Urban experimentation and institutional arrangements

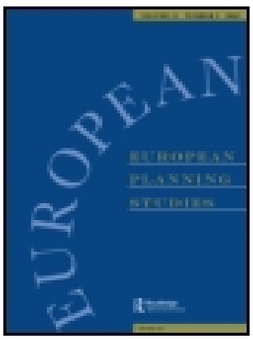
Raven, Rob; Sengers, Frans; Spaeth, Philipp; Xie, Linjun; Cheshmehzangi, Ali; de Jong, Martin

DOI
10.1080/09654313.2017.1393047

Publication date
2017

Document Version
Final published version

Published in
European Planning Studies



European Planning Studies

ISSN: 0965-4313 (Print) 1469-5944 (Online) Journal homepage: http://www.tandfonline.com/loi/ceps20

Urban experimentation and institutional arrangements

Rob Raven, Frans Sengers, Philipp Spaeth, Linjun Xie, Ali Cheshmehzangi & Martin de Jong

To cite this article: Rob Raven, Frans Sengers, Philipp Spaeth, Linjun Xie, Ali Cheshmehzangi & Martin de Jong (2017): Urban experimentation and institutional arrangements, European Planning Studies, DOI: 10.1080/09654313.2017.1393047

To link to this article: http://dx.doi.org/10.1080/09654313.2017.1393047

Published online: 24 Oct 2017.

EUROPEAN PLANNING STUDIES, 2017
https://doi.org/10.1080/09654313.2017.1393047

Routledge
Taylor & Francis Group

Urban experimentation and institutional arrangements

Rob Raven[a], Frans Sengers[a], Philipp Spaeth[b], Linjun Xie[c], Ali Cheshmehzangi[c] and Martin de Jong[d,e]

[a]Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, Netherlands; [b]Institute of Environmental Social Sciences and Geography, Freiburg University, Freiburg, Germany; [c]Department of Architecture & Built Environment, Nottingham University Ningbo, Ningbo, People's Republic of China; [d]Faculty of Technology, Policy and Management, Delft University, Delft, Netherlands; [e]School of International Relations and Public Affairs, Fudan University, Shanghai, People's Republic of China

ABSTRACT

Currently little is known about how institutional arrangements co-evolve with urban experimentation. This paper mobilizes neo-institutional literature and recent urban experimentation literature as a framework to explore how and why institutional arrangements differ across urban contexts. Empirically the paper focusses on smart city initiatives in Amsterdam, Hamburg and Ningbo. These three cities are frontrunners in adopting a comprehensive smart city agenda, but they do so in different ways. The paper examines regulative, normative and cognitive elements of institutional arrangements, explores how they shape experimentation, and reflects on their place-based specificities. The comparative analysis suggests that the focus of, and approach to, experimentation can be understood as resting in a (possibly unique) combination of strategic agency and dynamics at multiple spatial scales.

ARTICLE HISTORY
Received 23 January 2017
Revised 29 September 2017
Accepted 12 October 2017

KEYWORDS
Urban experimentation; institutional arrangements; smart cities; comparative case study

1. Introduction

Cities are now firmly on the international agenda as key-sites for negotiating and shaping sustainable development, economic growth, technological innovation, social cohesion and the like. As urban actors are increasingly confident about their potential and roles in transforming cities, a new wave of 'government by experiment' (Bulkeley and Castan Bróto, 2013) is emerging, which gives centre stage to an actionable form of governance in 'urban living labs' or 'urban experiments'. Scholarship in urban studies and transition studies has started to explore these processes and the ways in which urban experimentation may shape wider processes of transformation (Bulkeley et al., 2016; Caprotti & Cowley, 2016; Evans, Karvonen, & Raven, 2016; Sengers, Wieczorek, & Raven, in press).

Despite these pioneering contributions, scholarly work on urban experimentation has only started to begin to conceptualize experimentation in relation to obdurate, incumbent structures (Hommels, 2005). In a recent contribution, we have proposed a generic three-dimensional framework – building upon insights from the field of sustainability transitions

CONTACT Rob Raven r.p.j.m.raven@uu.nl

– for analysis of urban experimentation and how they co-evolve with incumbent discursive, institutional and material urban infrastructures (Sengers, Späth, & Raven, in press). The aim of the current paper is to hone in on the institutional dynamics, and in particular on the ways in which institutional arrangements shape unfolding urban experimentation in particular places. The paper draws on institutional theory, and in particular the 'institutional pillars' framework as analytical strategy for comparative analysis (Scott, 2008).

Empirically, the paper focusses on 'smart city' experimentation. In recent years, 'smart cities' has emerged as a popular term amongst engineers, policy-makers, architects, scholars and others interested in how the proliferation and mainstreaming of connected information- and communication technologies might reshape the social- and material fabric of cities, including their sustainability (Crivello, 2015; Kitchin, 2014; Luque-Ayala & Marvin, 2015). The notion of smart cities has quickly approached and even surpassed popularity of previous terms for articulating urban futures, such as eco-cities or sustainable cities (de Jong, Joss, Schraven, Zhan, & Weijnen, 2015). So far, however, urban sustainability transitions scholarship has only limitedly engaged with analysis of 'smart' urban development (see for a pioneering contribution, Carvalho, 2015). A lack of scholarly engagement of the transitions community is even more striking given the substantial promises on ecological and social gains often attached to visions of smart urban development – obviously of key importance to this community. This paper hones in on three cities in Europe and Asia that have prominently started to organize smart city experimentation through new institutional arrangements: Amsterdam, Hamburg and Ningbo.

The research question that we address in this paper is how and why does smart city experimentation differ across urban contexts? We address this question in an explorative way by first discussing the analytical approach in Section 2 and the research design in Section 3. We then present the results of the empirical analysis in Section 4 in the form of stylized case narratives using the framework introduced in Section 2. Section 5 compares the results across the three cases and Section 6 concludes.

2. Urban experimentation and institutional arrangements

With most people now living in urban regions, cities have been argued to be in the forefront of contributing substantially to climate change, resource depletion and other degenerating processes to global environmental quality. At the same time, cities have been heralded as a critical context for promoting positive sustainable change through urban innovation and green entrepreneurship. City governments themselves have started to develop new institutional arrangements for (sustainable) urban development at least since the start of Local Agenda 21, and continue to do so as for instance evidenced by the recently established 'Global Parliament of Mayors'.

Next to these 'grand events' that establish international networks and shape the international institutional context for urban transitions, however, more recent scholarly work has drawn attention to the wave of urban experimentation that is occurring within cities globally, with a potentially more distributed and emergent character (Bulkeley & Castán Broto, 2013; Evans et al., 2016). Urban actors including public administrators, entrepreneurs, citizens and research institutes increasingly come together in these 'new political arenas' and collaborate around 'experimental projects' such as urban living labs to explore new configurations for urban energy systems, food provision, mobility, housing and the like.

