory environment' (Plimmer & Ford, 2019, p. 1) The emergence of project finance, individual highly financialized infrastructure projects that develop their own financing schemes, are also closely tied to investor interests. These are often cherry-picked as those infrastructural projects that yield high returns and fit current portfolio strategies, while being subject to little public scrutiny, weak regulatory oversight, and often questionably skewed financing schemes.[7] A prominent example is the Thames Tideway Tunnel, a £4.2 billion super-sewer development in London, the entire justification for which is drawn into question and has been described as 'a concrete tunnel for extracting rents, a pure financial asset' (Loftus & March, 2019, p. 14).

## The financial ecology of urban infrastructure

Having developed an understanding of the current key dynamics in the UK infrastructure–finance nexus, we can apply the concept of financial ecologies and derive a description of the financial ecology of urban infrastructure in the UK. We use the introduction of the UKMBA as a key vantage point from which to portray the changing dynamics within the financial ecology of urban infrastructure.

The first step is to identify the key actors within the ecology; the presented material helps one to pinpoint these: the UKMBA, local councils, the PWLB, investors and the current government pose the core group of actors, with rating agencies, regulators, the EIB and other banking institutions forming a second order of actors. The wider press and the public itself play only a minor role in the financial ecology. All these actors operate in different locations and relate to each other based on their own logics. The following will try to detail these relationships.

Applying Abbott's concept of linked ecologies, and examining the financial and political–administrative ecologies separately, the UKMBA constitutes a form of avatar of the financial industry within the political–municipal sector. To create a market (for bonds) and new financial instruments might be seen as hinges; that is, an effective strategy of the wider financial ecology that should now also operate in the city's political–administrative ecology. One might interpret the hinges as spreading innovation. However, as strategies, they may serve entirely different ends, depending on which ecology is examined. In the political–administrative ecology, the municipal bonds strategy serves as a strategy of avoidance, to avoid a political discussion and consensus-finding about a city's investments in urban infrastructure. In the financial ecology, municipal bonds are another measure for the leverage of returns and the distribution of risks. In particular, with municipal bonds, the communities share and take over the risks that the financial ecology is required to manage.

Further applying the concept of ecologies, we clearly identify a re-forging of its inner dynamics. Austerity is setting the framework within which this financial ecology morphs towards

a more market-oriented mechanism for financing urban infrastructure. This is further amplified by official government policies such as the National Infrastructure Assessment. The PWLB, as traditionally the central institution for financing urban infrastructure projects, is being supplemented by the UKMBA as a competing institution, which pursues the same aims via a different logic. The UKMBA introduces new actors into the ecology of urban infrastructure development and, more importantly, changes the dynamics of how these actors relate to each other. A significant difference is the shift of scales within the multilevel governance of cities: PWLB loans are largely top-down processes directed from a centralized government institution towards the borrowing councils, keeping a large degree of the financial knowledge and responsibility at the top level, whereas the newly proposed model turns this approach around and locates market exposure and financial responsibility at the local level. Here, not all councils are equally well equipped to handle the increased demands for financial knowledge.

This places local councils at the centre of the ecology. The shift of scales now firmly locates exposure to market volatility at the local level, which is again amplified by increased requirements for financial knowledge at the same level. This dynamic has led to new practices at the local level, where cross-financing involving commercial real estate investments outside of a council's own jurisdiction amplifies market exposure and increases overall complexity in the council's operations. Additionally, the UKMBA's joint and several guarantee adds to this increase in complexity, as it further fragments council interests beyond its own borders. On the upside, the UKMBA provides access to much-needed financial knowledge at the local level.

Investors' interests are dominated by a mixed market logic of maximizing returns on investment while finding safe havens for long-term investments, a strategy based around the development of strong hinges. Under the current configuration of the ecology, investors favour project finance for infrastructure investments to reduce overall complexity in their portfolios. This logic has to be negotiated with the administrative and political burdens of local councils, which have to adapt infrastructural projects to increase attractiveness. The UKMBA assumes the central role in translating between these realms, and faces problems on both sides: it fails to provide adequate public ratings – the common coin of risk evaluation – to market actors, while it also struggles to overcome local institutional and political complexity to prepare the ground for the new mechanism. The interesting aspect here is that the UKMBA assumes the role of communicating and translating risk in both directions. That is, both market risks and systemic risk on the one hand, while also negotiating political risk. It is thus central in establishing knowledge of these risks on both sides, thus reshaping the actors' subjectivities and potentially influencing their resulting practices.

An important aspect of the financial ecology perspective is that we not only consider occurrences of investment, but also changes that are not tied to the flow of capital. The UK faces an immense gap in infrastructure funding, and the UKMBA – as one of the main strategies to fill it – has, to date, failed to perform. This failure contributes towards the widening of the infrastructural gap, adding more pressure on the financial ecology's trajectory. External dynamics such as the ongoing Brexit negotiations foster an insecure investment environment that also questions the future relationship towards key institutions such as the EIB. All these dynamics, taken together, mean that the financial ecology of urban infrastructure in the UK is in a fluid state, in which the lack of political intervention fails to establish a predictable trajectory. This is particularly significant for infrastructure development, as the main requirement for long-term investment and development is stability and predictability.

## CONCLUSIONS

Having established an understanding of the financial ecology's configuration and inner dynamics, we can use the infrastructural perspective outlined previously to identify potential spatial effects.

The following presents a list of these effects, allocated to their corresponding infrastructural dimensions:

- Constraining effects of lack of investment in infrastructure: while the financial ecology still enables infrastructure investment up to a certain level, its current configuration, characterized by the infrastructural gap, has immediate spatial consequences: flood risks keep increasing, the transport sector struggles with overburdened systems and modernization projects such as decarbonization efforts are stifled, setting up a plethora of long-term problems for the future. Many of these consequences are as yet unfelt, which is largely due to the long timeframes on which the ecology operates and the institutional debts we owe to previous generations of practice.
- Path dependencies with new patterns of interdependence: councils' investments in commercial real estate create massive path dependencies, as they often dominate a council's balance sheet and tie its operation of services directly to property market volatility. Going down this path of cross-financing services exposes councils to increasing spatial fragmentation of its interests and exacerbates the complexity of its operations.
- New spatial alliances and patterns of mediation between actors: similarly, the UKMBA's joint and several guarantee increases interdependence between signatory councils and widens the realm of financial concern far beyond a council's own borders. This not only increases complexity but also widens the inequality between the 'first class, highly rated councils' and the rest (Public Finance, 2016, p. 1). These new spatial alliances begin to influence how councils evaluate their own position and capabilities, thus increasingly mediating their perception.
- Investment patterns promoting fragmented infrastructure solutions: the increasing desire of investors to establish effective hinges, paired with regulatory weakness within the financial ecology, bolsters the development of project finance based infrastructure investments. This promotes fragmented infrastructure solutions that cater towards investor needs rather than meeting the facts on the ground and providing optimal long-term solutions.
- Vulnerability of local infrastructure to market volatility: as much as infrastructure is an asset, it is also a major vulnerability that is capable of disrupting cities extensively. In the case of the changing financial ecology of urban infrastructure, we have shown how particular constructs favoured by the financial ecology expose local infrastructures to market volatility. A systemic breakdown of markets could then directly translate to the local level, where large utility companies often operate under similar moral hazards as the banks that were bailed out during the last financial crisis.
- New habits and practices in council operations: we can identify changes in local councils, which partake in the aforementioned property investment schemes: they acquire new knowledge and implement changes to long-standing practices, slowly changing the habits of council operations and with it solidifying the market oriented trajectory of the financial ecology itself.

This list of effects is of course not exhaustive and serves as a starting point for discussing the merits of moving the focus of financialization research more towards the study of infrastructures. By using financial ecologies as an analytical tool and infrastructure as a perspective, we showed how the financial ecology of urban infrastructure in the UK creates spatial effects within cities. Thus, the paper directly answers calls from the discourse on financialization to examine its spatial effects more closely, and provides an analytical tool to explore these effects in different contexts (cf. French et al., 2011). Beyond this, it widens the discussion of financialization within the

infrastructure discourse by outlining the spatial complexity of infrastructure and tying it to the configuration of financial ecologies.

The changing financial ecology of urban infrastructure in the UK provides glimpses of one future for urban infrastructure under prevailing austerity. New vehicles for infrastructure investment imply repercussions that are directly related to the localization of risk, the exposure of fundamental infrastructures to market volatility, as well as growing exposure to an exchange-value-based market logic in the creation, operation, and governance of public utilities. As councils struggle to finance infrastructure projects and maintenance, sunk investments continually depreciate, seriously harming the installed base for future investments. Pathways towards more sustainable forms of development remain out of bounds and constrain the future potential of societal and environmental change by maintaining habits, patterns, and practices. All the while, vulnerability is increased, not only to market risks but also to continued high risk of flooding, fire and other threats associated with climate change. Infrastructure is the central pillar underpinning the operation of modern societies, and its financialization seriously affects how these societies constitute themselves in our cities.

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## NOTE

[1] The discussion is based on the analysis of primary documents, a thoroughly reviewed collection of secondary sources and supplemented with 12 expert interviews conducted between 2015 and 2018.
[2] Interview: Administration 2, personal interview, 23 September 2016. See also in the supplemental data online.
[3] Interview: Finance 1, personal interview, 1 March 2017.
[4] Interview: Finance 2, personal interview, 16 January 2018.
[5] Interview: Finance 3, personal interview, 7 September 2016.
[6] Interview: Finance 2, personal interview, 16 January 2018.
[7] Interview: Finance 2, personal interview, 16 January 2018.

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## REFERENCES

Abbott, A. (2005). Linked ecologies: States and universities as environments for professions. *Sociological Theory*, *23*(3), 245–274. doi:10.1111/j.0735-2751.2005.00253.x

Ahlers, R., & Merme, V. (2016). Financialization, water governance, and uneven development. *WIRES Water*, *3*, 766–774. doi:10.1002/wat2.1166

Allen, J., & Pryke, M. (2013). Financialising household water: Thames water, MEIF, and ring-fenced politics. *Cambridge Journal of Regions, Economy and Society*, *6*, 419–439. doi:10.1093/cjres/rst010

Angelo, H., & Calhoun, C. (2013). Infrastructures of the social: An invitation to infrastructural sociology. [*unpublished manuscript*].

Arrighi, G. (1994). *The long twentieth century: Money, power, and the origins of our times*. London: Verso.

Ashton, P., Doussard, M., & Weber, R. (2012). The financial engineering of infrastructure privatization. *Journal of the American Planning Association*, *78*(3), 300–312. doi:10.1080/01944363.2012.715540

Ashton, P., Doussard, M., & Weber, R. (2014). Reconstituting the state: City powers and exposures in Chicago's infrastructure leases. *Urban Studies*, *53*, 1384–1400. doi:10.1177/0042098014532962

Bakker, K. (2013). Constructing 'public' water: The World Bank, urban water supply, and the biopolitics of development. *Environment and Planning D: Society and Space*, *31*, 280–300. doi:10.1068/d5111

Barwell, D. (2018). Six steps to closing the UK infrastructure gap. *AECOM*. Retrieved from https://www.aecom.com/without-limits/article/six-steps-closing-uk-infrastructure-gap/

BerlinHyp. (2016). Grüner Pfandbrief der Berlin Hyp wird erneut prämiert. Retrieved from http://www.berlinhyp.de/uploads/media/2016-02-04_Green_Bond_Award_D_01.pdf

Bojadzijev, M. (2015). Housing, financialization, and migration in the current global crisis: An ethnographically informed view from Berlin. *South Atlantic Quarterly*, *114*(1), 29–45. doi:10.1215/00382876-2831268

Brenner, N., Madden, D. J., & Wachsmuth, D. (2011). Assemblage urbanism and the challenges of critical urban theory. *City*, *15*(2), 225–240. doi:10.1080/13604813.2011.568717

Chattopadhyay, S. (2012). *Unlearning the city: Infrastructure in a new optical field*. Minneapolis, MN: University of Minnesota Press.

Christophers, B. (2010). On voodoo economics: Theorising relations of property, value and contemporary capitalism. *Transactions of the Institute of British Geographers*, *35*, 94–108. doi:10.1111/j.1475-5661.2009.00366.x

Clark, E., Larsen, H. G., & Hansen, A. L. (2015). Financialisation of built environments: A literature review. *FESSUD Working Paper Series*, *114*, 1–56.

Clark, E., & O'Connor, K. (1997). The informational content of financial products and the spatial structure of the global financial industry. In K. R. Cox (Ed.), *Spaces of globalization* (pp. 89–114). New York, NY: Guilford.

Coutard, O. (2008). Placing splintering urbanism: Introduction. *Geoforum; Journal of Physical, Human, and Regional Geosciences*, *39*(6), 1815–1820.

Coutard, O., & Rutherford, J. (Eds.). (2015). *Beyond the networked city: Infrastructure reconfigurations and urban change in the North and South*. London: Routledge.

Epstein, G. A. (Ed.). (2005). *Financialization and the world economy*. Cheltenham: Edward Elgar.

Eturk, I., Froud, J., Johal, S., Leaver, A., & Williams, K. (2007). *Financialization or what's going on*. International Working Group on Financialization Inaugural Workshop, London.

Färber, A. (2014). Potenziale freisetzen: Akteur-Netzwerk-Theorie und Assemblageforschung in der interdisziplinären kritischen Stadtforschung. *sub/Urban*, *2*(1), 95–103.

French, S., & Kneale, J. (2009). Excessive financialisation: Insuring lifestyles, enlivening subjects, and everyday spaces of biosocial excess. *Environment and Planning D: Society and Space*, *27*, 1030–1053. doi:10.1068/d7607

French, S., Leyshon, A., & Wainwright, T. (2011). Financializing space, spacing financialization. *Progress in Human Geography*, *35*(6), 798–819. doi:10.1177/0309132510396749

Froud, J., Haslam, C., Johal, S., & Williams, K. (2000). Shareholder value and financialization: Consultancy promises, management moves. *Economy and Society*, *29*(1), 80–110. doi:10.1080/030851400360578

Furlong, K. (2011). Small technologies, big change: Rethinking infrastructure through STS and geography. *Progress in Human Geography*, *35*(4), 460–482. doi:10.1177/0309132510380488

Gandy, M. (2004). Rethinking urban metabolism: Water, space and the modern city. *City*, *8*, 363–379. doi:10.1080/1360481042000313509

Gandy, M. (2008). Landscapes of disaster: Water, modernity and urban fragmentation in Mumbai. *Environment and Planning A: Economy and Space*, *40*, 108–130. doi:10.1068/a3994

Gandy, M. (2011). Landscape and infrastructure in the late-modern metropolis. In G. Bridge & S. Watson (Eds.), *The new Blackwell companion to the city* (pp. 58–65). Chichester: Blackwell.

Gotham, K. F. (2009). Creating liquidity out of spatial fixity: The secondary circuit of capital and the subprime mortgage crisis. *International Journal of Urban and Regional Research*, *33*(2), 355–371. doi:10.1111/j.1468-2427.2009.00874.x

Graham, S. (2010). *Disrupted cities: When infrastructure fails*. New York, NY: Routledge.

Graham, S., & Marvin, S. (2002). *Splintering urbanism: Networked infrastructures, technological mobilities and the urban condition*. London: Routledge.

Graham, S., & McFarlane, C. (Eds.). (2015). *Infrastructural lives: Urban infrastructure in context*. Milton Park: Earthscan.

Graham, S., & Thrift, N. (2007). Out of order: Understanding repair and maintenance. *Theory, Culture and Society*, *24*(3), 1–25. doi:10.1177/0263276407075954

Halbert, L., & Rouanet, H. (2014). Filtering risk away: Global finance capital, transcalar territorial networks and the (un)making of city-regions: An analysis of business property development in Bangalore, India. *Regional Studies*, *48*(3), 471–484. doi:10.1080/00343404.2013.779658

Harvey, D. (1989). From managerialism to entrepreneurialism: The transformation in urban governance in late capitalism. *Geografiska Annaler: Series B, Human Geography*, *71*(1), 3–17. Retrieved from http://www.jstor.org/stable/pdfplus/490503.pdf?acceptTC=true doi:10.1080/04353684.1989.11879583

Harvey, D. (2006). *The limits to capital* (3rd ed.). London: Verso.

Harvey, D. (2010). *The enigma of capital: And the crises of capitalism*. Oxford; New York: Oxford University Press.

Heynen, N., Kaika, M., & Swyngedouw, E. (Eds.). (2006). *In the nature of cities: Urban political ecology and the politics of urban metabolism*. Milton Park: Routledge.

Institution of Civil Engineers. (2014). *The state of the nation: Infrastructure 2014*. London: Author.

KPMG. (2019, July 15). Infrastructure gap to hinder UK's growth potential. *KPMG*. Retrieved from https://home.kpmg/uk/en/home/media/press-releases/2019/07/infrastructure-gap-to-hinder-uk-s-growth-potential.html

Latour, B. (1993). Ethnography of a high-tech case: About Aramis. In P. Lemonnier (Ed.), *Technological choices – Transformations in material culture since the Neolithic* (pp. 372–398). Milton Park: Routledge.

Leyshon, A., & Thrift, N. (2007). The capitalization of almost everything: The future of finance and capitalism. *Theory, Culture and Society*, *24*(7–8), 97–115. doi:10.1177/0263276407084699

Limbach, C. (2013). *Climate bonds – Kommunalanleihen: Analyse der Potenziale zur Finanzierung der Energiewende auf kommunaler Ebene*. Munich: AVM.

Local Government Association. (2014). The UK municipal bonds agency: Establishment of a local government collective agency for the issue of local authority bonds. Retrieved from https://www.local.gov.uk/sites/default/files/documents/municipal-bonds-agency-re-dcd.pdf

Local Government Association. (2019). Councils can: 2019 conference paper. Reference Code: 9.125. Retrieved from https://www.local.gov.uk/councils-can-2019-conference-paper

Loftus, A., & March, H. (2019). Integrating what and for whom? Financialisation and the Thames Tideway Tunnel. *Urban Studies*, *56*(11), 2280–2296. doi:10.1177/0042098017736713

Marrs, C. (2019, May 15). Spending watchdog probes council borrowing for property investment. Room 151. Retrieved from https://www.room151.co.uk/treasury/spending-watchdog-probes-council-borrowing-for-property-investment/

Martin, R. (2002). *Financialization of daily life*. Philadelphia: Temple University Press.

McFarlane, C. (2008). Sanitation in Mumbai's informal settlements: State, 'slum', and infrastructure. *Environment and Planning A: Economy and Space*, *40*(1), 88–107. doi:10.1068/a39221

McFarlane, C. (2011). Assemblage and critical urbanism. *City*, *15*(2), 204–224. doi:10.1080/13604813.2011.568715

McFarlane, C., & Rutherford, J. (2008). Political infrastructures: Governing and experiencing the fabric of the city. *International Journal of Urban and Regional Research*, *32*(2), 363–374. doi:10.1111/j.1468-2427.2008.00792.x

Merna, T. (2019, February 18). What the infrastructure gap means for the future of society. *Institution of Civil Engineers*. Retrieved from https://www.ice.org.uk/news-and-insight/the-civil-engineer/february-2019/the-infrastructure-gap

Monstadt, J. (2009). Conceptualizing the political ecology of urban infrastructures: Insights from technology and urban studies. *Environment and Planning A: Economy and Space*, *41*, 1924–1942. doi:10.1068/a4145

Moore, E. (2016, January 19). Multibillion-pound municipal bond market stuck at zero. *The Financial Times*. Retrieved from https://www.ft.com/content/16284e12-baec-11e5-b151-8e15c9a029fb?mhq5j=e1

Nardi, B. A., & O'Day, V. L. (1999). *Informational ecologies: Using technology with Heart*. Cambridge: MIT Press.

National Infrastructure Commission. (2018). National infrastructure assessment. Retrieved from https://www.nic.org.uk/wp-content/uploads/CCS001_CCS0618917350-001_NIC-NIA_Accessible.pdf

O'Brien, P., & Pike, A. (2015). The governance of local infrastructure funding and financing. *Infrastructure Complexity*, *2*(3), 1–9.

OECD. (2016). *Stronger growth remains elusive: Urgent policy response is needed. Interim Economic Outlook*. 18.2.2016.

O'Neill, P. (2013). The financialisation of infrastructure: The role of categorisation and property relations. *Cambridge Journal of Regions, Economy and Society*, *6*, 441–454. doi:10.1093/cjres/rst017

O'Neill, P. (2018). The financialisation of urban infrastructure: A framework of analysis. Urban Studies Special Issue: Funding, financing and governing urban infrastructures, pp. 1–22.

Park, R. E., Burgess, E. W., & McKenzie, R. D. (1925). *The city*. Chicago, IL: The University of Chicago Press.

Phillips, K. (1994). *Arrogant capital: Washington, Wall Street, and the frustration of American politics*. New York: Little, Brown and Company.

Pike, A. (2006). 'Shareholder value' versus the regions: The closure of the Vaux Brewery in Sunderland. *Journal of Economic Geography*, *6*(2), 201–222. doi:10.1093/jeg/lbi005

Plender, J. (2017, April 25). UK public finance: councils build a credit bubble. *The Financial Times*. Retrieved from https://www.ft.com/content/84892c56-1a17-11e7-bcac-6d03d067f81f

Plimmer, G., & Ford, J. (2019, January 22). Infrastructure investors put 'blanket ban' on UK assets. *The Financial Times*. Retrieved from https://www.ft.com/content/d23400e6-1d6e-11e9-b126-46fc3ad87c65

Public Finance. (2016). First local government bond agency issue set for autumn. Retrieved from http://www.publicfinance.co.uk/news/2016/05/first-local-government-bond-agency-issue-set-autumn

Robinson, J. (2011). Between Marx and Deleuze: Discourses of capitalism's urban future. In M. Gandy (Ed.), *Urban constellations* (pp. 14–17). Berlin: Jovis.

Rutland, T. (2010). The financialization of urban redevelopment. *Geography Compass*, *4*(8), 1167–1178. doi:10.1111/j.1749-8198.2010.00348.x

Sassen, S. (2006). *Cities in a world economy*. Thousand Oaks, CA: Pine Forge Press.

Sayer, A. (2012). Facing the challenge of the return of the rich. In W. Atkinson, S. Roberts, & M. Savage (Eds.), *Class inequality in austerity Britain* (pp. 163–179). London: Palgrave Macmillan.

Shamir, R. (2013). *Current flow: The electrification of Palestine*. Stanford: Stanford University Press.

Simone, A. (2004). People as infrastructure: Intersecting fragments in Johannesburg. *Public Culture*, *16*(3), 407–429. doi:10.1215/08992363-16-3-407

Simone, A. (2011). The surfacing of urban life. *City*, *15*(3–4), 355–364. doi:10.1080/13604813.2011.595108

Slater, T. (2017). Planetary rent gaps. *Antipode*, *49*(S1), 114–137. doi:10.1111/anti.12185

Star, S. L. (1999). The ethnography of infrastructure. *American Behavioral Scientist*, *43*(3), 377–391. doi:10.1177/00027649921955326

Star, S. L., & Ruhleder, K. (1994). Steps towards an ecology of infrastructure: Complex problems in design and access for large-scale collaborative systems. In *Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work* (pp. 253–264). ACM.

Star, S. L., & Ruhleder, K. (1995). Steps toward an ecology of infrastructure: Design and access for large information spaces. *Information Systems Research*, *3280*(217), 1–39.

Sullivan, S. (2013). Banking nature? The spectatucal financialisation of environmental conservation. *Antipode*, *45*, 198–217.

Swyngedouw, E., & Heynen, N. C. (2003). Urban political ecology, justice and the politics of scale. *Antipode*, *35*(5), 898–918. doi:10.1111/j.1467-8330.2003.00364.x

UKMBA. (2015). UK municipal bonds agency plc: Strategic report. Retrieved from https://www.ukmba.org/wp-content/uploads/2015/05/Signed_Financial_Statements_15.pdf

Weber, R. (2010). Selling city futures: The financialization of urban redevelopment policy. *Economic Geography*, *86*(3), 251–274. doi:10.1111/j.1944-8287.2010.01077.x

Wyly, E., Moos, M., Foxcroft, H., & Kabahizi, E. (2008). Subprime mortgage segmentation in the American urban system. *Tijdschrift Voor Economische en Sociale Geografie*, *99*, 3–23. doi:10.1111/j.1467-9663.2007.00436.x

Wyly, E., Moos, M., & Hammel, D. (2012). Race, class and rent in Americas subprime cities. In M. Albers (Ed.), *Subprime cities: The political economy of mortgage markets* (pp. 242–289). Oxford: Wiley-Blackwell.

Wyly, E., Moos, M., Hammel, D., & Kabahizi, E. (2009). Cartographies of race and class: Mapping the class-monopoly rents of American subprime mortgage capital. *International Journal of Urban and Regional Research*, *33*, 332–354. doi:10.1111/j.1468-2427.2009.00870.x

Zademach, H. (2015). Gutes tun und Geld verdienen? Ethische Investments nachhaltige Geldanlagen. *Georaphische Rundschau*, *67*(2), 46–52.

**Second Publication**

# The temporalities of financialization: Infrastructures, dominations and openings in the Thames Tideway Tunnel

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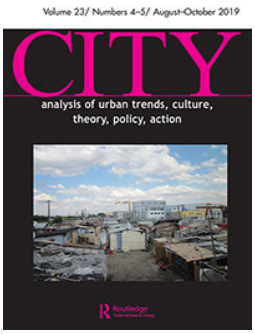


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# The temporalities of financialization

## Infrastructures, dominations and openings in the Thames Tideway Tunnel

Fritz-Julius Grafe and Hanna Hilbrandt

*In the last decade, a bourgeoning body of literature has explored the influence of financial actors, techniques and motives in the urban development of North American and European cities. Less has been said about the influence of finance on the temporalities of urban production and urban life. Yet finance is, at its most basic, the management of debt; and debt is, simply put, the deferral of payment; thus, by its very nature, financialization introduces new temporal dynamics into whatever object of investment it engages with. This paper examines these temporal dynamics in the financialized production of a large-scale urban infrastructure project, the Thames Tideway Tunnel (TTT), a 25-km 'super-sewer' beneath the River Thames where it runs through the center of London. From analyzing how financial actors, motives, and instruments influence the planning and implementation of this massive sewer expansion, it traces the ways in which the temporal characteristics of finance have repercussions in the urban space that privilege financial interests. This analysis contributes both conceptual and empirical insights. Firstly, it provides a theoretical conceptualization of the ways in which the temporalities of financialization shape the material production of the city. Secondly and more empirically, our case analysis allows us to schematize the different ways in which the financialization of the TTT project shapes the temporalities of its production, with wide-ranging political, economic and environmental implications. In summary, the paper closes a crucial gap in understanding how different temporalities of finance intersect in the making of contemporary cities.*

**Key words:** Financialization, temporalities, infrastructure, Thames Tideway Tunnel, urban development

## Introduction

Since the 2008 global financial crisis, research has explored the nexus of urban production and financialization and a number of crucial effects thereof, including the deepening of socio-economic inequalities (Christophers 2012; Fields and Uffer 2016; Aalbers 2017; Wijburg and Aalbers 2017) and the reorganization of institutional and regulatory frameworks (Savini and Aalbers 2016). Less has been said about the influence of finance on the temporalities of urban production, yet its effects on urban development are substantial and direct. At its most basic, finance is

defined by time: As the management of debt, i.e. the deferral of payment, finance is, in temporal terms, the present provision of funds by a commitment to future dependencies. Temporal dynamics resulting from such debt management include cycles of boom, bust, and crisis, the routine of dividend payouts, the long-durée of aspiration and the risky futures of speculation. It becomes obvious that finance introduces a whole slew of temporal dynamics into the equation of how, when, why and where investment in the urban fabric is prone to take place. Commonly understood as 'the increasing role of financial motives, financial markets, financial actors and financial institutions in the operation of domestic and international economies' (Epstein 2005), *financialization* can—in temporal terms—thus also be understood as the increasing dominance of finance in the definition of temporal relations. Differently put, financialization implies the ascendance of particular timescales of dividend-payout, cost calculation, or investment decisions. Understanding the ways in which these temporal specificities shape the production of urban space is crucial in two ways.

Firstly, it contributes to a theoretical conceptualization of the ways in which the temporalities of financialization shape the material production of the city. Time and temporalities have long been understood to be socially constructed (Wajcman 2008; Hope 2010, 2011; Barak 2013; Ogle 2013). In this sense, the social is governed by multiple temporalities—different rhythms, timescapes or conceptions of past and future—that hardly play out in coherent ways. Rather, the ways in which temporalities manifest themselves depend on the power relations that sustain dominant regimes of time. In line with the approach of this Special Feature, we employ the notion of infrastructure to describe the constitution and structuring logics of temporalities and their interactions (see Besedovsky et al., this issue). From this perspective, temporalities constitute infrastructures yet transcend the usual metaphorical and conceptual understandings of these: underlying social interaction, temporalities as infrastructures pre-figure and mediate social life. Through connections, patterns and path dependencies they enable or constrain practices, thereby perpetually reproducing existing power relations (Angelo and Calhoun 2013; Angelo and Hentschel 2015); yet, constructed through social practices, temporalities can be disrupted, leading to either standstill or change (cf. Star and Ruhleder 1996; Angelo and Calhoun 2013). In untangling some of the ways in which the temporal logics of finance define this temporal infrastructure, for instance through industry-specific timescapes or forms of forecasting the future, and linking these to resulting reconfigurations of the urban production, our analysis offers novel ways of theorizing the nexus of time, finance and space.

Secondly, the paper elaborates a more precise empirical understanding of the workings of these temporalities, providing further insights into possibilities for intervention and change. In this vein, this paper analyzes the financialized production of a £4.2 billion[1] urban infrastructure project, the Thames Tideway Tunnel (TTT), also known as the 'super sewer.' This 25-km tunnel is situated where the River Thames runs through London and is intended to solve the city's wastewater problems by retaining sewage that presently overflows into the River Thames. Thames Water (TW), London's water provider and central actor in the development of the sewer project, is owned by a multinational consortium committed to the regular generation of dividends for its investors (Allen and Pryke 2013) and provides a textbook example of today's financialized landscape of urban infrastructure provision (see also Loftus and March 2019 for an analysis of the rent extraction scheme of the Tideway Tunnel).

In bringing these aims together, our case analysis points toward five critical and

entangled temporal dynamics that characterize how financialization impacts urban development: first, the alignment of opportunities to create new trajectories in favor of financialization, for instance in the concurrence of market dynamics and moments of political opportunity; second, the pre-emptive extraction of profits for the future provision of services; third, the active construction of new temporalities that set the stage for other urban processes (e.g. regular dividends, interest payments, regulatory cycles, etc.); fourth, economically framed projections of the future that skew decision making towards economic rationales; and fifth, moments in which existing temporalities are put under strain and create frictions with other temporalities whose logic diverges from that inherent to the project. These dynamics allow us to detail how the structural set-up of the financial framework favored finance's temporal needs within the complex equation of urban infrastructure provision. Yet while these factors dominate the development process, our conclusion also points to openings for change.

The paper builds on the analysis of legislative and planning documents, expert reports and legal frameworks issued between 2001 and 2017. We understand these documents as interacting—at times competing with or explicitly counteracting—a web of public discourse in the media, blogs and other publications that we also took into consideration (Colomb 2012, 31). Following Sayer (2005, 7), the analysis accounts for the ways in which documents tend to deliberately play towards particular ends as ambiguous tools that may represent vested interests. The analysis focused on documents that concerned the financing of the tideway tunnel, its possible effects and the contestations thereof, leaving aside any material on other alternative wastewater projects. We analyzed the data regarding the temporal logics inserted through financialization as well as other—possibly contradictory—temporal dynamics, to discern temporal patterns or conflicts and derive analytical categories thereof. Based on these categories, we re-examined the material in order to test our observer impressions. We backed up the analysis of these documents through interviews, conducted between 2017 and 2018, with financial experts involved in both the development and critique of London's water infrastructure.