The argument goes that urban infrastructures will have to transform substantially in order to limit further environmental damage and prepare for life in the 'Anthropocene', and that experimentation offers a hands-on perspective to learn about such challenges in urban contexts. From a sustainability transitions perspectives, experiments can be defined as 'inclusive, practice-based and challenge-led initiative designed to promote system innovation through social learning under conditions of uncertainty and ambiguity' (Sengers et al., in press). In urban contexts, experimental practices have been suggested to be more fluid, open-ended, contingent and political (e.g. Bulkeley et al., 2016; Caprotti & Cowley, 2016; Hodson, Geels, & McMeekin, 2017). They are characterized by multiplicity rather than singular, well-planned and consensus-oriented learning processes as suggested by the transitions literature or innovation literature more generally.

Such an open-ended, fluid perspective does not imply that experimentation, and the kinds of agencies it may enable, occurs in absence of pre-configured contexts. Scholarly work has started to remind us that transition experiments by no means can be understood independent of their multi-scalar contexts (Coenen, Benneworth, & Truffer, 2012). Their situatedness has to be empirically and conceptually explored (Karvonen & van Heur, 2014). A range of diversities may exist across perspectives of what experiments and their sustainabilities mean to whom and where (Raven et al., 2017). In fact, some have warned about the potential danger of engaging with an 'experimentation' discourse – transferring a 'context-independent' perspective of rigorous academic method in laboratory contexts to the real-life, place-specific context of urban life full of history and lived experiences (May & Perry, 2016). Indeed, urban experimentation occurs in historically-configured places with, for instance, established institutional arrangements, incumbent actor networks, regional-specific resources, power relations, cultural preferences, urban discourses and material infrastructures. Similar observations about the important role of place-specific processes and variables in experimentation and urban innovation have been put forward in the recent literature on the geography of sustainability transitions (Truffer, Murphy, & Raven, 2015).

In this paper we aim to understand relations between place-specific institutional arrangements and experimentation. We do so by building upon neo-institutional theory, and in particular Scott's conceptualization of three institutional 'pillars' that constitute and regulate social interactions (Scott, 2008). This widely accepted conceptualization is based on a review of neo-institutional approaches across different disciplines. As such, this framework synthesizes different institutional perspectives into a coherent framework that considers the entire continuum from legally enforced (regulative) institutions to informal but taken-for-granted (cognitive and normative) institutions. The framework has been used for analytical purposes ranging from organizations (such as in evolutionary economic theory), to organizational fields (such as in traditional institutional sociology), as well as entire world systems (such as in economic history) (Scott, 2008, p. 89). Earlier conceptualizations in sustainability transitions literature have also suggested that this conceptualization may prove useful for analysis of transition dynamics (Geels, 2004). As such we expect this to be a fruitful starting point for our analysis.

Scott defines institutions as 'regulative, normative and cultural-cognitive elements that, together with associated activities and resources, provide stability and meaning to social life' (Scott, 2008, p. 56). Each of these 'institutional pillars' has its own logic of compliance and basis of legitimacy, which are reproduced through particular mechanisms in social

interactions. The regulative pillar places emphasis on explicit regulatory processes, such as formal rules, laws, policies, protocols and standards. Not complying to these rules may have implications in terms of legal sanctions. Hence institutional analysis of smart city initiatives would elaborate on the formal institutional dimensions of these initiatives, such as the ways in which they draw on urban, regional, national or international policy initiatives for urban development (e.g. McCauley & Murphy, 2013).

The normative pillar places emphasis on rules that introduce prescriptive, evaluative and obligatory pressures and refers to things like values, role expectations, social norms, duties, responsibilities, i.e. normative rules prescribe what is considered appropriate behaviour. Not complying to these rules may result in strong emotional responses related to a sense of shame or disgrace, or for those who exhibit rule-following behaviour, a feeling of pride and honour. Such rules are not necessarily formalized in written documents, but internalized in the behaviour of actors through socialization. Relevant to the study of smart city initiatives are issues around the different kind of roles that actors have (or should have) in these experiments and platforms. Ongoing debates in smart city literature have increasingly emphasized the need for more inclusive development of smart cities, which prescribe a central role to citizens next to public administrators and technology firms (Bolívar & Meijer, 2016). Another element of the normative pillar relates to debates about what 'smart' means in relation to urban development. This relates to questions such as how in smart city experiments and platforms certain societal challenges are framed, and how economic, social or ecological challenges are prioritized in them. What are considered as legitimate goals or priorities of smart city initiatives, including their sustainability (Glasmeier & Christopherson, 2015)?

Finally, the cognitive pillar stresses cultural-cognitive elements and refers to shared conceptions and frames through which meaning is given, and the world is interpreted. Cultural-cognitive elements are often very implicit but persuasively present in and through the sense-making activities of actors – even up to a point where cognitive schemes have become part of routine ways of understanding and interpreting the world. Actors themselves are often not explicitly aware of them and take them for granted. They form implicit 'cultural reservoirs' or 'cognitive logics' for action. Not conforming with these schemes leads to confusion. As such, they can often only be derived indirectly from observed patterns in routine behaviour, and in particular when confusion is observed when not conforming to them. Because cultural-cognitive schemes are so fundamental and constitutive to social life, they are often overlooked. Symbols, discourse and cultural categories, and the ways in which they are 'brought to life' in social interactions, are important elements of the cultural-cognitive pillar and as such an important object of analysis in cultural-cognitive institutional approaches – just as formal regulations and policies, for instance, are in the regulative institutional approaches. In the case of smart city experimentation, the cultural-cognitive pillar of institutions would entail, for instance, an analysis of how smart cities are framed as solutions to contemporary urban challenges and such discursive approaches have received relatively much attention in this field, in particular from a critical perspective (e.g. Gibbs, Krueger, & MacLeod, 2013; Vanolo, 2014).