## Financial markets, temporalities, and urban development

In the last decade, a bourgeoning body of literature interested in the particular *urban* effects of financialization (Heeg 2013; Savini and Aalbers 2016; Aalbers 2017) has investigated the financialization of land (Kaika and Ruggiero 2016; Aalbers and Haila 2018), material infrastructure (Torrance 2008; O'Neill 2013; Loftus and March 2016), housing and real estate (Aalbers 2017), as well as urban redevelopment processes (Rutland 2010; Weber 2010). While we do not discuss this literature in detail, an indication of some of its key themes is useful. This body of work describes new financial technologies and instruments that help global capital to secure profitable outlets and also function to assess or minimize risk (Bitterer and Heeg 2012; David and Halbert 2014); it demonstrates how financialization has shifted power relations in urban and national governance (Weber 2010; Ashton, Doussard, and Weber [2014] 2016); documents the emergence of a 'shareholder-value maximization' credo (Froud et al. 2000; Pike 2006) that seeks to maximize the exchange-value of underlying assets as opposed to their use-value (Clark, Larsen, and Hansen 2015); and captures the impacts of financialization on everyday life (Martin 2002; French and Kneale 2009), for instance in housing struggles (Bojadžijev 2015; García-Lamarca and Kaika 2016; Kaika and Ruggiero 2016) or the effects of financialized water provisioning (Allen and Pryke 2013). While some of this literature touches upon the role of time (notably, Martin 2002; Graham and Thrift 2007; Weber 2010), current analyses are limited in that they do not explicitly reflect the temporal dimension of financialization (but see Kloeckner and

Mueller 2018). Yet, as this paper shows, financialization not only impacts upon the characteristics of time, but finance's temporal effects have further repercussions in urban space. This aspect is particularly crucial when it comes to urban infrastructure with its long operational timescales and immediate impacts on urban life.

### *The production of temporalities*

The temporal effects of finance are usefully contextualized in literatures that problematize the social construction of time. Despite recurring complaints regarding the neglect of the temporal dimensions in urban analysis, the 19th century saw a wide and interdisciplinary engagement with multiple understandings of time (Nowotny 1992). These include Marxist analysis, in which time emerges as a central category in capitalism's endeavors to speed up, compress time and increase productivity (Thompson 1967; Harvey 2008), geographical analysis of the nexus of space and time (Hägerstrand 1978; May and Thrift 2001; Cresswell 2004; Massey 2005), sociological accounts of time and its significance in social interaction (Elias 1992), an economic psychology of time (Mieg 2005), as well as anthropological accounts of diverse cultural conceptualizations of time (Adam 1994; Fabian 2002).

This literature has recognized that temporality does not impose itself on society, but emerges in social practice (Wajcman 2008). Consequently, time is socially experienced, thus 'multiple and heterogeneous' (May and Thrift 2001, 3), while it similarly 'involve[s] and invoke[s] our relations with others in time' (Keightley 2012, 202). Social time is, in this 'practiced' sense, not only relative and relational, it is also open to change through adaptation, appropriation and negotiation, while also being determined by path dependencies, on the one hand, and on the other by power relations emerging from different temporal interests. Here, we speak of temporalities in its plural form, to refer to the social experience of time-lived practices and perceptions, hence to differentiate *temporalities* from the abstract notion from time as a 'physical' externality (LiPuma 2017, 145).

Adam (2007) understands the power relations of capitalism to have led to specific temporalities that have, in turn, fundamentally shaped contemporary social relations. While industrial capitalism was fundamentally shaped by the dominance of clock time as the central measure of productivity (Thompson 1967), in the 1970s and 1980s the onset of global electronic communication transcended 'the durational and sequential properties of clock time' (Hope 2010, 2011). Key concepts emerging to understand this new era, such as Castells' 'network society' (Castells 2010), Urry's 'mobility paradigm' (Urry 2000), and Sassen's 'global city' (1991), describe the ways in which interconnections between people across space (May and Thrift 2001, 10) define new temporalities.

The temporalities of financialized capitalism (Hope 2006) are critically determined by these global, technological connections that underpin the workings of most financial practices. For instance, as Hardin (2014, 205–206) writes, forms of prognostication collapse 'the future into the now' (cf. Searle 2016, 53). 'In a virtual sense,' Hope (2010, 652) notes, 'the future is pulled into the present (to be assigned a monetary value).' Crucially, such modeling transforms the future, as it 'steers towards or away from certain outcomes … under the guise of merely trying to anticipate them' (Orpana 2017, 77–78; see also Riles 2004, 2011). In addition, financial capitalism is 'future exploitative' (Orpana 2017), i.e. transferring risk to the future (Hardin 2014, 102), predominantly the futures of urban inhabitants who are frequently unaware of the risks they are required to bear (see also Bear 2011; Allen and Pryke 2013, 427). Moreover, financial markets, in particular derivatives markets, trade in future uncertainty, whereby risk 'becomes a necessary resource for technologized derivatives trading and a constitutive feature of the real-time present'

(Arnoldi 2004, 106–107). By speeding up or compressing time, technology allows markets to 'reduce or eliminate sequential lags of time' (Hope 2010, 653), thereby gaining more profit in shorter periods of time. These short-term dynamics have shaped long-term change through the aggregate effects of these technologies in financial markets. This is most evident in shifts in market cycles (e.g. Kondratiev waves, Schumpeter's business cycles and cycles of financial crises) and related financial crises.

Few authors have discussed the effects of these temporal changes on the built environment. Yet, as financial markets have become more integrated into the production of the built environment, the temporalities of these cycles of 'boom, bubble, and bust' (Weber 2015, 23) have been mediated through urban space. Most prominently, David Harvey has described capital's search for new markets through the notion of 'the spatial fix': short-term relief from crisis of overaccumulation, in which investment in the built environment absorbs surplus value (Harvey 2003, 115–116). Temporally speaking, the effect of these fixes implies that cities are changing at ever faster pace—i.e. the pace of the market (Weber 2015, 17). Yet, the spatial fix is also a temporal fix, because crises are pushed just slightly further into the future. The needs of finance thereby drive the building cycle (Weber 2015, 19) through periods of 'expansion, slowdown, a downturn, and a recovery' (ibid: 25).

Yet, to date, empirical evidence has not unearthed the interactions between multiple temporalities at play and their repercussions in urban space. To fill this gap, the remainder of this paper contributes a temporal analysis of the TTT that enables us to outline the different ways in which the financialization of this infrastructure project shaped and continues to shape the temporalities of its production. We thereby pursue the argument that the dominance of financial actors and motives introduced a whole slew of new temporal logics, interests and dynamics into the equation of how, when, why, where and to whose advantage investment in the urban fabric is prone to take place. The Tideway Tunnel poses an ideal research subject for this endeavor, being characterized from inception to execution by a multitude of tropes that exemplify the financialization of urban infrastructures in contemporary cities.

## *The financialized temporalities of the TTT*

First, a word about the tunnel's aims, history and governance structure. The Thames Tideway Scheme is an ongoing large-scale urban infrastructure project that seeks to prevent the discharge of sewage overflows into the River Thames, by constructing a 25-km tunnel to serve as a temporary storage facility.[2] The discharge of untreated sewage into the river led the European Commission to sue the UK in 2009 under the 1991 Urban Waste Water Treatment Directive. In 2001, well before these judicial actions were set in motion, the UK Environment Agency, Thames Water (TW), the Department for Environment, Food, and Rural Affairs (Defra, the responsible ministry), and the Greater London Authority instigated the Thames Tideway Strategic Study to evaluate the impacts of the discharges and potential solutions to the problem.[3] Following this study, the Thames Tideway Scheme moved forward with a three-tiered approach to achieving improved sewage screening, storage and treatment: First, a deep storage and conveyance tunnel was constructed; second, London's sewage treatment works are to be modernized; and third, the construction of the Thames Tideway Tunnel (TTT), the focus of this paper.

The principle responsibility for this project lies with TW. Similarly to other water utilities in the United Kingdom, TW was privatized during a period between the late 1980s and early 1990s. Subsequently, several takeovers have resulted in over-leveraged balance sheets. As these weigh heavily on the company's ratings, the tunnel is being constructed by a separate entity, Bazalgette

Tunnel Limited (BTL). Although this new special-purpose company with an offshore holding structure similar to that of TW is legally and financially separated from TW, both companies are in fact tightly entangled, with TW being both the supplier and customer of BTL. TW and BTL are regulated by the regulatory body Ofwat (Water Services Regulation Authority), whose main responsibility lies in the management of licenses and the negotiation of tariffs every five years. However, TWs byzantine corporate structure complicates political oversight, obscures the final responsibility over the project and widens the disconnect between TW's 13 million customers, its owners, and the utility. The primary investors in BTL are Allianz, IPP, Swiss Life, Dalmore Capital, and DIF. These insurance companies, pension funds and infrastructure funds specialize in low-risk, low-volatility long-term investments as a means of harboring their clients' assets for longer periods of time. Shareholder value and quarterly reports are core metrics that drive their decision-making. Tax optimization structures and maximizing of financial benefits are routine practice.

The involvement of local government and the public was scant, as the responsibilities were immediately referred to Ofwat and TW following the EU lawsuit.[4] Participation was limited to minimizing the impacts on boroughs by means of managing construction sites. Most Londoners are not aware of the added costs already appearing on their water bills (interviews Jan. 2018). An exception is the initiative '*Clean Thames Now and Always*,' which coordinates efforts to question the long-term sustainability of the project vis-à-vis other solutions, such as sustainable urban drainage systems (SUDS).

### *How the temporalities of finance shaped the TTT*

To consider how 'financialized temporalities' shaped the project, it is crucial to recall the developments that brought the project about: The pressure on the UK Government by the previously mentioned EU lawsuit coincided with the fallout from the financial crisis and ensuing austerity policies, limited availability of bank loans and TW's financially weak position. Hence, multiple temporal dynamics came together in ways that facilitated financialization. In this moment, only the financial construct described above appeared to appease wary investors, while at the same time promising them significant returns and solving the underlying problem of raw sewage discharges. Consequently, the project was brought about hand in hand with crucial conflicts of interest bound up in the project, and the desires of powerful actors to capitalize upon large-scale development. The opportunistic nature of financialization to capitalize on the alignment of different developments and timelines at opportune moments to create new trajectories can be defined as a first critical characteristic of the temporal impacts of financialization. This alignment led to the sudden transformation of a development with severe consequences for other temporal dynamics.

Once momentum was gained, the inherent logic of finance dictated the preference of large-scale, ring-fenceable, technocratic measures with particular temporal effects. As previously noted, establishing BTL enabled the sewer project to be kept separate from TWs heavily leveraged balance sheet, through complex financial engineering that ring-fenced its profits separately from the wider risks of the project (cf. Allen and Pryke 2013). Thus, limiting interactions with existing urban infrastructures also made the project easier to quantify, project, securitize and trade, and defined the type of project that was to be constructed.[5] Debt obligations required the creation of revenue streams while the project was being completed. In the resulting model (revenue increment financing / cash flow financing), customers thus pay during both the construction period as well as during service delivery.

As Allan and Pryke helpfully note, in this model 'it would seem that the households themselves are the financial asset' (2013, 419). This not only contradicts common investment principles, it also transfers the project's completion risk from the utility to the customers (Blaiklock 2017). Both the securitization of revenue streams, as well as adding the costs of the project to customers' bills, enabled a structure that largely benefited investors over customers. To understand the temporal specificities of the project, it is critical to emphasize that water consumers do not (yet) profit from the effects of the project; they are thus paying for a project that they might not even benefit from, while shareholders are already receiving payouts from their revenue streams. This preemptive extraction of profits for future services defines the second critical characteristic by which the temporal impacts of financialization influence the production of urban space.

Investing large amounts of resources in this project created path dependencies, thereby structuring future possibilities for intervention. Once various actors committed to long construction periods, the TTT became dependent on pricing volatility and other market dynamics. In particular, the seven-year (or more) construction period does not allow for 'fixed price construction contracts,' as construction companies cannot anticipate price fluctuations for materials and labor over such an extended period of time; this thus exposes the project to cost inflation (Blaiklock 2017, 16). Blaiklock, an infrastructure banking expert, concludes: 'the incentive for contractors to achieve project completion to time and cost is now much diminished, if not eliminated' (Blaiklock 2017, 4), with significant implications for the future temporal dynamics of the project. The financialized production-logic of the TTT thus established routines, repetitions, and timeframes that constitute new temporalities, which in turn set the stage for other urban processes. This is the third critical characteristic of the temporal impacts of financialization. This logic of structuration of time also becomes apparent in the ways in which the model is legally regulated: it is mostly structured around financial objectives rather than those of the public. For instance, one of the case's prominent legal frameworks is the RAB Model (Stern 2014), which Ofwat uses to calculate TW's value in the tariff-setting process. It is the central mechanism that informs negotiations in the five-year tariff-setting cycle and thus defines the political influence that regulators can wield over the license holder.[6] The legal framing and toolset of the regulator thus establishes a temporal timeframe in which windows of intervention are possible, but only based on the calculative model employed, which by its own merits fails to look beyond solely economic projections of the future.

The ways in which dominant interests designed the project externalized costs not only into the future but also onto unwitting customers. Furthermore, it also dictated the duration of the project: namely for as long as it would serve the interests of the shareholders. As the perception of the future was thus entirely described in financial terms, the project's time horizon disregarded considerations of the future beyond the logic of financial calculus. Crucially, in this way financial interests foreclosed long-term sustainability dynamics, thereby side-stepping considerations of climate change and potential flooding during the project setup and instead shifting their resolution onto future generations. As alternative technologies such as sustainable urban drainage systems (SUDS)—which would have been much more attractive in this regard—are less easily financialized, they were hardly considered as options in the largely investor-driven process. This correlation not only points to a general weakness concerning the financialization of climate change in the urban realm, it also highlights the discrepancies between the time horizons of financial actors and those of the general public (Clean Thames Now and Always 2017). This skewing effect of economically defined

long-term expectations and modeling mechanisms of the future is a fourth critical characteristic of the temporal impacts of financialization. In the present case, this is evident in the ways in which finance informs decision making about the future through current strategies of profit maximization.

The project construction phase began in 2016 and is to conclude in 2023. Projections made about the scheme were quickly outdated, putting the overall rationale of the project in question: The Thames Tideway Strategic Study of 2006 calculated the capital cost as £1.7 bn, projecting economic benefits of £3–5 bn. As Blaiklock notes, 'this presented the best answer to the problem within the technologies available *at the time* [emphasis added]'; however, 'by 2012 it had become clear that TW could not fund TTT from its own resources, unless it strengthened its balance sheet by issuing more capital' (Blaiklock 2017, 9–10), an option rejected by TW. In 2016, Prof. Chris Binnie, former chairman of the Thames Tideway Strategic Study, argued that 'TTT was arguable not now needed.' As the UK Government now emphasizes SUDS under the Flood and Water Management Act 2010, TTT appears to become redundant a decade after its projected completion date (Blaiklock 2017, 10). This quick change of calculus provides a crude demonstration of how the logic of financial modeling that set the stage for the project obscures not only its long-term pricing uncertainty (falsely suggesting that future costs would be calculable), but also the possibility of finding alternative solutions.

Similarly, critics point out that differing amounts of resources have been allocated to researching potential alternative strategies and note the lack of any updated research since the initial study; and that uncomfortable, independently derived insights that question the need for the project as a whole have been brushed aside (Thames Blue Green Economy 2016; Blaiklock 2017). As this critique coincided with the notice of the possible obsolescence of the project in 10–12 years, public debate has recently gained some momentum. It is during these moments that the entire temporal logic of the project and its underlying financial mechanisms are drawn into question. Here, perhaps, the temporalities of the project might come under duress.

This friction between the project's inherent temporalities and those that are defined by external expectations and mechanisms point to a final critical characteristic of the temporal impacts of financialization. The temporalities of financialization are defined by conflicts with, and disruptions to, the continuous reproduction of established temporalities. This is frequently a result of polychronie, the plurality of temporalities and their interactions and conflicts with each other. These disruptions open windows for social change, for instance when protests and political activities align with windows of opportunity during periods of disruption, as this volatile state lends itself to readjustments. To identify and act upon these windows of intervention, it is crucial to (re-)claim public and analytical oversight of the development of such projects.

## Conclusion

Although multiple temporal dynamics are at play within the project, we identified five critical characteristics of the temporal impacts of financialization on—and through—the production of the TTT. *First*, the alignments of opportunities in the 'right' or 'critical' moment as a staging point for the expansion of financialization, here, for instance, in the push for large-scale financialized projects; *second*, the pre-emptive extraction of profits for future services from London's inhabitants; *third*, the quality/ability of finance to pre-structure further temporalities, for instance those of regulatory models; *fourth*, the ways in which finance defines expectations of the future; and

*finally*, moments of friction and disruption between different temporalities. These critical characteristics provide a stepping-stone towards a better understanding of the temporal impacts of financialization. In jointly considering these temporal characteristics, our conclusion draws wider insights from the analytic proposition of this Special Feature and explores the infrastructural qualities of the outlined temporal dynamics. These dynamics act together in polychronie. Like any infrastructure, this polychronie creates and maintains habits by establishing and reinforcing patterns, yet as it forecloses certain pathways, it also creates openings.

In pointing to moments of closure, the inherent logic of finance dictates the preference of large-scale, ring-fenceable technocratic measures involving only limited interactions with existing urban infrastructures, which during the project initiation phase skew public oversight and tend to be presented as the only feasible solution. This is the critical phase for intervention, since obligations are put in place and resources committed once the financial framework is settled. Akin to a large container ship, it is at this point that the project builds its momentum and sets its course. Once actors publicly and politically commit to the project and vest their interests 'on board,' the tanker's inertia builds up to a critical level, and even major interventions may only result in minor corrections to its course, as committed financial and political resources form a sort of inert obduracy that hinders rapid interventions. These closures are hugely consequential for the citizens of London, who not only bear the costs and inconveniences of the construction phase, but also the long-term burden of the problems that the project—through its narrow scope and both its financial and physical design—is unable to resolve. While some project costs—such as the climate costs of the construction project—are externalized into the future, other costs, such as the construction costs of the project are paid in the here and now—although the promised benefits for the public (if any) are only expected at a later date. In both cases, the question of who bears the costs is obscured by opaque structures that shift the future liability from private investors to the public. Risk-averse investors maintain control over their future, while the future of the tax- and utility payer is put at risk through government taking on the ultimate financial responsibility for the project, as public utilities are often monopolies that are considered 'too big to fail'. Moreover, considering the question of sustainability and the effects of climate change for London, the question of flooding and the lack of added benefits come to the fore. Long-term obligations and constraints, imposed on the city in order to fulfill TW's needs for cost optimization, severely restrict public oversight and future room for maneuver.

The mechanisms outlined illustrate the immense political power with which finance permeates urban temporalities, and raise major questions: on the one hand, how to reclaim the power necessary to define the contemporary rhythms of the city; and on the other, how to generate a political voice for future generations. A higher degree of transparency and accountability are certainly part of the solution, as well as the political representation of those who actually bear the costs of today's commitments. Temporal conflicts between states, citizens and private corporate actors illustrate how states and citizens have lost a certain amount of temporal authority (echoing Hope 2010). In this regard, financialization seemingly depoliticizes the process of urban infrastructure provision, as it constantly curtails the realm of influence that the public still holds over its utilities. This exemplifies how the social construction of time is negotiated within the city and how boundaries for future populations are put in place.

As Star (1999) noted, infrastructures are always innovated and built upon an existing infrastructural base, which both enables their formation but also constrains their form. In this sense, a description of the

temporal dynamics, solely focused on the increasing power of finance to define notions of time, falls short of portraying how the intricacies of financialized temporalities make space for openings. In particular, intersecting temporal dynamics provide windows for interventions; for example as poor governance practices are questioned in accordance with election cycles—particularly when they coincide, for instance, with times of financial turmoil. As we are witnessing a certain fatigue following failed privatizations and the longer-term fallout from such deals, as well as a changing political climate toward less liberal policies, the recommunalization of urban infrastructure assets might inspire cities across continental Europe (Beveridge and Naumann 2014). To be sure, in the case of the TTT, the window of opportunity that opened up with the concurrence of a wider awareness of its production and the news of its possible redundancy, did not (yet) result in changes of the project. However, more could be learned from analyzing the temporalities of more successful struggles against financialization. Consider, for instance, recent efforts of Berliners to reverse the privatization and financialization of the city's rental housing sector (Uffer 2014). In the past years, longstanding struggles of social movements to contest housing financialization have concurred with the election of a centre-left coalition and the increasing frustration of a majority of Berliners with the city's rising rents to facilitate the establishment of a rent cap and put a halt to the extraction of financial profits from the city's housing stock (*Guardian*, October 22, 2019). Thereby, the temporal infrastructure of election cycles, the routine work of bureaucracies and the long tradition of housing protest came together in ways that opened a window of opportunity to enact political change. In sum, these moments of openings and closures expose how polychronous temporalities add up to more than just the sum of their parts: they constitute an infrastructure of urban time, in which financilization need not play the dominant part.

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## Notes

1 Projected cost at the time of writing.
2 The spillovers tend to occur when minimal rainfall is channeled into the sewer system by London's impervious surfaces. Construction is ongoing and the total cost is estimated at £4.2 billion.
3 Published in 2005, it concludes that out of the four possible strategies of (1) adoption of source control and sustainable urban drainage; (2) separation of foul and surface drainage and local storage; (3) screening, storage, or treatment at the discharge point to river; and (4) in-river treatment, only the third option would be able to achieve the environmental objectives.
4 However, politicians such as Boris Johnson (then Mayor of London) did not shy away from capitalizing on positive publicity associated with ribbon-cutting ceremonies such as that at the Lee Tunnel in 2016.
5 This is most apparent in TW's highly leveraged balance sheet, with an 80/20 debt-to-equity ratio, increasingly exposing the company to market volatility and shareholder interests.
6 An important aspect of this model is the discrepancy between Ofwat's cost of capital calculations vis-à-vis TW's own calculations, which assume a higher level of debt, thus benefiting their profits. Moreover, the RAB model creates flawed funding commitments that introduce financial inefficiencies by failing to provide the whole project funding at the onset of construction. The model also fails to evaluate issues beyond the horizon of bond finance, as impacts relating to environmental, climatic and social dynamics are not considered.

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## References


Aalbers, M. B. 2017. "The Variegated Financialization of Housing." *International Journal of Urban and Regional Research* 41 (4): 542–554.

Aalbers, M. B., and A. Haila. 2018. "A Conversation About Land Rent, Financialisation and Housing." *Urban Studies* 55 (8): 1821–1835.

Adam, B. 1994. "Perceptions of Time." In *Companion Encyclopedia of Anthropology*, edited by T. Ingold, 503–526. Oxon: Routledge.

Adam, B. 2007. "Foreword." In *24/7: Time and Temporality in the Network Society*, edited by R. Hassan, and R. E. Purser, ix–xi. Stanford: Stanford Business Books.

Allen, J., and M. Pryke. 2013. "Financialising Household Water: Thames Water, MEIF, and 'Ring-Fenced' Politics." *Cambridge Journal of Regions, Economy and Society* 6 (3): 419–439.

Angelo, H., and C. Calhoun. 2013. "Infrastructures of the Social: An Invitation to Infrastructural Sociology." Unpublished Manuscript.

Angelo, H., and C. Hentschel. 2015. "Interactions with Infrastructure as Windows into Social Worlds: A Method for Critical Urban Studies: Introduction." *City* 19 (2–3): 306–312.

Arnoldi, J. 2004. "Derivatives: Virtual Values and Real Risks." *Theory, Culture and Society* 21 (6): 23–42.

Ashton, P., M. Doussard, and R. Weber. [2014] 2016. "Reconstituting the State: City Powers and Exposures in Chicago's Infrastructure Leases." *Urban Studies* 53 (7): 1384–1400. First published online May 16, 2014.

Barak, O. 2013. *On Time: Technology and Temporality in Modern Egypt*. Berkeley: University of California Press.

Bear, L. 2011. "Making a River of Gold: Speculative State Planning, Informality, and Neoliberal Governance on the Hooghly." *Focaal* 61: 46–60.

Beveridge, R., and M. Naumann. 2014. "The Berlin Water Company. From 'Inevitable' Privatization to 'Impossible' Remunicipalization." In *The Berlin Reader. A Compendium on Urban Change and Activism*, edited by M. Bernt, B. Grell, and A. Holm, 189–203. Bielefeld: Transcript.

Bitterer, N., and S. Heeg. 2012. "Implementing Transparency in an Eastern European Office Market: Preparing Warsaw for Global Investments." *Articulo – Journal of Urban Research* (9). doi:10.4000/articulo.2139.

Blaiklock, T. M. 2017. *Thames Water, the Thames Tideway Tunnel: Regulatory Weaknesses Lack of Transparency: A Flawed Project Structure and Conflicts of Interest*. Private document provided by the author 12.2017.

Bojadžijev, M. 2015. "Housing, Financialization, and Migration in the Current Global Crisis: An Ethnographically Informed View from Berlin." *South Atlantic Quarterly* 114 (1): 29–45.

Castells, M. 2010. "Globalisation, Networking, Urbanisation: Reflections on the Spatial Dynamics of the Information Age." *Urban Studies* 47 (13): 2737–2745.

Christophers, B. 2012. "Anaemic Geographies of Financialisation." *New Political Economy* 17 (3): 271–291.

Clark, E., H. G. Larsen, and A. L. Hansen. 2015. "Financialisation of Built Environments: A Literature Review." *FESSUD Working Paper Series* 114.

Clean Thames Now and Always. 2017. "Green Infrastructure vs. the Thames Tideway Tunnel." Accessed November 16, 2017. http://cleanthames.org/the-controversy/in-pictures/.

Colomb, C. 2012. *Staging the New Berlin: Place Marketing and the Politics of Urban Reinvention Post-1989*. London: Routledge.

Cresswell, T. 2004. *Place: A Short Introduction*. Malden, MA: Blackwell.

David, L., and L. Halbert. 2014. "Finance Capital, Actor-Network Theory and the Struggle Over Calculative Agencies in the Business Property Markets of Mexico City Metropolitan Region." *Regional Studies* 48 (3): 516–529.

Elias, N. 1992. *An Essay on Time. Vol. 9 of The Collected Works of Norbert Elias*. Revised ed. Dubin: University College Dublin Press.

Epstein, G. A., ed. 2005. *Financialization and the World Economy*. Cheltenham: Edward Elgar Publishing.

Fabian, J. 2002. *Time and the Other: How Anthropology Makes its Object*. New ed. New York: Columbia University Press.

Fields, D., and S. Uffer. 2016. "The Financialisation of Rental Housing: A Comparative Analysis of New York City and Berlin." *Urban Studies* 53 (7): 1486–1502.

French, S., and J. Kneale. 2009. "Excessive Financialisation: Insuring Lifestyles, Enlivening Subjects, and Everyday Spaces of Biosocial Excess." *Environment and Planning D: Society and Space* 27 (6): 1030–1053.

Froud, J., C. Haslam, S. Johal, and K. Williams. 2000. "Shareholder Value and Financialization: Consultancy Promises, Management Moves." *Economy and Society* 29 (1): 80–110.

García-Lamarca, M., and M. Kaika. 2016. "'Mortgaged Lives': The Biopolitics of Debt and Housing Financialisation." *Transactions of the Institute of British Geographers* 41 (3): 313–327.

Graham, S., and N. Thrift. 2007. "Out of Order: Understanding Repair and Maintenance." *Theory, Culture and Society* 24 (3): 1–25.

Hägerstrand, T. 1978. "Survival and Arena: On the Life History of Individuals in Relation to Their Geographical Environment." In *Human Activity and Time Geography*, edited by T. Carlstein, D. Parkes, and N. Thrift, 122–145. London: Edward Arnold.

Hardin, C. J. F. 2014. "Neoliberal Temporality. Time-Sense and the Shift from Pensions to 401(k)s." *American Quarterly* 66 (1): 95–118.
Harvey, D. 2003. *The New Imperialism*. London: Oxford University Press.
Harvey, D. 2008. *The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change*. Reprint, Malden, MA: Blackwell.
Heeg, S. 2013. "Wohnungen als Finanzanlage: Auswirkungen von Responsibilisierung und Finanzialisierung im Bereich des Wohnens." *Sub\Urban. Zeitschrift für Kritische Stadtforschung* 1 (1): 75–99.
Hope, W. 2006. "Global Capitalism and the Critique of Real Time." *Time and Society* 15 (2–3): 275–302.
Hope, W. 2010. "Global Financial Crisis | Time, Communication and Financial Collapse." *International Journal of Communication* 4: 641–669.
Hope, W. 2011. "Crisis of Temporalities: Global Capitalism After the 2007–08 Financial Collapse." *Time and Society* 20 (1): 94–118.
Kaika, M., and L. Ruggiero. 2016. "Land Financialization as a 'Lived' Process: The Transformation of Milan's Bicocca by Pirelli." *European Urban and Regional Studies* 23 (1): 3–22.
Keightley, E. 2012. "Conclusion: Making Time – The Social Temporalities of Mediated Experience." In *Time, Media and Modernity*, edited by E. Keightley, 201–233. London: Palgrave Macmillan.
Kloeckner, C., and S. Mueller. 2018. "Financial Times: Competing Temporalities in the Age of Finance Capitalism." *Finance and Society* 4 (1): 1–14.
LiPuma, E. 2017. *The Social Life of Financial Derivatives. Markets, Risk, and Time*. Durham: Duke University Press.
Loftus, A., and H. March. 2016. "Financializing Desalination: Rethinking the Returns of Big Infrastructure." *International Journal of Urban and Regional Research* 40: 46–61.
Loftus, A., and H. March. 2019. "Integrating What and for Whom? Financialisation and the Thames Tideway Tunnel." *Urban Studies* 56 (11): 2280–2296. doi:10.1177/0042098017736713.
Martin, R. 2002. *Financialization of Daily Life*. Philadelphia: Temple University Press.
Massey, D. 2005. *For Space*. Reprint, London: SAGE.
May, J., and N. Thrift. 2001. *Timespace: Geographies of Temporality*. London: Routledge.
Mieg, H. A. 2005. "Themenheft, Faktor Zeit' Editorial." *Wirtschaftspsychologie* 7 (3): 4–21.
Nowotny, H. 1992. "Time and Social Theory: Towards a Social Theory of Time." *Time and Society* 1 (3): 421–454.
Ogle, V. 2013. "Whose Time Is It? The Pluralization of Time and the Global Condition, 1870s–1940s." *The American Historical Review* 118: 1376–1402.
O'Neill, P. M. 2013. "The Financialisation of Infrastructure: The Role of Categorisation and Property Relations." *Cambridge Journal of Regions, Economy and Society* 6 (3): 441–454.
Orpana, S. 2017. "Freedom 2044? The Temporality of Financialization and Scenario Planning in Looper." In *Time, Globalization and Human Experience: Interdisciplinary Explorations*, edited by P. Huebener, S. O'Brien, T. Porter, L. Stockdale, and Y. R. Zhou, 68–87. London: Routledge.
Pike, A. 2006. "'Shareholder Value' Versus the Regions: The Closure of the Vaux Brewery in Sunderland." *Journal of Economic Geography* 6 (2): 201–222.
Riles, A. 2004. "Real Time: Unwinding Technocratic and Anthropological Knowledge." *American Ethnologist* 31 (3): 392–405.
Riles, A. 2011. *Collateral Knowledge. Legal Reasoning in the Global Financial Markets*. Chicago: University of Chicago Press.
Rutland, T. 2010. "The Financialization of Urban Redevelopment." *Geography Compass* 4 (8): 1167–1178.
Sassen, S. 1991. *The Global City: New York, London, Tokyo*. Princeton, NJ: Princeton University Press.
Savini, F., and M. B. Aalbers. 2016. "The De-Contextualisation of Land Use Planning Through Financialisation: Urban Redevelopment in Milan." *European Urban and Regional Studies* 23 (4): 878–894.
Sayer, A. 2005. *The Moral Significance of Class*. London: Cambridge University Press.
Searle, L. G. 2016. *Landscapes of Accumulation. Real Estate and the Neoliberal Imagination in Contemporary India*. Chicago, IL: The University of Chicago Press (South Asia across the disciplines).
Star, S. L. 1999. "The Ethnography of Infrastructure." *American Behavioral Scientist* 43 (3): 377–391.
Star, S. L., and K. Ruhleder. 1996. "Steps Toward an Ecology of Infrastructure: Design and Access for Large Information Spaces." *Information Systems Research* 7 (1): 111–134.
Stern, J. 2014. "The Role of the Regulatory Asset Base as an Instrument of Regulatory Commitment." *European Networks Law and Regulation Quarterly* 2 (1): 15–27.
TBGE (Thames Blue Green Economy). 2016. "The Case Against the Thames Tideway Tunnel." Accessed December 15, 2017. http://www.bluegreenuk.com/freewater/tbge/References/The%20case%20against%20the%20Thames%20Tideway%20Tunnel.pdf
Thompson, E. P. 1967. "Time, Work-Discipline, and Industrial Capitalism." *Past and Present* 38 (1): 56–97.
Torrance, M. I. 2008. "Forging Glocal Governance? Urban Infrastructures as Networked Financial Products." *International Journal of Urban and Regional Research* 32 (1): 1–21.
Uffer, S. 2014. "The Uneven Development of Berlin's Housing Provision Institutional Investment and Its Consequences on the City and Its Tenants." In *The Berlin Reader: A Compendium on Urban Change and*