We note here that we do not aim to provide a full review of this rich conceptualization, but rather use it in a way that enables to explore and compare the place-specificity of institutional contexts developing around smart urban experimentation. We make one important vocabulary change to Scott's framework. To accommodate for a more fluid

and open-ended conceptualization of experimentation in relation to its contexts, as suggested by urban literature on experimentation, we chose not to refer to institutional 'pillars', which implicates a more static, heavy conceptualization of urban institutions. Rather, following Scott's terminology in his definition of institutions in general (see above), we refer to three 'elements' that together constitute and span a particular 'institutional arrangement' in and through which smart city experimentation is configured. A range of agencies may be involved in strategically establishing, contesting and reproducing these arrangements as experimentation unfolds in dynamic, multi-level contexts, such as various forms of political, cultural and technical work (Lawrence, Suddaby, & Leca, 2009; Perkmann & Spicer, 2008). Hence, we recognise a particular 'situatedness' of institutional elements in the sense that place-based varieties in institutional context will pre-configure any attempts to create new institutional arrangements. As such the 'smart institutional arrangements' that are the focus in this research are likely to be emerging from both routine reproduction of already existing institutions, as well as novel institutional reconfigurations coming from responses to and strategic mobilizations of new challenges and opportunities, as perceived and framed by the actors involved. Our conceptualization thus embraces a more fluid understanding on urban institutional dynamics than suggested by the concept of institutional pillars.

3. Research design

This paper draws on a comparative research design. Case study selection rests in an extensive mapping of smart city initiatives in the Netherlands (Sengers, 2016), Germany (Spaeth, 2017), the U.K. (Caprotti, Cowley, Flynn, Joss, & Yu, 2016), France (Bond, 2017) and China (Tan-Mullins, Cheshmehzangi, Chien, & Xie, 2016), which were conducted as part of an ongoing three-year international research project.[1] From this mapping, we selected three cases that we expected to demonstrate different institutional arrangements, honing in on different relations between various public and private actors, as well as differences between more distributed versus more centralized forms of experimentation. The cases we selected are Amsterdam (The Netherlands), Ningbo (China) and Hamburg (Germany).

Each case study city has been explored through a long-term engagement of three locally based research teams in each of the three countries where the cities are located. Data collection took place roughly between May 2016 and May 2017. All teams included native speakers who collected data in an iterative process of interviewing, reading and analysing grey material and comparing case insights in online and face-to-face meetings. Additionally, deeper comparative understanding of the cases was gained through collective site-visits in which international teams observed and discussed each of the three case study sites. Site visits involved a combination of observing experiments, listening to presentations and engaging with case study actors in a dialogue on possible similarities and differences across sites. Table 1 provides key figures on data collection.

The semi-structured interviews ranged between roughly 30 minutes and 2 hours. Most interviews were conducted face-to-face during which notes were taken. The three-dimensional institutional framework and the notion of experimentation functioned as a sensitizing concept for the empirical analysis (Blumer, 1954). As such these concepts sufficiently allowed for a balance between developing a conceptual understanding of 'what to look for'

Table 1. Key figures on data collection.

	Interviews	Grey literature	Collective site visits
Amsterdam	Urban/regional public administrators (7) National public administrators (3) Knowledge institutes (3) Private actors (6) Civil society (4) Other: Journalists (1), actors representing the Smart City Amsterdam partnership (8)	Official policy documents (10) Reports, such as from knowledge institutes (20) Leaflets, such as for branding purposes (5) Websites (40) Other: reports comparing Amsterdam with other cities (5), speeches and expert presentations (10), Ph.D. thesis (1)	Amsterdam site visit (January 2016). Places visited: ASC experience lab, WAAG Society FabLab, Ceuvel experimental site, Marineterrein experimental site
Hamburg	Urban/regional public administrators (7) National public administrators (7) Knowledge institutes (10) Private actors (5) Civil society (11)	Official policy documents (18) Reports from knowledge institutes (36) Leaflets, such as for branding purposes (11) Websites (40) Other: reports comparing Hamburg with other cities (9), speeches (3), thesis (1)	Hamburg site visit (March 2017) Places visited: HafenCity University, City Science Lab, Senatskanzlei, Osaka 9 Sustainability Pavilion, HafenCity experimental site, Gut Karlshoehe experimental site
Ningbo	Urban/regional public administrators (4) National public administrators (5) Knowledge institutes (3)	Official policy documents (12) Reports, such as from knowledge institutes (18) Leaflets, such as for branding purposes (2) Websites including news websites (20) Other: reports on Chinese smart cities (2), speeches (3)	Ningbo site visit (May and November 2016) Places visited: University of Nottingham Ningbo China, Ningbo Academy of Smart City, Smart City Science and Technology Museum, China Mobile experience hall of Ningbo IOT and Smart City

and how to perform comparative research across cases, whilst simultaneously providing sufficient flexibility for the empirical material 'to speak'. Table 2 provides an operationalization of the key concepts and examples of what to look for in the research.

Based on the collected material, initial data interpretations and intermediate comparative interactions, each national team drafted a four-page case study report to summarize

Table 2. Operationalization of key concepts.

	Description	Examples what to look for
Regulative institution	Rules and processes with formalized authority, such as those resting in public policies and other processes with formal capacity to set rules for, monitor and sanction activities.	References to urban, regional, national or international policy frameworks, agendas and incentive schemes, or formalized collaboration frameworks.
Normative institution	Values and norms that specify what is important (and what not) and prescribe ways in which these things should be accomplished.	References to prioritizations of what a smart city should be, and through which means and through whose involvement they should be developed.
Cognitive institution	Shared conceptions and frames through which meaning is given, and the world is interpreted.	Framings of how to conceive of smart cities and the ways in which upscaling of smart cities is understood.
Smart city institutional arrangement	More or less formalized collaborations for smart city development.	Empirical evidence for newly established organizations, platforms, applications or letter of intents to collaborate on smart city development.
Smart city experiment	Real-life applications of smart city technologies in projects with a particular focus to explore the feasibility and desirability of smart cities.	Data (such as starting and ending dates, involved participants and learning objectives) on ongoing or planned smart city projects in the case study cities.

the main findings relevant to the conceptual framework. The next section turns to the findings in each of the cases.

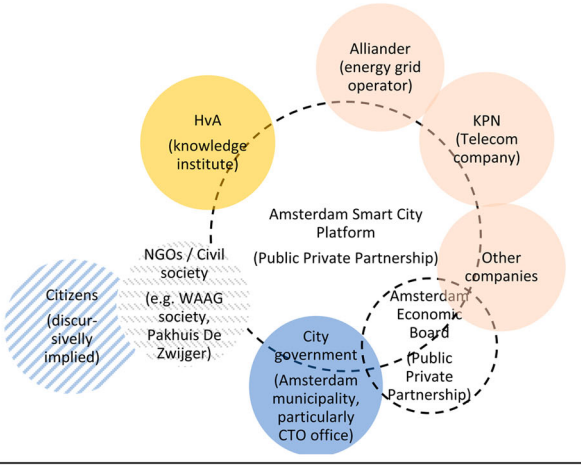
4. Institutional arrangements and experimentation in three smart cities