*Activism*, edited by M. Bernt, B. Grell, and A. Holm, 155–170. Bielefeld: transcript Verlag.

Urry, J. 2000. *Sociology Beyond Societies: Mobilities for the Twenty-First Century*. London: Routledge.

Wajcman, J. 2008. "Life in the Fast Lane? Towards a Sociology of Technology and Time." *The British Journal of Sociology* 59 (1): 59–77.

Weber, R. 2010. "Selling City Futures: The Financialization of Urban Redevelopment Policy." *Economic Geography* 86 (3): 251–274.

Weber, R. 2015. *From Boom to Bubble: How Finance Built the New Chicago*. Chicago: University of Chicago Press.

Wijburg, G., and M. B. Aalbers. 2017. "The Internationalization of Commercial Real Estate Markets in France and Germany." *Competition and Change* 21 (4): 301–320.

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**Third Publication**

# Finance, water infrastructure, and the city: comparing impacts of financialization in London and Mumbai

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# Finance, water infrastructure, and the city: comparing impacts of financialization in London and Mumbai

Fritz-Julius Grafe

**ABSTRACT**

This paper examines how financialization changes the financial ecologies of urban water infrastructure provision, and the consequences of these impacts. It begins by illustrating the current state of research on the financialization of infrastructure, and then details the method for contributing towards this literature. A comparative approach, based on the financial ecologies of urban infrastructure, is introduced and explained. The changing financial ecologies of London (UK) and Mumbai (India) are presented by means of a twin approach that examines, on the one hand, new state-level initiatives that introduce municipal bonds into their respective countries, and, on the other, highly individualized financial constructs that aim to enable similar, large water infrastructure projects in the two cities. The findings include the importance of local knowledge and the expertise needed to translate these knowledges/risks between actors in the financial ecology. Faults in these processes lead to compromised decision-making, which is largely enabled by weak oversight. Closer scrutiny and more transparent tendering processes are recommended as policy tools to overcome these shortcomings.

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## INTRODUCTION

> financial markets were supposed to dovetail the underlying commodity markets, but today the tail wags the dog. (K. N. Vaidyanathan, Senior Fellow, Geoeconomic Studies, Gateway House; Gateway House: Indian Counsel on Global Relations, 2018)

The continuously increasing significance of the finance sector within the global economy has had direct consequences for cities across the world. Subprime mortgages, real estate investment trusts and tax increment financing are just some of the ways by which our cities have become subject to what we now commonly refer to as 'financialization'. These practices have resulted in an accumulation not just of economic power, but also of social and political impacts that reshape our society.

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Today, these impacts are not yet fully understood because they affect the urban on multiple levels and differing timescales. Furthermore, the resulting effects vary across locations and contexts.

This paper makes the argument that these effects are magnified when examining infrastructures, as they are at the nexus between epistemological narratives of economic growth, urbanization and financial practices. Infrastructures define the use of urban space, they enable modern societies while at the same time they create constrains and division (cf. Angelo & Calhoun, 2013). According to Stephen Graham, infrastructures, in the urban context specifically: 'are at the heart of the ways in which cities act as the main centers of wealth creation and capital accumulation through extending their control and appropriation of labor power and of resources over distant territories, people and ecosystems' (Graham, 2010, p. 4). Thus, they are not only crucial to the economic impacts on urban development but also to society–environment relations as a whole.

In this regard and bearing in mind the close entwinement of the human metabolism with water, it could be argued that water infrastructure is one of the central prerequisites for the urban, spanning a rich history from river use to aqueducts to desalination plants. These Infrastructures are often invisible in the Global North, whereas in the Global South they are frequently objects of contestation. Both the visible and invisible domains are charged with a turmoil of power relations. The politics associated with water infrastructures reach from international resource conflicts to the micropolitics of managing access to a single public water tap (Graham et al., 2013). Since much of the aging water infrastructure in the Global North is in a dilapidated condition, and much in the Global South is yet to be built, the question of finance, for both construction and maintenance, is central for the futures of billions of urban dwellers.

This paper aims to answer the question of how financialization changes the financial ecologies of urban water infrastructure provision, and what the consequences of these impacts are. To understand better the patterns and dynamics of this process, it adopts a comparative approach, contrasting the evolving financial ecologies of water infrastructure provision in London and Mumbai. It aims to expose how the financialization of water infrastructure changes the relationships between key actors in the ecology, and how the role of local knowledge and its translation into different social contexts are central to this process. Understanding this process allows us to show how financialization influences long-term planning and decision-making and thus affects the capacity of our cities to adapt to future challenges.

## FINANCIALIZATION OF INFRASTRUCTURE

Financialization at its most basic is commonly defined as 'the increasing role of financial motives, financial markets, financial actors and financial institutions in the operation of domestic and international economies' (Epstein, 2005, p. 3). The debate around the increasing financialization of cities has been discussed within the literature from several perspectives in recent years. Arguably, the concept of financialization first entered the urban discourse in the guise of David Harvey's spatial fix (Christophers, 2010, 2012; Harvey, 2006) and from there came into its own by application to a wide range of issues concerning the particular urban effects of financialization (Aalbers, 2017; Clark et al., 2015; French et al., 2011; Heeg, 2013; Leyshon & Thrift, 2007; Rutland, 2010; Savini & Aalbers, 2016). Perspectives include the financialization of urban development in terms of land (e.g., Kaika & Ruggiero, 2016), housing (e.g., Aalbers, 2017), redevelopment processes (Rutland, 2010; Weber, 2010), as well as urban infrastructure (O'Neill, 2013; Torrance, 2008).

This paper is particularly interested in the financialization of infrastructure. Adapting the definition of financialization to the urban context, we identify the increasing significance of financial institutions, an increasingly shareholder-oriented form of corporate governance, a more market-based capital supply and ongoing financial innovation as key characteristics (Rutland, 2010). In terms of financialization of infrastructure, the literature discusses these

characteristics with varying emphasis and outlines distinct differences from other processes of financialization in cities.

The growing power of financial institutions is marked foremost by increasing significance of specialized infrastructure investment funds and their particular modes of operation. Groups such as the Macquarie Group, Brookfield Asset Management and Global Infrastructure Partners are the established actors in this field, with institutions such as BlackRock and IFM constantly expanding their operations in the infrastructure sector (cf. Infrastructure Investor, 2018). Allen and Pryke (2013) emphasize the significance of Macquarie Group's model of infrastructure financing during their ownership of Thames Water and the resulting overleveraged balance sheet that overshadows future infrastructure investments (Loftus & March, 2017). From an institutional perspective, O'Neill (2013) emphasizes the remaining importance of the state (in its role as a guarantor of property rights) as a prerequisite for often legally complex infrastructure issues.

The importance of the shareholder value dimension is especially significant in the literature, as this shifts the focus from an asset's use-value towards its exchange value, completely changing the valuation process (cf. Callon, 1998). This shift towards a shareholder-oriented process can lead to compromised decision-making and externalization of costs into the future (Loftus & March, 2017). Furthermore, it often frames the interactions between regulator and operator and the viability of any regulatory mechanisms (Grafe & Hilbrandt, 2019). Appel & Kumar (2015) outline the wider dynamic between a prevalent epistemology of economic growth and the rise of infrastructure finance.

The changing landscape of capital supply for infrastructure provision, from either state- or bank-based sources to more market-oriented approaches, has been largely driven by austerity policies in the wake of the 2008 financial crisis and the ongoing liberalization of economies. O'Brien and Pike (2015) explore this dynamic in the context of UK City Deals and outline the difficult nexus of local capacities, state involvement and risk assessment. The consequences of market-based capital sourcing again become apparent when re-engineered balance sheets resulted in overleveraged entities that became constrained by their debt burdens (Grafe & Hilbrandt, 2019). Ahlers and Merme (2016) explore the effects of financialization on the water sector and outline the undemocratic tendencies of such processes and their potential impacts on social–ecological landscapes.

The infrastructure sector is subject to ongoing financial expansion and innovation. Securitization is expanding and pushing into all aspects of urban infrastructure. Municipal bonds are being introduced worldwide as novel mechanisms for financing infrastructure projects (Grafe & Mieg, 2019), and localized individualized financial constructs employ complex tax optimization structures that often foray into grey areas of international tax law (Grafe & Hilbrandt, 2019). Allen and Pryke (2013) explore the consequences of ring-fencing in the water sector and outline their effect on customers' bills.

Underlying these discussions of financialization is the ongoing debate on the significance of local knowledge for anchoring global financial capital in particular places. Most of these discussions centre around real estate development, such as Clark and O'Connor's (1997) discussion of mortgage-backed securities and the importance of local knowledge in the primary market as opposed to the securitized secondary market. Wood (2004) further emphasizes the role of local knowledge vis-à-vis globalized property finance, in its capacity to navigate local complexities such as political and administrative barriers. More recently, Halbert and Rouanet (2014) discussed the particular processes by which transcalar territorial networks translate local knowledge towards foreign investor expectations and thus filter the risks that would otherwise prevent the landing of global financial capital in Bangalore. They emphasize that, when actors 'collect data, unravel legal issues or shape representations of the new city, they invariably translate FFI's [foreign finance investors] expectations into the urban built environment' (p. 11). Local

knowledge and its translation thus play a central role in the anchoring of global financial capital in places with varying cultural practices and contexts.

In sum, the literature shows that the financialization of infrastructure is largely defined by a city's flows, enabled by their infrastructures and the financial sector's desire to securitize these revenue streams. O'Neill (2018) concludes that the capital, organizational and regulatory structures of particular projects are the key dimensions through which financialization takes hold of urban infrastructure and imposes its logic on their underlying flows.

## METHOD

The paper builds on structured document analysis and recursive abstraction of 297 legislative and planning documents, reports, public statements and media coverage from the period 2001–18. The analysis is focused on documents that discuss financial markets and infrastructure in the given ecologies. The data were analysed in detail regarding the effects of financialization of urban infrastructure in order to identify patterns and conflicts and derive analytical categories thereof. Based on these categories, the material was re-examined to test observer impressions. This document analysis was supplemented with 22 expert interviews conducted between 2015 and 2018.

Recent developments in comparative urbanism offer new means for theory generation that are both regionally embedded and sophisticated enough to allow for theoretical abstraction. The works of Jennifer Robinson (Robinson, 2011, 2014) and Colin McFarlane (McFarlane, 2006, 2010) set an agenda that aims to eliminate the parochialism of urban theory by overcoming the North–South divide in theory generation as well as emphasizing urban experiences that go beyond economic indicators. This allows analysis of the impacts of finance –infrastructure dynamics found not only in cites dominated by formal economies and fixed built environments, but also in those shaped by an informal economy. The latter will allow insights into how finance has the potential to affect the majority of present and future urban dwellers. Central to this methodology is selecting appropriate units of comparison that avoid territorial definitions of the city, thereby allowing the inclusions of networks and flows within the analysis. The units of comparison in this particular case are the two financial ecologies of water infrastructure provision in London and Mumbai; this includes their spatial configurations, stakeholders and connections. With these units of comparison defined, appropriate methods of data generation are applied.

In this paper, the units of comparison are conceptualized as the *financial ecologies of urban infrastructure*. A more detailed discussion of the benefits of using financial ecologies as a method can be found in a previous issue of this journal (cf. Grafe & Mieg, 2019). To summarize: the concept of ecologies is picked up in several papers examining the finance–infrastructure nexus (French et al., 2011; Monstadt, 2009; Swyngedouw, 2009), where it is important to note that ecology in these works mostly refers to Abbott's (2005) understanding of the term, where he contends that "'Ecology" … names a social structure that is less unified than a machine or an organism, but that is considerably more unified than is a social world made up of the autonomous, atomic beings of classical liberalism' (p. 248). In Abbott's conception, three main components make up these ecologies: their respective actors, their locations, and their associating relations. Interlinkages of these ecologies can be formed via 'hinges'; that is, a strategy that provides results to allies in other linked ecologies and 'avatars,' which are considered a colony from one ecology within another (pp. 245–255).

This concept will be the basis for the comparison, as it will help to delineate the financial ecologies of urban infrastructure in the two cities. This will enable us to compare the particular arrangements of actors, locations and relations with their individual subjectivities, knowledges and practices intact. It also facilitates linking these local configurations to the financial system, and reveals how financialization interacts with the development, governance, and maintenance of urban infrastructures. One of the benefits of this approach is a more nuanced understanding

of the impacts of financialization on cities, as it looks beyond the built environment as an empirical surface for the anchoring of global financial capital (cf. Grafe & Mieg, 2019).

Furthermore, within each city a twin approach will be applied, initially examining new state-level initiatives that introduce municipal bonds to their respective countries. This is done to understand the trajectories of national financialization initiatives within the ecologies, and how these state programs reshape their configurations. Second, highly individualized financial constructs that aim to enable similar large water infrastructure projects will be examined. This outlines how the private sector extends the financialization of urban water infrastructure and how these individual practices affect the ecologies. Together, these two dynamics represent the key changes currently affecting the financial ecologies of urban infrastructure provision. They portray changing processes across different scales and exemplify how a financial ecology's configuration becomes altered, resulting in both immediate local impacts and long-term structural changes.

## FINANCIAL ECOLOGY: LONDON

The financialization of infrastructure provision in the UK is a wide and varied subject; we will focus here on two key aspects that define the evolving financial ecology of urban infrastructure: the first is the attempt to introduce municipal bonds as a new measure to finance infrastructure projects under austerity policies, whereas the second examines a 'tailor-made' project finance construct, by example of London's Thames Tideway Tunnel.