4.1. Amsterdam

There is no national smart city strategy in the Netherlands. The closest thing is a 2017 vision document co-created by 140 urban actors, companies and scientists and handed over to the Dutch prime minister Rutte (Wamelink, 2017). According to initial helicopter interviews with a variety of smart city experts around the country, Amsterdam is clearly the leading Dutch city in terms of smart city ambitions and experimentation (Sengers, 2016). Amsterdam is the capital city and the largest city of the Netherlands (population around 0.9 million) and, by Dutch standards, the city is a financial and cultural powerhouse. Located in the western part of the country, it is at the centre of the Amsterdam Metropolitan Area (population around 2.4 million), which constitutes the northern wing of the polycentric Randstad delta metropolitan region (population around 7 million). Whereas most Dutch cities fine-tune their smart city strategies, rhetoric and experimentation in relation to regional clusters such as healthy urban living (Utrecht), security (The Hague), port industry (Rotterdam) and high-tech knowledge industry (Eindhoven), Amsterdam does not have a clear-cut profile in terms of economic specialization or industrial clustering. The city has long enjoyed a popular image of tolerance, trade and social innovation and recent years have seen a renewed focus on urban expansion, regeneration and gentrification – all of which are important structural developments that are tied to the content of 150 or so smart city pilot projects dotted around the city, mainly concentrated in a few Living Lab areas (Nieuw-West, IJburg, Marineterrein, Buiksloterham and ArenA stadium). This collection of experiments is aggregated under the umbrella of a dedicated platform called Amsterdam Smart City (ASC). Figure 1 provides an overview of key actors involved and a timeline of main developments.

4.1.1. Experimentation

Two things are unique about experimentation in Amsterdam: (1) the large and fragmented amount of very-small scale pilot projects; (2) the governance arrangement of the ASC platform that facilitates a peculiar but productive relationship between urban government and corporate stakeholders. Amsterdam presents itself to the world as a citizen-driven smart city with little central steering, which could be characterized as a type of bottom-up smart city (as opposed to a control room centred, government-driven smart city), although a recent report on the ASC and its portfolio of experiments revealed that citizens do not play an active partnership role in most experiments that were studied (Van Winden, Oskam, Van Den Buuse, Schrama, & Van Dijck, 2016). Nevertheless, the platform is involved in enabling bottom-up activities, such as organizing Hackathons or endorsing maker-spaces and FabLabs. Around a third of the experiments initially listed on the ASC website were clearly couched in terms of environmental sustainability, mostly these were about energy saving and electric mobility (Sengers, 2016). The idea of addressing societal problems through smart city experimentation is common in the major experiments.



2008: A contract is signed on a fiber-to-the-home (FTTH) network in Amsterdam between the municipality, Alliander (grid operator) and KPN (telecom company) and the first 'smart city' questions are posed in terms of reducing CO2 emissions by a combination of connectivity and electricity. Meanwhile the financial crisis hits and due to a lack of public funding the city government looks for ways to get the private sector to invest more.

2009: The Amsterdam Smart City (ASC) platform is founded by Amsterdam Innovation Motor, city of Amsterdam (municipality), Aliander (grid operator), KPN (telecom company) and gets EU EFRA regional development subsidy to make connections with other parties in Amsterdam and start pilot projects.

2011: Subsidy ends but the coalition continues through direct funding of Alliander, KPN, city of Amsterdam and Amsterdam Economic board. Besides funding these organizations also supply the staff of ASC. 'Smart city' is becoming a popular term and key actors in Dutch cities think of ways to position themselves collectively on the global stage.

2016: The prime minister starts to see the term smart city as an opportunity for Dutch cities and businesses and ongoing steps are taken to give more concrete expression to the collective strategy.

Figure 1. Amsterdam: stylized actor constellation and timeline.

4.1.2. Regulative elements

The ASC platform sits squarely at the heart of smart city development in Amsterdam. It is tasked with promoting economic development, with contributing to technological and social innovation relevant to tackle a range of urban problems and – most importantly – with facilitating smart city experimentation in the Amsterdam Metropolitan Area. The ASC platform is a Public Private Partnership (PPP) constituted by a variety of actor types and it assumes the role of an 'innovation intermediary' – an organizational body that seeks to broker social network ties (Howells, 2006). Private companies play a key role as well as local government actors (at the city-level as well as metropolitan level). The actors involved argue that such a PPP construction where government is less directly able to manage the direction of smart city development became the only feasible option after the 2008 crisis due to a lack of public funding. At the time of writing (May 2017), the actors of the platform were trying to build a more open platform – a Facebook type of community – to minimize their own guiding role and to maximize their function as a role broker. One of the central actors within this PPP platform configuration is another PPP geared to promote regional economic cooperation ('Amsterdam Economic Board').

This PPP-within-PPP structure illustrates how central this type of actor constellation is in governing smart city experimentation in Amsterdam.

This type of informal multi-actor mode of collaboration is hailed by the involved actors themselves as a good example of the Dutch 'polder model' governance style – a consensus-oriented form of decision-making through cooperation across different socio-economic and political interests. This approach is in fact one of the things that is noticed and appreciated by foreign delegations coming to Amsterdam to learn about smart city development. Whilst labelling this way of working as typically Dutch, until very recently there has not been any concerted effort to develop a national strategy or policy in terms of smart city in the Netherlands. National government agencies are not strongly involved as important actors in the ASC platform. Earlier EU-level activity, on the other hand, was important initially in providing the financial resources to create the current network. These days, the key organizations in the ASC platform fund it themselves and no direct EU steering involved (though some of the bigger experiments supported by ASC are projects with large amounts of EU co-funding). The most heavily involved government actors are metropolitan-level agencies (Amsterdam Economic Board) and municipal-level agencies (City of Amsterdam, particularly the CTO office).

In terms of a legal framework or clear regulation, not much is firmly fixed in the ASC platform configuration. A small group of key actors, such as the municipality, electricity grid operator and a telecom company (the latter two former state-owned) supply the manpower, which forms the core team that manages the platform. They build bridges between interested stakeholders and they promote Amsterdam as smart city to the wider world. There are clear organizational overlaps between the ASC platform and the municipality – in particular the CTO office tasked with formulating ways to deal with innovative and potentially disruptive technologies. There is also clear rhetoric that states that the smart city should be harnessed to address societal challenges such as inequality and sustainability. Yet, smart city goals and vision documents are not directly linked to the city's other roadmaps or visions regarding such challenges. There are also no fixed criteria that determine whether an experiment is mentioned on the platform's website. This seems to be determined on an ad hoc basis, which allows for maximum flexibility in operating effectively as an intermediary organization.