### The financial ecology

As mentioned previously, the financial ecology of urban infrastructure provision is first and foremost defined by its set of actors, their relative locations and their respective relations. These form the core of the financial ecology which is then in turn linked to other relevant ecologies.

The financial ecology of urban infrastructure provision in the UK is defined by two core dynamics: first, the fallout from the wave of privatizations in the water sector since the late 1980s, and ongoing austerity policies as a consequence of the 2008 financial crisis. This climate is exacerbated by a financial climate of uncertainty due to ongoing and convoluted Brexit process. It is in this unfavourable economic climate in which the Public Works Loan Board (PWLB) is primarily responsible for providing capital for infrastructure development. As a consequence, public–private partnerships by means of private finance initiatives have become a common mechanism for realizing the most pressing projects. The public is largely unaware of these dynamics, except in cases of breakdown and environmental degradation, which for investors and politicians often eases the process of greenlighting potentially contentious projects. Knowledge of and about the infrastructures is mostly well kept by responsible institutions, and officials and engineers often consider themselves members of a long and well-established tradition of public engineering.

The following section describes this ecology in more detail by exploring the two aforementioned angles that illustrate its changing dynamics.

### The UK and the introduction of municipal bonds

Municipal bonds find their way into the ecology of UK infrastructure finance as a direct consequence of the 2008 financial crisis, after which they were introduced as a measure to reduce government spending in the face of austerity politics. In a climate of tight public budgeting, semi-successful public–private partnerships, rising interest rates for infrastructure projects, and the fallout of widespread privatizations of public assets since the late 1980s, municipal bonds are intended as a tool to empower municipalities to access new sources of capital for public works.

Institutionally, the municipal debt market was initiated by the founding of a national Municipal Bonds Agency (UKMBA) in 2014 (LGA, 2014), effectively establishing an avatar of the

financial industry in the ecology of urban infrastructure provision (cf. Grafe & Mieg, 2019). The UKMBA is owned by local councils and the Local Government Association. Within this ecology, as a parallel structure to the PWLB, the UKMBA considers its main aim to be the provision of loans at lower interest rates than those provided by the former. Municipal bonds are the financial asset intended to fulfil this function, which will largely depend on legal and financial mechanisms such as the pooling of borrowing requirements and a formalized credit assessment process (UKMBA, 2015). Furthermore, the agency provides services such as facilitating inter-council borrowing and the provision of expertise to councils during negotiations with lenders.

The success of the UKMBA so far is muted. Comparatively few local authorities have joined the agency and the first bonds are yet to be issued. Comments such as that only 'first class, highly rated councils' can participate, as well as improving interest rates at the PWLB, have held back the establishment of a successful bond market thus far (Public Finance, 2016, p. 1). Furthermore, the complexities of the legal and administrative challenges in fulfilling these functions have been widely underestimated. This situation is further emphasized by the fact that the task of assessing and translating risk and credit quality is also problematic when only few ratings have been made public thus far. All this leads to a certain level of hesitancy on the part of investors, which has stunted the progress of municipal bond markets in the UK.

The financial ecology is, however, fundamentally changed: the establishment of a parallel structure for infrastructure funding opens the door to new actors and relations, as well as the establishment of a new, permanent avatar. This avatar provides new expertise and practices to the councils, which also help it to engage with financial markets beyond municipal bond projects. The establishment of the municipal bond market is still a political project, which is pushed both by politicians and investors alike, as a means to provide funding for much needed infrastructure projects and to establish new investment opportunities for excess liquidity of long-term investors.

## The Thames Tideway Tunnel and private-sector activities

The advancement of municipal bonds is only one aspect in which financialization takes hold of the financial ecology of infrastructure provision. The second development of note is the emergence of project finance, individual localized often heavily financialized infrastructure projects that develop their own financing schemes, intended to help realize infrastructure projects. A case in point is the development of London's Thames Tideway Tunnel or 'super-sewer', a massive engineering project that aims to stem the discharge of sewage overflows into the River Thames by constructing a 25-km tunnel as a temporary storage facility beneath the river.

The central actor with initial responsibility for this project is Thames Water, which is the 'UK's largest water company, with 13 million customers in the South-East of England, of which just under 9 million rely upon them for their water supply' (Allen & Pryke, 2013, p. 419). It is regulated by Ofwat (the Water Services Regulation Authority), whose main responsibility lies in the negotiation of tariffs every five years based on Thames Water's business plans and Ofwat's internal Regulatory Assets Base Model (RAB). Thames Water was privatized in the early 1990s during a wave of privatizations across the UK and has since undergone several takeovers and restructurings, resulting in lower ratings – mostly due to overleveraging of the underlying assets to finance said takeovers. Many public utilities in Britain that were privatized since the late 1980s were at first listed on the London Stock Exchange, but have since become unlisted and have commonly adapted some sort of offshore structure that further obfuscates transparency (Blaiklock, 2017). Such is the case for Thames Water, which in 2012 had 10 corporate layers between shareholders and the licenced water company, with some subsidiaries taking advantage of tax havens (Thames Water Cayman Island Finance Ltd holds over half of Thames Water's £10 billion long-term debt). Thames Water is ultimately owned by Kemble Water Holdings Ltd, a consortium of international infrastructure and pension funds, while its financial model is principally one of debt refinancing based largely upon the securitization of

household revenue streams (cf. Allen & Pryke, 2013). Blaiklock (2017) states that, contrary to common investment principles, customers pay both during the construction period as well as during service delivery, which essentially transfers the project completion risk from utility to customer. Blaiklock concludes that 'the incentive for contractors to achieve project completion to time and cost is now much diminished, if not eliminated. Furthermore, customers cannot manage, control or mitigate such risks' (p. 4).

Project delivery is to be implemented by Bazalgette Tunnel Ltd (BTL) as an infrastructure provider, a new special-purpose company with an offshore holding structure that keeps the project separate from Thames Water's balance sheets, largely as a consequence of the latter's weak financial position due to still looming acquisition debt. BTL is backed by several long-term investors such as pension funds, Allianz, Amber Infrastructure Group, Dalmore Capital and DIF. A proportion of the project costs is to be passed on to Thames Water's costumer bills, with an estimated £25 added per annum in the mid-2020s. BTL received its operating license from Ofwat in 2015. This establishes a set of relationships between the central actors in this ecology that is largely defined by debt dependencies to external actors.

Outside of this core dynamic, several practices outline the power dynamic between the central actors, the public and academic research. The first of these is the rather uncompetitive tender process, which attracted only two bids. Another controversy is the fierce debate around the Thames Tideway strategic study, where some researchers see the first option of sustainable urban drainage systems (SUDS) as a more feasible and sustainable solution (cf. Clean Thames Now and Always, 2016). This critique is reinforced by the differing levels of resources allocated to researching the four potential strategies, and the lack of any updated research since, as well as the brushing aside of uncomfortable independent insights that question the need for the project as a whole (Blaiklock, 2017). The latter issue is further emphasized by the 2010 Flood and Water Management Act, which now emphasizes SUDS and could cause the tunnel to be redundant in 10–12 years. Another criticism is the explosion of costs to about five times the original estimate, while the debt/equity ratio of Thames Water is criticized for overtly benefitting investors (Blaiklock, 2017). A further critique is that the underlying infrastructure was poorly maintained over the years, and that it would be perfectly capable of managing the discharge volumes if maintained properly (Blaiklock, 2017; Clean Thames Now and Always, 2016). The limited consideration of climate change impacts and long-term developments outside of population growth are also commonly criticized. Loftus and March come to the following conclusion about the efficacy of the Tideway Tunnel and its effects on London:

> Here we find a coalition of institutional investors able to assemble different aspects of London's hydrosocial cycle into a vast machine for making profits. Financial and political interests come to be integrated into an elite fix that will generate returns for the pension funds, insurance companies and sovereign wealth funds now integral to the hydrosocial cycle of the city. Rather than an ambitious project to avoid a polluted Thames, generate clean energy, and build creatively on the challenges of the water–energy nexus, the Thames Tideway Tunnel is a concrete tunnel for extracting rents, a pure financial asset. (Loftus & March, 2017, p. 14)

The project and its set-up thus become a successful hinge for providing results to allies: they extract profits and transfer them to external actors. Drawing together the dynamics of establishing municipal bonds and project finance, we can identify the emerging trajectory for the ecology of urban infrastructure provision in the UK.

## FINANCIAL ECOLOGY: MUMBAI

The financialization of infrastructure provision in India is a more complex subject than the processes at play in the UK. Here, we again employ two key aspects as a lens through which to

explore the evolving financial ecology of urban infrastructure development: the first focuses on the introduction of municipal bonds to finance infrastructure projects in overburdened and underfinanced cities, whereas the second focus again examines an exemplary project that is defined by its individualized financial set-up and resulting complications.

## The financial ecology

The current ecology of water infrastructure provision is defined primarily by a single dynamic: an immense need for infrastructure development in the face of an enormous investment gap. Actors such as the World Bank and Asian Infrastructure Investment Bank (AIIB) aim to fill this gap by injecting foreign currency. The World Bank has been an especially significant player in early efforts to do so, which has not been without controversy and resulted in a shift it its priorities towards privatization (cf. Bakker, 2013). A certain air of expectancy of imminent privatization of water utilities in this period, particularly in Mumbai, paralysed any further investment and expansion of existing systems, resulting in the degradation of infrastructures, regulators, and institutions (cf. Björkman, 2015). Mumbai's ambitions to become a 'world class city' in the image of Singapore have particularly strained the transition from old established systems to newer digital ones, losing crucial expertise and knowledge in the process of a forced transition. It is against this background that the government seeks to enhance its own spending through new avenues for capital generation. The most common practices for infrastructure provision are currently reliant on state funding through initiatives such as the Jawaharlal Nehru National Urban Renewal Mission (2005–12) and, most recently, the Atal Mission for Rejuvenation and Urban Transformation (2015–present) with a focus on public–private partnerships.

Beyond these dynamics, cities are often characterized by political tensions between an emergent middle class and more recent arrivals. Anand (2017) concept of 'hydraulic citizenship' helps unpack practices of unequal distribution – based on particular forms of citizenship, belonging and connection that define to a large degree the public debate around water infrastructure projects. Gandy (2008) discusses this dynamic for the case of Mumbai and gives the wider historical context of the colonial roots of Mumbai's water issues. This sets an important frame for the financial ecology of urban infrastructure development, in which the public plays a much more present and involved role than in the London case. From the perspective of investors, it is the difficulty of evaluating risk and complexity to a satisfying degree that most often deters them from committing to long-term infrastructure projects, especially when comparable but less risky assets such as government bonds are available. This complexity adds up to a playing field in which a plethora of consultants thrive: from engineering to project management to business to finance to non-governmental organizations (NGOs), consultants of all stripes promise to cut through the complexity and get things done. The role of knowledge of and about the existing systems becomes the crucial nexus of interaction between the actors: consultants market the supposedly needed knowledge; citizens blame a supposedly corrupt state apparatus for abusing a perceived knowledge monopoly; investors seek knowledge that translates to their metrics; and public officials struggle to transform local knowledges at all levels into formal, accessible information for all actors.

The following section explores this ecology in more detail by outlining two cases that exemplify current dynamics.

## India and the introduction of municipal bonds

Municipal bonds in themselves are still a relatively new instrument in India, with municipal bonds for infrastructure financing in India originating directly from a United States Agency of International Development (USAID) programme that ran from 1994 to 2010. The Financial Institutions Reform and Expansion Debt (FIRE-D) programme primarily seeks to support the Indian government in strengthening domestic capital markets to expand their capabilities as sources of development finance, with a particular focus on the relationship between debt

markets and infrastructure by emphasizing 'development and financing of commercially viable urban environmental infrastructure projects; by channeling USAID Housing Guaranty funds to selected demonstration cities and states; and through policy advocacy, management support, technical assistance, training and research' (cf. USAID, 1998, p. 4). This first aim, to increase the capacity of India's cities and to raise and allocate financial resources, was tied to the improvement of urban water and sanitation services, with one main strategy being to pursue the establishment of a market-based municipal bonds market in cooperation with national, state and local governments.

Within this framework the first taxable municipal bond was issued in 1997 in Bangalore, followed by the first tax-free municipal bond in 2002 in Ahmedabad. These first issuances were followed by sharp incline in issued bonds until 2005, followed by a decline and end towards 2010 (cf. Chakrabarti, 2014; Vaidya & Vaidya, 2008). This coincides with the lifetime of the FIRE-D programme, under which a total of 25 municipal bonds were issued, mostly for water infrastructures. Valued at a total of US$2 billion through taxable bonds, tax-free bonds and pooled financing, there remains a large unfilled gap compared with the projected urban growth and need for US$835 billion of infrastructure investment (this is roughly half of India's 2012 gross domestic product (GDP), while public expenditure is estimated at only 1.5% of GDP) (cf. Chakrabarti, 2014; Vaidya & Vaidya, 2008). Key dynamics within these projects include the advantageous position of larger municipal corporations vis-à-vis smaller ones by means of higher property tax income and institutional capacities, which still is not enough to overcome low ratings, unclear regulation at different levels and political uncertainty. Smaller municipalities rely on pooled schemes backed by state guarantees, but still suffer from the same factors and resulting investor hesitation.

Sheikh and Asher (2012) distinguish supply- and demand-side problems. On the supply side, fiscally healthy municipalities often become bogged down by statutory obligations, resulting in underspending and an inability to take on debt. This is exacerbated by a lack of revenue sources that could offset potential debt and unpredictability of large government interventions, such as the Jawaharlal Nehru National Urban Renewal Mission, which effectively pushed aside several municipal bond initiatives. Furthermore, a lack of localized expertise leaves municipalities unequipped to engage efficiently with markets. On the demand side, the authors outline general market conditions in India, which are currently unfavourable for municipal bonds, which also often prove to be illiquid assets due to a lack of secondary markets (Sheikh & Asher, 2012). This is further emphasized by a lack of reliable information, as municipalities practice a culture of non-disclosure. Also, there remains confusion on a legal level: regulatory oversight and processing of defaults is convoluted, which results in an overall evaluation of municipal bonds as somewhat risky investments (Vaidya & Vaidya, 2008).

Consequently, the state attempts to resurrect the municipal debt market by issuing new Securities and Exchange Board India (SEBI) regulations, which enable the direct listing on stock exchanges, include further obligations for municipalities to contribute at least 20% of costs, prove a track record of at least three years of positive balance sheets; and improve informational flow from municipalities (SEBI, 2015). This is to result in at least investment-grade bonds.

Politically, municipal bonds remain high on the agenda as a fix to India's infrastructure problems, with Prime Minister Modi himself pushing for their implementation at the inauguration of the National Institute of Securities Markets campus at Patalganga (Modi, 2016):

> You are all aware of the huge capital requirements for improving urban infrastructure. This government has launched an ambitious Smart Cities programme. In this context, I am disappointed that even now, we do not have a municipal bond market. There will be problems and difficulties in creating such a market. But the true test of an expert innovation is when it solves a complex problem. Can SEBI and the Department of Economic Affairs ensure that at least 10 cities in India issue municipal bonds within one year?

## The Mumbai Sewage Disposal Project (MSDP) and private-sector activities

As with the previous case, this section expands the perspective on the financial ecology of infrastructure provision by example of a specific project and an analysis of its particular financialization. The MSDP will provide the case for this analysis, focusing on the latest developments related to MSDP-II. The project is especially relevant for present purposes because it addresses the same issues as the London Tideway project: its main aim is to overcome overwhelming sewage discharges and associated problems by increasing the capacity of the Water Supply and Sanitation Department (WSSD) of the Municipal Corporation of Greater Mumbai (MCGM). MSDP-II is an ambitious effort that includes the construction of two major conveyance tunnels and improvement and construction of seven treatment plants based on projected needs in the year 2025, with an overall cost projection of about US$850 million (cf. Gupta et al., 2017). Furthermore, the overall MSDP project seeks to 'Sustain … the financial viability of the provision of water supply and sewerage services in Brihan Mumbai through direct charges to beneficiaries at appropriate levels' (World Bank, 2004, p. 2).

The selection of a case from Mumbai is especially relevant to the theme of financialization, as the city is India's financial capital, which besides its relative wealth and access to capital faces major problems in overcoming its infrastructural problems. Björkman (2015) explains in great detail how this particular position on the subcontinent resulted in an expectation that the water system would be privatized, thereby paralysing the WSSD for an extended period and substantially contributing to the present precarious state of the city's water infrastructure.

Mumbai's sewage system was created at the height of the British Raj in the late 19th century, with occasional extensions as the city grew. The first efforts to integrate and coordinate the system go back to the 1970s, when the first stage of the MSDP-I project was implemented under the supervision of the World Bank and included MCGM's first master plan for the sewerage system, issued in 1979. This plan divided Mumbai into seven sewerage zones that operate independently with their own treatment facilities. MSDP-I was completed in 2003 (cf. World Bank, 2004). The extension and evolution of this project is referred to as MSDP-II.

The central actor in MSDP-II is the WSSD, which at the behest of the MCGM manages the tendering processes and implementation, while initial finance is provided through Modi's Atal Mission for Rejuvenation and Urban Transformation (AMRUT). AMRUT is a state-level initiative that seeks to boost water infrastructure development in Indian cities by means of public–private partnerships. The AMRUT Guidelines section on financing explicitly suggest a flexible approach in acquiring the overall needed capital, this includes an acknowledgement of the fact that costs should be passed on to the public in the form of different loan mechanisms:

> Different sources of finance have to be identified. At the ULB level [Urban Local Body], the contribution from internal sources (e.g., taxes, fees, others), external sources (e.g., transfers from States, project fund from Central/State Governments, others) and possibilities of debt, bonds and others has to be assessed. The challenge is to motivate citizens to share the additional cost. One way is to take a loan for project funding for a locality and repay the loan through an increase in property taxes for, say, 10 years in that locality only. This is called Tax Increment Financing (TIF). (MOUD, 2015, p. 13)

This sets the stage for the different tendering processes through which the WSSD hopes to implement the different subprojects of the MSDP-II, and the level at which individual projects either come to life or wither. Overwhelmingly, the latter has become the common case, with the 2017 CAG report critically concluding that:

> It was observed that there was no monitoring mechanism in MCGM to ascertain the progress of the implementation of the Master Plan. There was failure of MCGM in awarding any single contract

> after lapse of nine years indicated lack of pursuance of preparatory works such as, resolving land issues, obtaining required statutory clearances from [the Ministry of the Environment and Forests] and finalizing technological/capacity issues of [waste water treatment facilities] etc. MSDP incurred 141.78 crore on designing works and no capital work could be commenced for want of preparatory works. (CAG 2017, pp. 94–95)[1]

A central aspect in this development was the involvement of an international consortium of advisers led by the project management consultancy Mott MacDonald, which struggled to deliver progress on the project in the first nine years, following two extensions of their contract. This resulted in a blame game between consultants and politicians in which the former blame political complications and the absence of environment clearance for the lack of project progress, whereas politicians blame inappropriate advice and the consultants' preoccupation with maximizing their own profits as the key roadblocks (*Mumbai Mirror*, 2018). This resulted in steps to blacklist the consultancy from any further projects in the region. Furthermore, minor projects such as canal works and rescue pit constructions were characterized by financial irregularities, overpayments, cost inflations and faulty designs, resulting in further blacklisting of contractors (CAG, 2017; MCGM, 2018). This situation, together with the major delays, has resulted in underperformance of the infrastructure itself as well as major cost increases, from an estimated Rs2300 crore in 2006 to Rs14,368 crore in 2018 (Pillai, 2018).

After a decade, the Colaba treatment plant is currently the only major work that has made some progress, the tendering process for which began in May 2011 and was finalized in July 2016, following lengthy delays 'due to deviations in design parameters proposed by the PMC [Project Management Consultant]' (CAG, 2017, p. 91). The tender for the plant was awarded to Suez SA, a publicly traded French utility company that generated a revenue of €15.1 billion in 2015. The contract includes design and construction over three years and subsequent operation for 15 years, with projected revenue for Suez of €42 million (Suez, 2016).

## ANALYSIS: A COMPARISON

Having established the respective financial ecologies and their current dynamics in the two cities, we have defined the units of comparison for the comparative analysis (cf. Robinson, 2011). The following section will proceed with their comparative examination, paying particular attention to the configurations of actors within the ecologies as well as their connections linking them to external networks and flows. This eschews territorial definitions of the cities and emphasizes the relational dimension of their financialization.

### The Municipal bond dynamic

As the case of municipal bonds in the UK shows, the introduction of a municipal bond agency establishes a new avatar in the financial ecology of infrastructure provision, whose main objective is the opening up of new sources of capital at lower interest rates (i.e., compared with those offered by the PWLB). In the case of India, the motivation is the same desire for a cheaper source of capital, but the role of the avatar of the financial industry is assumed by the World Bank. Both these institutions assume the role of facilitators who bring investors and cities together through financial innovation. These avatars support municipalities with expertise in accessing financial markets, on the one side, and in translating local complexity into assets the market can evaluate, on the other. Therefore, they have a crucial role in negotiating risk, both financial and political, for both sides. They differ with regard to the amount of power they hold over defining the legal framework for new bonds: As a publicly owned institution, the UKMBA has more leverage on legislative measures to enable mechanisms such as pooled finance schemes, whereas the World Bank as investor and counsellor had only indirect influence in formulating policy. It is important

to note that the World Bank has since withdrawn from this position, which leaves the Indian ecology without a central avatar managing and coordinating the advancement of the municipal bond market. SEBI, the regulator of the Indian securities market, has since assumed some of these responsibilities and pushed regulatory frameworks towards establishing municipal bonds. As mentioned previously, the municipal bonds themselves act as hinges providing results to allies in the financial industry in their respective ecologies. The links they create have the effects of investing capital, extracting profits and introducing new outside interests into the ecology. In both cases, municipal bonds establish new parallel structures within their ecologies, affecting relationships but not yet succeeding in reconfiguring established sets of relations between key actors. As was shown, this is partly dependent on factors that lie outside of the ecology, such as market dynamics and support for the scheme at the national level. Municipal bonds hence propose a semi-fixed model for the capital structure of infrastructure developments; this often proves too inflexible to adapt to the underlying fluidity produced by constant readjustments of the organizational structure, which tries to quantify the often dynamic and contested knowledges on the ground. Within the ecology, the crucial role is assumed by the avatars and their ability to translate risk between parties and actors and establish a common knowledge base on which further practices can be based.

## The project finance dynamic

This structural expansion of the national financial framework for urban infrastructure provision carried out by these new avatars is accompanied by a less centralized processes of financialization that has immense impacts on the financial ecology of urban infrastructure provision, namely the highly individualized financial constructs that enable the largest-scale projects. The following section describes how these affect the financial ecology.

The Tideway case exemplifies how a highly adapted and heavily financialized project framing defines relationships between actors and locations in the financial ecology. The case shows how, in the earliest stages of project planning, financial interests have significant influence on the process of establishing the most viable solution for the problem at hand. First, asymmetric funding of research into viable solutions predefined the preferences for technocratic, large-scale engineering efforts, which are more easily ring-fenced and securitized than decentralized and more environmentally integrated solutions. Furthermore, the project exemplifies widespread conflicts of interest in the rather small world of large-scale infrastructure development and financing, which are often defined by the professional biographies of key actors and their professional networks. All this was exacerbated by a weak tendering process involving only two applications. This exposes an existing power asymmetry in the financial ecology between local political representatives, regulators, academia, service providers, contractors and investors from the start, in which decision-making on the local level is already compromised.

Similarly, Mumbai's ongoing efforts to improve its sewage system show how financialization takes hold of the financial ecology: having failed as an object of privatization, the state actively promotes heavily financialized development of the infrastructure system by pairing the AMRUT funding scheme with ample windows of opportunity for individual financialized solutions. However, the problem within the ecology does not lie with the availabilities of flexible capital structure models, but with the availability, quality and evaluation of knowledge regarding the underlying infrastructure system and resulting plannability for proposed projects. International consultancies are vying to fill this void, but have yet failed to cope with local complexities. Here too, conflicts of interest abounded, ultimately resulting in the blacklisting of multiple contractors. The progress on the Colaba treatment plant exemplifies the preference for large-scale, clearly ring-fenceable projects that have minimal and clearly defined points of interaction with the existing system. An essential point of difference is the much greater public awareness

and scrutiny that go along with any water issues within the city, resulting in even more red flags that deter potential investors.

### The tendering process and regulation

Both cases exemplify the importance of the tendering process in defining relations between actors over the course of the project, as this is the greatest lever on the administrative side to determine the organizational structure of the project. It is the central moment in which the level of financialization and the future configuration of the ecology is determined. Infrastructure investors favour safe, long-term investments that provide a steady revenue stream in order to spread their risk, which incentivizes politicians and administrators to optimize their prospective projects to fit this mould in order to attract investment in projects that might otherwise not be considered viable. The consequences are a regionalization of market risk into the municipalities and often the sidestepping of public debate in order to circumvent potential project hold-ups. Here, the Mumbai case provides a valuable lesson for the global North: the public scrutiny on urban water issues secures a certain level of transparency, that would surely benefit tendering processes in the Global North.

The regulatory structures in both cases further outline the power asymmetry in the ecology: In London's case, the offshore capital structure of Thames Water and its withdrawal from the stock exchange greatly reduce transparency for regulators, while Mumbai's overburdened and disintegrating institutions fail to monitor potential progress that might be made. Furthermore, regulatory measures are largely toothless in face of the fact that these large utilities are 'too big to fail', and that their continued success is in the interest of the regulator even in the face of alleged mismanagement. These financial ecologies of urban infrastructure provision are characterized by a power asymmetry between actors, where, on the one hand, government agencies seek to woo investors to support less attractive projects by providing favourable incentives, while, on the other, investors prefer to cherry-pick, shape and fast-track those projects that best fit their portfolios. In the terms elaborated by O'Neill (2018), these processes significantly influence how the changing financial ecologies redefine the capital, organizational and regulatory structures of urban infrastructure projects.

## DISCUSSION

### Patterns of financialization of urban water infrastructure

In using financial ecologies of urban infrastructure as a tool for comparative analysis of increasingly financialized urban water infrastructures, we can abstract certain patterns that occur in both contexts:

First, local knowledge defines the interactions and power structure between the different actors in the financial ecology. The role of the avatars as translators of these knowledges is a key dynamic in determining the financialization process. It is new financial market expertise that is introduced via the avatars into the ecologies, in which the same avatars then take on the role of evaluating and abstracting local knowledges about water system into quantifiable metrics that set the guidelines for determining what sort of project is viable. It is this constant translation of political, financial, social, and environmental risks into categories that the respective actors can understand and evaluate.

Second, this translation process and resulting informational flow is not equal, transparent, or successful between all actors, which can lead to power asymmetries in the decision-making process, in which particular biases can tilt the project in a preferred direction from its outset. This translation process is particularly compromised in the context of highly individualized financial constructs, as here the connections are more akin to hinges than to fully formed avatars, as they are less clearly defined and not necessarily accessible to all actors. This is one of the main

mechanisms by which water infrastructures become subject to financialization, and both these findings speak directly to the ongoing debates on the importance of local knowledge in anchoring global financial capital, where Halbert and Rouanet's (2014) work in particular provides an excellent point of connection for a more in-depth analysis on how different forms of knowledge are instrumentalized in the financialization of urban infrastructure. It is important to note that the findings presented here emphasize even more the role of local knowledge in the context of urban infrastructure provision, as interaction with existing systems and practices adds several more layers of complexity than those existent in the real estate sector.

Third, the inherent logic of market-based infrastructure provision prioritizes financial risk assessments over political, environmental or social risks, which leads to a bias of actors representing the financial sector towards projects that minimize financial risk. This leads to preferences for large-scale infrastructure projects that are ring-fenceable and have limited and clearly defined points of interaction with the existing water system. This makes it easier to calculate, issue and sell a financial asset that represents the underlying infrastructure. As a consequence, cherry picking of particularly easily securitizable infrastructure projects prevails, and decentralized, highly integrated approaches appear less attractive. This also holds true for the financial asset level, where aggregated infrastructure securities aim to spread risks (e.g., aggregated municipal bond offerings in UK and India) but fail to attract attention in a competitive market. An added factor is the remaining status of a fledgling parallel structure for funding infrastructure, in which risk is also generated by unpredictable state initiatives that could completely upset the market. This third pattern speaks to the two strands of literature, which concern themselves with the increasing significance of shareholder value in decision-making and more general debates on the consequences of market-based capital provision. Findings support both Ahlers and Merme's (2016) analysis, as well as Loftus and March's (2017) contribution and strengthen the argument of compromised decision-making under a predominantly economically biased paradigm of urban infrastructure provision.

Finally, the compromised position of oversight and regulation becomes apparent: financial innovation to securitize revenue streams for the infrastructure sector thrives on obfuscation and lack of transparency, as tax optimization benefits from offshore structures and withdrawal from stock exchanges limits reporting obligations. This is further emphasized by the notion that the infrastructure operators are also largely considered to be 'too big to fail' and are thus subject to the same moral hazard that played a significant role in the past financial crisis. As a result, operators overleverage their assets, as regulators have no political interest in withdrawing licenses and crashing the water system per se. In the long term, this structural asymmetry has dire consequences for the financial ecology's main objective: providing urban water infrastructure. By continuously overemphasizing financial interests and their focus on the exchange value of infrastructures (by means of potential for securitizable revenue streams), their actual use-value and purpose become neglected. This skewed duality introduces immense temporal complexities, where horizons of financial calculus disconnect from the needs for long-term, sustainable infrastructures (Grafe & Hilbrandt, 2019). The findings presented here speak both to Allen and Pryke's (2013) work on ring-fencing in the water infrastructure sector in particular, but also to the more general debate on financial innovations and the causes of financial meltdown in 2008 (cf. Financial Crisis Inquiry Commission, 2011). This nexus of financial innovation beyond oversight, and the resulting risk in geographic terms, is a research area that is still underdeveloped.

## Establishing the ground rules and looking ahead

If we relate these patterns to O'Neill's (2018) dimensions of infrastructure financialization, we realize how capital, organizational and regulatory structures are indeed the central avenues through which financialization progresses; however, we also see that these presuppose the

groundwork of parsing local complexity, establishing secured knowledge and translating it in such a way that it can enable these dimensions to take hold. This dynamic of knowledge and the resulting configuration of actors within the ecology defines the ground rules upon which the interplay of capital, organizational and regulatory structures unfold.

This points us towards the tendering process as the central lever in how regulators and the public can maintain more control over infrastructure projects and their long-term impacts. A strong and clearly defined tendering process not only benefits the city and its population in the long run, but also makes it easier for investors to ascertain local complexity and propose more appropriate solutions. In this context it is important not only to be critical of financialization and the machinations of capitalism, but also to enable cities to navigate the changing environment in which they must find ways to provide these essential services. A more proactive approach, such as that taken by the UKMBA and SEBI, provides some measure of public supervision and capacity-building, as opposed to individualized constructs that maximize their profits on the basis of moral hazard and obfuscation.

The much more public debate, which is a common subject in Indian newspapers in the second case, is a positive example of how public engagement can hold decision-makers accountable. This is sorely lacking in the British example, where public awareness often only begins when projects are a fait accompli, if at all. Making a case for increased visibility of infrastructure development and maintenance in the Global North would ensure greater transparency in the decision-making process and also shift the overly economic bias within it towards a broader debate around the environmental and social aspects of infrastructure development, closely aligned with the more embedded understanding of infrastructure provided by Angelo and Calhoun (2013) as well as Graham (2010).