4.1.3. Normative elements

One of the key characteristics of the ASC platform configuration is that a variety of stakeholders work together in an informal atmosphere where mutual trust and collaboration are the norm as well as a commitment to a similar set of values. Aside from the promotion of regional economic development, a particular set of idealistic values is put forward. These values include addressing societal challenges such as sustainability (very explicitly), but also promoting active citizenship and social inclusion (mostly implicitly).

The focus on harnessing technological innovation for economic development and environmental sustainability is omnipresent in the ASC platform rhetoric. Phrases such as 'development of new markets and profits for innovative solutions' and 'promoting sustainable economic growth' and 'contributing to the livability' attest to this (ASC, 2017). Active citizen participation in the smart city is promoted by at least two civil society organizations that participate in many of the platform activities (De Waag and Pakhuis de Zwijger) and it also features in the rhetoric of the city's Chief Technology Officer: 'the Amsterdam Smart City programme enables citizens to use the information that is available to make the choices

they want to make. This means that implementation is sometimes a bit slower than with a top-down strategy' (Baron, 2013, p. 101). The commitment to social inclusion came to the fore in a speech by the mayor on the 2015 annual smart city event. The mayor positioned Amsterdam as a 'front runner smart city' with seamless links to the past:

> Amsterdam has a centuries old tradition that can be summed up in three values: tolerance, trading spirit and inclusiveness … it has never been a city of kings and bishops but it has always been a city of merchants. You find no palaces here but canal houses that date back to the days since we have been used to self-governing. And we have never forgotten to look back to see who stayed behind and should also be included. (Van der Laan, 2015)

Other implicit values have to do with ideas about the guiding role of the government in supporting innovation and development. In the platform's PPP configuration, government agencies are not the only actors setting the agenda. There is a deeply held belief amongst some of the people involved in promoting the ASC platform that large government interference or subsidies do not work and that deep cooperation with the private sector is the only way forward. Sometimes such neo-liberal agenda points are communicated to the outside world as one of the key lessons from the smart city experiments.

4.1.4. Cognitive elements

Amsterdam presents itself as a front-runner in the smart city arena, from which other cities ought to learn. Tours are organized for foreign delegations and often they are fully booked. Branding Amsterdam to the outside world as a 'bottom-up' smart city is seen a way to attract investment and skilled workers and hence as a way to boost economic development. More specifically, it helps to create an image of the city as highly dynamic innovation eco-system where entrepreneurship is rewarded and where a range of smaller and bigger companies as well as a pro-active and facilitating government can find one another easily (in this storyline bottom-up does not necessarily mean citizens, but lack of government steering in favour of more entrepreneurial freedom).

These logics are articulated in the following way:

> [the goal is to] connect the right people to accelerate startup of projects in the city to tackle the challenges our city is facing … [by] connect[ing] the right stakeholders and [to] accelerate this progress. This advances the development of new markets and profits for innovative solutions. Where possible, these solutions are replicated elsewhere in the city. (ASC, 2017)

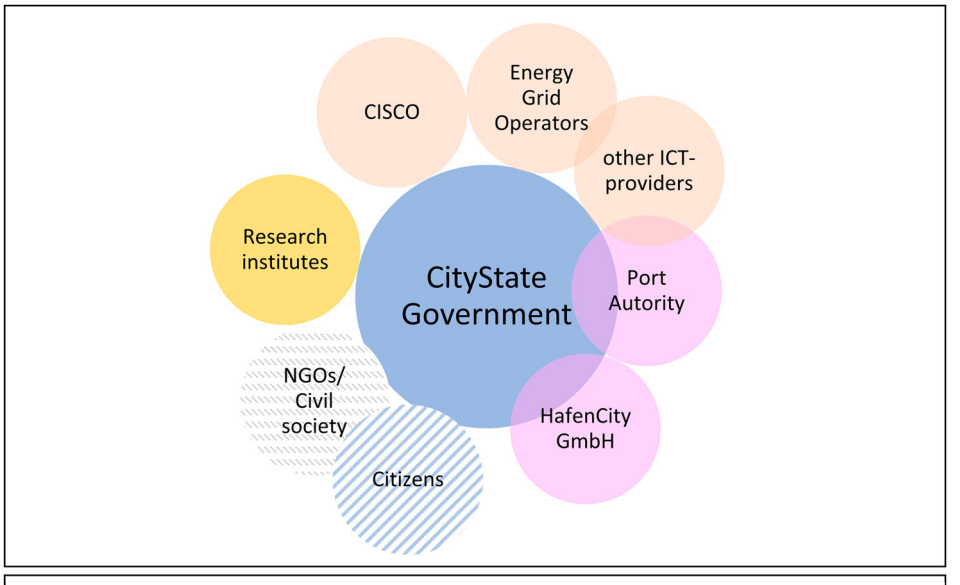
This points to several ideas that underpin smart city development: (1) a belief in progress and that innovation leads to profit and new markets; (2) the need to tackle grand societal challenges; (3) cooperation because the public and the private need each other; (4) acceleration and replication of experiments can foster up-scaling since this type of knowledge can allegedly be transferred.

Especially this last idea attests to the importance of experimentation underpinned by an evolutionary logic of a chaotic set of bottom-up emerging experiments, from which the fittest are to be scaled up.

4.2. Hamburg

With its roughly 1.8 million inhabitants, Hamburg is the second biggest city in Germany. The city region's territory and administration also serves as one of the 16 German

provincial states. Roughly 2.8 million people live in the agglomeration of Hamburg, which in turn forms part of the larger 'Hamburg Metropolitan Region', home to roughly 5 million people. The city encompasses the port of Hamburg in which up to 140 million tons of goods are processed annually, making it the biggest harbour in Germany and the third largest in Europe. The city has traditionally been characterized as a particularly open, internationally visible one, and the current administration sees it competing with Shanghai and Sydney to be one of the most attractive, innovative and livable cities by the sea. Throughout the city, several eco and smart city projects have been planned or implemented. When a new Government was formed in early 2015, 'digitization' was a key theme of the coalition agreement between the social democrats and the green party. Just prior to this, the senate had passed a 'Digital City Strategy' to bundle, influence and coordinate processes of digitization in many fields, among them education and health. Consequently, a coordination office (Leitstelle Digitale Stadt) was established to facilitate and supervise the cooperation of governmental and private actors and to ensure that the comprehensive and democratically legitimized perspective of the municipality is acknowledged in these processes (Figure 2).



2011: An infrastructural project is started in the port area, including sensors in roadways and bridges. A cooperation agreements are signed between city of Hamburg, Vattenfall and Eon-Hanse regarding the development of energy supplies for Hamburg (incl. smart Grid experiments in HafenCity).

2014: A Memorandum of Understanding is signed between City of Hamburg and CISCO.

2015: Outgoing city state government (Senat) approves the "Strategy for digitalization of the big city". A new coalition government is elected (social democrats + green party), headed again by first Mayor O. Scholz. "Digitalization of the big city" becomes a key term of the coalition agreement and the coordination office "Leitstelle Digitale Stadt" is established.

2016: As part of the EU2020 Project "mySmartLife", Hamburg is selected "lighthouse city", after two previous applications were not successful.

Figure 2. Hamburg: stylized actor constellation and timeline.

4.2.1. Experimentation

Experimentation is believed to be critical to Hamburg's digital strategy. 'We need to create the basis and appropriate framework conditions for the social change driven by digitization. […] Waiting is no realistic option. And understanding often results from experimentation', said Hamburgs first mayor recently again (Scholz, 2016a). In a first phase of experimentation, 2011–2014, multiple public–private partnerships with big companies such as CISCO and Vattenfall were announced to position Hamburg as a place where smart city developments were actively shaped and experimented with (e.g. MoU Cisco - Hamburg et al., 2014). Initial experiments focused on applying sensors for parking, lightning and traffic control in the harbour area, as well as experiments with smart grids. After 2015, a more mundane strategy was followed involving a stepwise 'digitization' of public services and infrastructures to the benefit of citizens and enterprises in the city state (Hamburg Senate, 2015). Some experiments have been developed in public–private partnerships. There has not been much publically visible reporting on the results of these experiments. Nevertheless, involved actors describe the experiments as helpful in the sense that people from organizations with different prevailing institutional logics get to know each other and start to practice co-operation. In this sense, the developments in Hamburg can reflect a social learning process in which different roles for diverse public and corporate actors are experimented with in anticipation of an increasing need to cooperate.

4.2.2. Regulative elements

Hamburg's lord mayor, Olaf Scholz, has repeatedly argued for an engagement of the local government in smart city experiments to ensure that the unavoidably digitized future is co-shaped with the public good in mind (cf. public speeches on 30 April 2014 and 2 May 2016).[2] 'Progress by technological development is possible, if we accept and engage in shaping it, rather than just reacting and getting shaped ourselves' (Scholz, 2016b). In line with this ambition, the municipality cum state government first engaged in bilateral and multilateral negotiations with system providers (IBM, Microsoft, Cisco, etc.) and network operators (Vattenfall, Eon-Hanse, etc.) to establish visible smart city experiments in Hamburg. The above-mentioned Memorandums of Understanding (of 2011 and 2014) reflect this ambition.

That Hamburg's government strongly aimed at getting selected and funded as a lighthouse city within the EU funding scheme Horizon 2020 certainly influenced how various local activities were shaped. The objective was finally achieved (in a third attempt) when the consortium 'mySmartLife' was selected in 2016. After the mayor has been re-elected in 2015, the new red–green coalition government agreed on a digitization strategy and institutionalized an officer for digitalization within its administration. Since 2014 already, a series of roughly quarterly meetings allowed for delegates from state departments, semi-public enterprises and private partners to coordinate their Smart City experiments in the city. The Hamburg port authority, a state-owned company developing the HafenCity district and various local universities are included in these discussions as important actors.

4.2.3. Normative elements

The organizational setting developed in 2015 for the coordination and supervision of experiments clearly reflects the widely accepted view in the German political system

(repeatedly and prominently expressed by the lord mayor) that the municipality is responsible for ensuring that the public interest (like data safety) is sufficiently considered in all public–private partnerships. The municipality is thus described as a principal, as superior to the agents. In all official statements, the classical idea of a representative democracy strongly prevails: That the citizens delegate all power for a legislative period into the hands of a city state government, which is only accountable to a respective parliament. The shaping of smart city experiments for Hamburg consequently happens in closed circles of experts usually without the public or external experts being given a voice. The public is informed very sporadically about the experiments in speeches of the lord mayor or the senator for economic affairs.

In 2015, the term 'Smart City' has been dropped in all strategic communication of the state of Hamburg and was mostly replaced by 'digitization' (A similar shift can also be observed in Berlin). These practices reflect a strategy to ensure legitimacy for smart city experiments in a skeptical environment by stressing the benefits that citizens will gain through them (in terms of livability, comfort and security). In an earlier phase (2011–2014) the ideal of a smart City was promoted also in Germany primarily as a set of technological developments that would allow for an optimization of flows in the city (on the level of mere engineering). The subsequent critique of this approach has been particularly pronounced in Germany, with many urban governance professionals developing a very critical stance. However, while the benefit to the population in terms of living quality, comfort and safety are put centre-stage in all smart city related communications, most activities in Hamburg are also clearly and explicitly geared primarily towards the creation of economic opportunities.

Presenting the harbour area as a natural test ground for the smartening of road infrastructure (parking, lightning and traffic control) signifies the priority that was given (in 2014) to the engineering of solutions in a testbed before ordinary citizens are confronted with them. However, an experiment which (in 2016) invited Hamburg's citizens to engage in a participatory exercise of 'finding places' for refugees (with the help of MIT's visualization technology 'CityScope') may indicate that a discrepancy between the (new) rhetoric of people centredness on the one hand and the largely technology-focused pilot projects developed before may have been problematized at this stage. However, if at all, citizens have only been empowered to participate in the shaping of urban policies in a very tightly defined way. Their role, even in the 'finding places' project, has been limited to providing suggestions which the municipal specialists would essentially be free to ignore. There have also been very few examples of co-operations between the municipality and civil society organizations. The funding of an art-meets-smart-city-visioning workshop via the city's cultural funds in August 2016 (www.ada-hamburg.de/english/) remains a rare exception.

4.2.4. Cognitive elements

Since 2014, Hamburg has been presented in some particularly pronounced statements of the lord mayor and the mayor for economic affairs as being on the way to becoming Germany's primary smart city. This positioning of Hamburg as a prime mover also reflects a perception that Hamburg is particularly well prepared to benefit economically from proactive digitization activities (Stadt Hamburg, 2016). The port is often presented not only as an economic backbone of the city, but also as a symbol of a place-specific need and ability

to embrace change and to innovate. However, the decline of freight turnover associated with economic crises as well as increasing concerns about ecological and social costs (noise) of the inner-city port have recently seemed to contribute to the emergence of some debate about the primacy of the port in Hamburg's future economy, which has long been taken-for-granted.