For our understanding of financialization we have identified the central role of different knowledges and their translations, and how clearly defined institutional roles and powers can facilitate better outcomes for cities. With more individualized processes of infrastructure financialization, the lack of such institutions levelling the playing field exposes underlying mechanisms of obfuscation and financial innovation 'in the dark'. In using financial ecologies as a tool, we can better understand the impacts of financialization on our cities and analyse not only those occurrences in which forms of financialized investment flow but also those cases where they struggle to take hold. These cases are of particular interest as they expose the line of demarcation by which the financialization process discerns its own viability in the provision of urban water infrastructure.

## NOTE

[1] A 'crore' refers to a unit equivalent to 10 million in the Indian numbering system.

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## REFERENCES

Aalbers, M. B. (2017). The variegated financialization of housing. *International Journal of Urban and Regional Research*, *41*(4), 542–554. https://doi.org/10.1111/1468-2427.12522

Abbott, A. (2005). Linked ecologies: States and universities as environments for professions. *Sociological Theory*, *23*(3), 245–274. https://doi.org/10.1111/j.0735-2751.2005.00253.x

Ahlers, R., & Merme, V. (2016). Financialization, water governance, and uneven development. *WIRES Water*. https://doi.org/10.1002/wat2.1166

Allen, J., & Pryke, M. (2013). Financialising household water: Thames water, MEIF, and 'ring-fenced' politics. *Cambridge Journal of Regions, Economy and Society*, *6*(3), 419–439. https://doi.org/10.1093/cjres/rst010

Anand, N. (2017). *Hydraulic city: Water and the infrastructures of citizenship in Mumbai*. Duke University Press.

Angelo, H., & Calhoun, C. (2013). Infrastructures of the social: An invitation to infrastructural sociology. Unpublished Manuscript.

Appel, H., & Kumar, M. (2015, September 24). The infrastructure toolbox: Finance. https://culanth.org/fieldsights/finance

Bakker, K. (2013). Constructing 'public' water: The World Bank, urban water supply, and the biopolitics of development. *Environment and Planning D: Society and Space*, *31*(2), 280–300. https://doi.org/10.1068/d5111

Björkman, L. (2015). *Pipe politics, contested waters: Embedded infrastructures of millennial Mumbai*. Duke University Press.

Blaiklock, T. M. (2017). *Thames water, the Thames tideway tunnel: Regulatory weaknesses lack of transparency: A Flawed project structure and conflicts of interest*, private document provided by the author 12.2017.

CAG. (2017). Report of the comptroller and auditor general of India on local bodies. https://cag.gov.in/sites/default/files/audit_report_files/Report_No.5_of_2017_%E2%80%93_Local_Bodies_Government_of_Maharashtra.pdf.

Callon, M. (1998). *The laws of the markets*. Blackwell.

Chakrabarti, M. (2014). Municipal bond market in India. *Indian Journal of Applied Research*, *3*(4), 48–62. https://doi.org/10.36106/ijar.

Christophers, B. (2010). On voodoo economics: Theorising relations of property, value and contemporary capitalism. *Transactions of the Institute of British Geographers*, *35*(1), 94–108. https://doi.org/10.1111/j.1475-5661.2009.00366.x

Christophers, B. (2012). Anaemic geographies of financialization. *New Political Economy*, *17*(3), 271–291. https://doi.org/10.1080/13563467.2011.574211

Clark, E., Larsen, H. G., & Hansen, A. L. (2015). Financialization of built environments: A literature review. *FESSUD Working Paper Series* 114.

Clark, G., & O'Connor, K. (1997). The informational content of financial products and the spatial structure of the global finance industry. In K. R. Cox (Ed.), *Spaces of globalization: Reasserting the power of the local* (pp. 89–114). Guilford Press.

Clean Thames Now and Always. (2016). Thames Tideway Tunnel mythbuster. http://cleanthames.org/the-controversy/thames-tideway-tunnel-mythbuster/.

Despande, T. (2018, March 21). *Mumbai Mirror*. https://mumbaimirror.indiatimes.com/mumbai/civic/sewage-disposal-project-10-yrs-later-bmc-wants-to-blacklist-consultant/articleshow/63389232.cms

Epstein, G. A. (2005). *Financialization and the world economy*. Edward Elgar Publishing.

Financial Crisis Inquiry Commission. (2011). *The financial crisis inquiry report: The final report of the national commission on the causes of the financial and economic crisis in the United States including dissenting views*. Cosimo, Inc.

French, S., Leyshon, A., & Wainwright, T. (2011). Financializing space, spacing financialization. *Progress in Human Geography*, *35*(6), 798–819. https://doi.org/10.1177/0309132510396749

Gandy, M. (2008). Landscapes of disaster: Water, modernity, and urban fragmentation in Mumbai. *Environment and Planning A: Economy and Space*, *40*(1), 108–130. https://doi.org/10.1068/a3994

Gateway House: Indian Counsel on Global Relations. (2018, March 28). *Financialisation: Re-shaping the global financial architecture?* [video file]. https://www.youtube.com/watch?v=p7dHyDLcofY

Grafe, F.-J., & Hilbrandt, H. (2019). The temporalities of financialization: Infrastructures, dominations, and openings in the Thames Tideway Tunnel. *City*, *23*(4–5), 606–618. https://doi.org/10.1080/13604813.2019.1689730

Grafe, F.-J., & Mieg, H. A. (2019). Connecting financialization and urbanization: The changing financial ecology of urban infrastructure in the UK. *Regional Studies, Regional Science*, *6*(1), 496–511. https://doi.org/10.1080/21681376.2019.1668291

Graham, S. (2010). *Disrupted cities: When infrastructure fails*. Routledge.

Graham, S., Desai, R., & McFarlane, C. (2013). Water wars in Mumbai. *Public Culture*, *25*(1(69)), 115–141. https://doi.org/10.1215/08992363-1890486

Gupta, I., Vachasiddha, L., & Kumar, R. (2017). Evaluation of the costs and benefits of Mumbai sewage disposal project, India. *Indian Journal of Geo Marine Sciences*, *46*(8), 1539–1545.

Halbert, L., & Rouanet, H. (2014). Filtering risk away: Global finance capital, transcalar territorial networks and the (un)making of city-regions: An analysis of business property development in Bangalore, India. *Regional Studies*, *48*(3), 471–484. https://doi.org/10.1080/00343404.2013.779658

Harvey, D. (2006). *The limits to capital* (3rd ed). Verso.

Heeg, S. (2013). Wohnungen als Finanzanlage: Auswirkungen von Responsibilisierung und Finanzialisierung im Bereich des Wohnens. *Suburban. Zeitschrift für Kritische Stadtforschung*, *1*(1), 75–99. https://doi.org/10.36900/suburban.v1i1.71

Infrastructure Investor. (2018). The future of infrastructure report. https://d16yj43vx3i1f6.cloudfront.net/uploads/2018/11/FUTURE-OF-INFRASTRUCTURE.pdf.

Kaika, M., & Ruggiero, L. (2016). Land financialization as a 'lived' process: The transformation of Milan's Bicocca by Pirelli. *European Urban and Regional Studies*, *23*(1), 3–22. https://doi.org/10.1177/0969776413484166

Leyshon, A., & Thrift, N. (2007). The capitalization of almost everything: The future of finance and capitalism. *Theory, Culture and Society*, *24*(7–8), 97–115. https://doi.org/10.1177/0263276407084699

LGA. (2014). Brady, A., Andersson, L., & Breedon, F. (2014). *The UK municipal bonds agency: Establishment of a local government collective agency for the issue of local authority bonds*. Local Government Association.

Loftus, A., & March, H. (2017). Integrating what and for whom? Financialization and the Thames Tideway Tunnel. *Urban Studies*, online first. https://doi.org/10.1177/0042098017736713

McFarlane, C. (2006). Crossing borders: Development, learning and the North–south divide. *Third World Quarterly*, *27*(8), 1413–1437. https://doi.org/10.1080/01436590601027271

McFarlane, C. (2010). The comparative city: Knowledge, learning, urbanism. *International Journal of Urban and Regional Research*, *34*(4), 725–742. https://doi.org/10.1111/j.1468-2427.2010.00917.x

MCGM. (2018). Press release. http://www.mcgm.gov.in/irj/go/km/docs/documents/HomePage%20Data/Press%20Release/PR05031821.pdf

Modi, N. (2016, December 24). Modi's remarks at inauguration of NISM campus. *The Hindu*. Retrieved from: https://www.thehindu.com/news/resources/Modi%E2%80%99s-remarks-at-inauguration-of-NISM-campus/article16941672.ece

Monstadt, J. (2009). Conceptualizing the political ecology of urban infrastructures: Insights from technology and urban studies. *Environment and Planning A: Economy and Space*, *41*(8), 1924–1942. https://doi.org/10.1068/a4145

MOUD. (2015). *Atal mission for rejuvenation and urban transformation (AMRUT) mission statement & guidelines*. Ministry of Urban Development, Government of India.

O'Brien, P., & Pike, A. (2015). City deals, decentralisation and the governance of local infrastructure funding and financing in the UK. *National Institute Economic Review*, *233*(1), R14–R26. https://doi.org/10.1177/002795011523300103

O'Neill, P. (2013). The financialisation of infrastructure: The role of categorisation and property relations. *Cambridge Journal of Regions, Economy and Society*, *6*(3), 441–454. https://doi.org/10.1093/cjres/rst017

O'Neill, P. (2018). The financialization of urban infrastructure: A framework of analysis. *Urban Studies*, Special Issue: Funding, financing and governing urban infrastructures, 1–22.

Pillai, S. (2018, March 4). *Hindustan Times*. https://www.hindustantimes.com/mumbai-news/delayed-sewage-disposal-project-in-mumbai-sees-cost-escalate-to-14-368cr/story-Az4edk3xPtszaXCBRqxTfK.html

Public Finance. (2016). First local government bond agency issue set for autumn. http://www.publicfinance.co.uk/news/2016/05/first-local-government-bond-agency-issue-set-autumn

Robinson, J. (2011). Cities in a world of cities: The comparative gesture. *International Journal of Urban and Regional Research*, *35*(1), 1–23. https://doi.org/10.1111/j.1468-2427.2010.00982.x

Robinson, J. (2014). Introduction to a virtual issue on comparative urbanism. *International Journal of Urban and Regional Research*. https://doi.org/10.1111/1468-2427.12171

Rutland, T. (2010). The financialization of urban redevelopment. *Geography Compass*, *4*(8), 1167–1178. https://doi.org/10.1111/j.1749-8198.2010.00348.x

Savini, F., & Aalbers, M. B. (2016). The de-contextualisation of land use planning through financialisation: Urban redevelopment in Milan. *European Urban and Regional Studies*, *23*(4), 878–894. https://doi.org/10.1177/0969776415585887

SEBI. (2015). Issue and listing of debt securities by municipalities, regulations. https://www.sebi.gov.in/legal/regulations/jul-2015/sebi-issue-and-listing-of-debt-securities-by-municipalities-regulations-2015-last-amended-on-february-15-2017-_34611.html

Sheikh, S., & Asher, M. G. (2012). A case for developing the municipal bond market in India. *ASCI Journal of Management*, *42*, 1–19.

Suez. (2016). Suez wins the contract to build and operate the Colaba wastewater treatment plant in Mumbai [Press release] https://www.suez.com/-/media/SUEZ-GLOBAL/Files/Press-release/EN/PR-suez-contract-wasterwater-treatment-plant-coloba-mumbai-2016-10-10-EN.pdf

Swyngedouw, E. (2009). The political economy and political ecology of the hydro-social cycle. *Journal of Contemporary Water Research & Education*, *142*(1), 56–60. https://doi.org/10.1111/j.1936-704X.2009.00054.x

Torrance, M. I. (2008). Forging glocal governance? Urban infrastructures as networked financial products. *International Journal of Urban and Regional Research*, *32*(1), 1–21. https://doi.org/10.1111/j.1468-2427.2007.00756.x

UKMBA. (2015). UK municipal bonds agency plc: Strategic report. https://www.ukmba.org/wp-content/uploads/2015/05/Signed_Financial_Statements_15.pdf

USAID. (1998). Project notes: Tools for developing commercially viable urban environmental infrastructure projects. https://pdf.usaid.gov/pdf_docs/Pnack348.pdf

Vaidya, C., & Vaidya, H. (2008). Creative financing of urban infrastructure in India through market-based financing and public–private partnership options, 9th Metropolitan Congress.

Weber, R. (2010). Selling city futures: The financialization of urban redevelopment policy. *Economic Geography*, *86*(3), 251–274. https://doi.org/10.1111/j.1944-8287.2010.01077.x

Wood, A. (2004). The scalar transformation of the U.S. Commercial property-development industry: A cautionary note on the limits of globalization. *Economic Geography*, *80*(2), 119–140. https://doi.org/10.1111/j.1944-8287.2004.tb00304.x

World Bank. (2004). Report No: 29311 Implementation completion report (CPL-39230 SCL-3923A IDA-27630).

# Appendix

## Document Analysis

This list of 297 documents includes legislative and planning documents, reports, public statements, and media coverage from the period 2001 to 2018. The analysis is focused on documents that correspond to the discussion on financial markets and infrastructure for the given ecologies.

*Table 1: Documents analyzed for the Indian Case*

| Source | Number of Documents |
|---|---|
| **Reports of the Comptroller and Auditor General of India** | 17 |
| **Ministry of Urban Development** | 12 |
| **Ministry of Environment and Forests** | 6 |
| **Municipal Corporation of Greater Mumbai** | 27 |
| **Securities and Exchange Board of India** | 9 |
| **Developers** | 3 |
| **World Bank** | 12 |
| **Political Organizations** | 5 |
| **Investors** | 3 |
| **Expert Reports** | 9 |
| **Press** | 31 |

*Table 2: Documents analyzed for the UK case*

| Source | Number of Documents |
|---|---|
| **National Audit Office** | 15 |
| **United Kingdom Municipal Bonds Agency** | 11 |
| **Department for Environment, Food and Rural Affairs** | 8 |
| **Environment Agency** | 10 |
| **European Commission** | 3 |

| | |
|---|---|
| **Financial Conduct Authority / Financial Services Authority** | 6 |
| **Greater London Authority** | 14 |
| **Thames Water** | 21 |
| **Bazalgette Tunnel Limited** | 15 |
| **Ofwat** | 13 |
| **Investors** | 10 |
| **Political Organizations** | 5 |
| **Expert Reports** | 14 |
| **Press** | 18 |

## Interviews

Number of interviews conducted: 22

Anonymized with individualized acronym

1. Banker (B), Utility (U), Administration (A), Press (P), Engineer (E), Initiative (I).
2. London (L), Mumbai (M)
3. Number (#)

BL1 (International Investment Bank) personal interview 1.3.2017

BL2 (European Investment Institution) personal interview 16.1.18

BL3 (International Investment Bank) personal interview 7.9.2016

IL1 (Environmental Initiative) personal interview 12.9.2016

AL1 (Local Authority) personal interview 15.9.2016

AL2 (Local Authority) personal interview 23.9.2016

AL3 (Local Authority) personal interview 23.9.2016

AL4 (Regulator) personal interview 27.9.2016

UL1 (Service Provider) personal interview 12.10.16

UL2 (Service Provider) personal interview 12.10.16

EL1 (Independent Consultant) personal interview 14.11.17

EL2 (Developer) personal interview 22.11.17

BM1 (International Investment Bank) personal interview 3.7.17

BM2 (Financial Regulator) telephone interview 5.9.2017

BM3 (International Investment Bank) telephone interview 29.9.2017

PM1 (Press) personal interview 20.1.2016

AM1 (Local Authority) personal interview 15.1.2016

AM2 (Local Authority) personal interview 15.1.2016

AM3 (Local Authority) personal interview 17.1.2016

AM4 (Service Provider) personal interview 17.1.2016

AM5 (Service Provider) telephone interview 3.7.2018

EM1 (Developer) telephone interview 24.4.2017