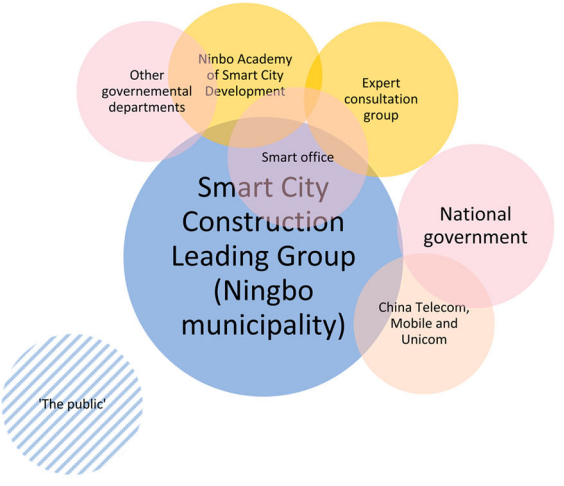
Visions of a flourishing digital economy now often refer to a rich endowment of the city state with universities and other organizations which may contribute targeted research and development activities through social learning and upscaling. The media sector, which has a long and strong tradition in Hamburg, and a young and emerging gaming industry are mobilized to make such visions compelling. As described above, however, this has not (yet) resulted in a systematic and continuous cooperation between the municipality and small enterprises or civic organizations. This may reflect a perception that smart city experiments need to be fostered through huge private investments, which can only be mobilized by large organizations. However, as it has since been decided that Hamburg will develop an integrated multi-sectoral data infrastructure under the complete control of the state and without any dependence on commercial investments, the clear focus on large commercial partners, as evident in the past, may already be history or very soon become so.

4.3. Ningbo

The City of Ningbo is the second largest city of Zhejiang Province in East China. It is also the most significant port city of the province, located in the south-east of the Yangtze River Delta. As a sub-provincial city, it comprises of six main urban districts of Ningbo City, three satellite cities and several rural counties in its administrative region (Tang, Chan, & Griffiths, 2015). According to the 2015 census (Ningbo Municipal Statistics Bureau, 2015), the overall population of the entire administrated area reached 7.8 million. As a second-tier city in China, Ningbo has gone through substantial development and redevelopment over the last two decades. Incorporating a multiplicity of national initiatives, such as 'low-carbon city', 'green city' and 'sponge city', into its urban development planning. Similarly, Ningbo became a pioneering city in Chinese 'smart city' construction (Figure 3).

4.3.1. Experimentation

Ningbo has been experimenting with finding its own strategic emphases for developing a smart city in a step-by-step process since 2010. The five-year plan 'Action Outline of Accelerating Smart City Development of Ningbo (2011–2015)' included the development of 10 application systems, covering logistics, manufacturing, trade, energy application, public service, social management, transportation, healthcare, residence service and cultural service) (The General office of CPC Ningbo municipal committee and Ningbo government, 2011). However, this all-embracing plan turned out to be too much; only three application systems have achieved significant progress, which are smart healthcare, smart transportation and smart education. The main driving force of the selection of these dimensions is likely shaped by the relevance of these focus areas for management-oriented government actors, as well as their already relatively matured development status at the city-level. In general, the platforms and models developed so far focus on centralizing previous fragmented data systems with the ambition to improve city management.



2010: Ningbo municipal party committee and the municipal government develop the first smart city strategy. Several new actors are established, including 'Ningbo Smart City Construction Leading Group', 'Ningbo Academy of Smart City Development' and 'Expert Consultation Committee'.

2011: The 'Action Outline of Accelerating Smart City Development of Ningbo (2011-2015)' is launched. The 1st Chinese Smart City Expo is held in Ningbo, jointly organised by eight central and provincial units, and operated by the local units (and has been held annually since after).

2013: The Ningbo International Smart City Research Centre is co-founded by the Ningbo Academy of Smart City Development and The University of Nottingham Ningbo China. Ningbo is named as one of the 15 pilot cities of China-EU smart city cooperation and wins the '2013 China Smart City promotion outstanding achievement award'. The Experience Hall of Ningbo IOT and Smart City is opened.

2014: The city wins the second place in the '2014 Top Ten China Smart City promotion outstanding achievement cities', and becomes the fourth in the top 50 China Urban Informatization cities; In the same year, Ningbo is elected as the '2014 China's Top Ten Smart City' (and again in 2015).

2016: Nearly 40 intelligent projects are signed during the 6th Chinese Smart City Expo. The total investment of the projects is nearly 20 billion Yuan (approximately 2.5 billion EUR). China Telecom and the Ningbo municipal government signed the "Thirteenth Five-Year Plan of Ningbo Smart City Development".

Figure 3. Ningbo: stylized actor constellation and timeline.

All three systems are operating at the scale of Ningbo's administrative area and each has its own smart experimentation platform. For smart transportation, the platform is virtual and consists of a smart phone app, called 'NingboTong'. It includes more than 20 public transportation services, such as taxi ordering, coach ticket purchase, parking location guidance, public bicycles (owned only by the public companies), query of the violation of the traffic law, etc. This is a centralized platform for all public transportation systems and is publicly accessible as a public service platform. For smart healthcare, 'Ningbo Cloud Hospital' platform represents a central system to store all personal medical records and enable all hospitals to have access to patients' records and details. The platform is partially publicly accessible for certain usage such as making online appointments with any of the public hospitals. For 'smart education', there is currently not much experimentation apart from one centralized online remote education platform, which is open to the public and integrates a centralized digital library and a life-long educational and digital learning platform.

Overall, all platforms in Ningbo are centrally managed and are aimed to act as measuring tools for better managing and monitoring the city and its citizens. The most significant of all is a virtual monitoring system run as a governmental management and regulatory platform. This platform is demonstrated in the exhibition hall of the 'Ningbo Smart City Science and Technology Museum' and is fully operating at a large scale, collecting data on a real-time basis and with regular updates and storage of data. The general public and private companies have no access to this data. The platform is mainly intended to measure a variety of factors to allow the governmental authorities and public companies to respond to them through a monitoring process. These factors include, crime, emergency occasions, car plate checks, speed checks, congestion situations, population density and environmental quality checks at the regional scale including the City of Ningbo and its surrounding areas and townships.

During interviews with planners and researchers from the Ningbo Academy of Smart City Development, interviewees expressed that several challenges have been identified in a review of smart city development so far, including limited public participation (which is mostly considered as a constrain to a wider diffusion of smart products and services); a lack of cooperation between different governmental sectors; and a lack of knowledge in utilizing big data collected from smart city platforms. Recognizing these challenges and learning from past experiences, the 'Thirteenth Five-Year Plan of Ningbo Smart City Development' was issued in 2016 (Ningbo Development and Reform Committee & Ningbo Smart City Construction, 2016), which features an emphasis on further promoting smart public service, incorporating city governance and management platforms, and promoting the innovative application of big data and internet industries.

4.3.2. Regulative elements

The move to experiment with smart city construction was depicted in the 2010 'Decision of Building Ningbo Smart City' as an imperative strategic measure for Ningbo to 'seize the future high ground and strive for the development of new advantages' (Ningbo municipal party committee and the municipal government, 2010). Hence, when Ningbo municipality launched the concept of smart city around 2010, there were no formal national policies or guidelines that could lead the city towards smart city construction, because the notion of 'Smart city' only appeared nationally in the 'State Council's Notice of Promulgating the Plan of Industrial Transformation and Upgradation (2011–2015)', issued in December 2011 (State Council, 2011).

Nevertheless, although Ningbo was a pioneering smart city, smart city development is very much nationally driven (Tan-Mullins et al., 2016). In September 2010, the Ningbo municipal party committee and the municipal government released the governmental policy of the 'Decision of Building Ningbo Smart City', followed by a five-year plan – the 'Action Outline of Accelerating Smart City Development of Ningbo (2011–2015)' – which is embedded in the national Chinese 12th five-year planning strategy. During these 5 years, Ningbo has launched 31 projects and 87 programmes, with a total investment amount of 40.7 billion yuan (US$6.36 billion) (The General office of CPC Ningbo municipal committee and Ningbo government, 2011).

Under the Chinese top-down governance system, Ningbo smart city development is led by the government and heavily relied on public actors. According to the 2010 decision to construct a smart city, Ningbo Smart City Construction Leading Group and a subordinate

office have been established to coordinate the overall development of smart city. Detailed works are carried out by the Smart City Construction Coordination Office, which is affiliated to the Ningbo Economic and Information Commission. To seek intellectual support for developing a smart city, an Expert Consultation Committee and the Ningbo Academy of Smart City Development have been established. The Academy is a deputy bureau level public institution under the management of Ningbo Smart City Construction Leading Group office, which is the first smart city specialized research institute in China that is directly managed by governmental sectors. Besides the leadership centre, related governmental departments from all administrative levels and major enterprises also play significant roles in the development of Ningbo smart city, which is well manifested in the implantation of specific projects.

4.3.3. Normative elements

Ningbo smart city is mainly driven by the government, with less of a role for the private sector and citizens. Private companies are currently not integrated with the city's operating overarching management platforms mentioned above. In the Sixth Chinese Smart City Expo held in September 2016 in Ningbo, Ningbo municipal government did sign an agreement on 'information economy and smart city construction related cooperation projects' with the three main communication operators (China Telecom, China Mobile and China Unicom). From the beginning of the smart city initiatives, these three major communication companies have sustained extensive and close cooperation on a variety of projects with the Smart City Development Leading Group. They are the members of the coordinating team of Accelerating Smart City Development of Ningbo City Action, together with municipal party committee units and several municipal bureaus, such as the Transportation Bureau, the Trade Bureau and the Education Bureau. Moreover, they are also one of the hosts of the Chinese Smart City Expo in Ningbo held every year since 2011, and signed cooperation agreements with the Ningbo municipal government on smart city development in Ningbo. However, these three companies who do play a major role in data collection and data usage are all Chinese state-owned communication companies Citizens, so far, have remained excluded from smart initiatives and at best figure as distinct targets of improved urban management.

In terms of normative priorities, most of the initiatives put priorities on economic and technological development, while few focus on social management and energy aspects. There is no clear indication of a focus on environmental aspects in the overall strategic framework of Ningbo smart city development. More importantly, the smart-branding approach is also representative for a wider underlying paradigm of Chinese city competition. The language used in Ningbo's institutional structure is supposed to strengthen Ningbo's role in the context of urban competitiveness, technological advancement and status development in the region.

4.3.4. Cognitive elements

The Ningbo government looked abroad and explored cases across the globe, such as in Singapore, the U.S. and the European context. These explorations were initially conducted to evaluate and learn from best-practices on smart cities. After the initial phase of evaluation, the Ningbo government found disparities between the other cases and the Chinese contexts, and therefore started the smart city development idea with a new conceptual

framework. The main factor was the significant difference between governance systems and policy contexts that cannot be simply adapted from one context to another. Moreover, China's rapid rate of urbanization poses a different set of requirements compare to the non-Chinese cases. Since the completion of the initial pilot programmes in Ningbo's smart development plan, the established authority structure plays a major role in testing procedures and setting-up technical platforms for monitory purposes. These procedures and platforms are seen as key in upscaling smart city initiates.

5. Cross-case comparison and discussion

In unpacking the institutional dimensions of smart city experimentation, we followed Scott's distinction between regulative, cognitive and normative institutional elements. Table 3 summarises the comparison.

Regarding, regulative elements, we want to highlight formal institutional arrangements that regulate social interactions, such as the legal framework and policies that enable cooperation. In Amsterdam the key entity is a PPP that allows a large array of actors to find one another easily. This results in informal cooperation but not in big legally binding commitments. Consequently, the pool of experiments is organized in a variety of legal entities ranging from citizen-driven cooperates to corporate-driven innovation projects in living lab in a loose institutional organization. In Hamburg agreements

Table 3. Cross-case comparison.

	Regulative	Normative	Cognitive
Amsterdam	Locally based public–private partnership to establish experiments with a variety of actors; ethos of informal collaboration ('Dutch polder model'); limited involvement of EU-level and national government and funding.	Explicit focus on sustainability; promotion of active citizenship and social inclusion; neo-liberal agenda of governing without government; presence of civil society organizations in informal networks.	The city as a highly dynamic innovation eco-system where entrepreneurship is rewarded and where successful experiments flourish and are upscaled.
Hamburg	City state-led process to establish experiments with system providers; involvement of local universities; coordination office with state authority; Port/HafenCity district as test-fields.	Municipality sees itself responsible for ensuring public interests (e.g. data safety, sovereignty); expert driven process; citizen-orientation emphasized, but little direct involvement of citizens in shaping experiments.	Visions of a flourishing digital economy fuel new collaborations between state, corporations and universities to enable social learning and upscaling, through public and private investments; Emphasis on attracting EU Horizon 2020 funding.
Ningbo	Embedded in national-level 12th and 13th five-year plan; strong focus on sectors that matter for city management (smart health, smart transport, smart education); only involvement of Chinese partners; coordination of actors by a centralized 'Smart City Construction Leading Group' at the municipal level.	Municipality sees itself responsible for data storage and data management; mainly driven by the local government; but with strong involvement of three state-owned Chinese communication firms; economic and high-tech development are prioritized; strengthening Ningbo's role in (inter)national urban competitiveness and status development; public participation is very limited at the current stage.	Initially strongly oriented on transnational learning from Singapore, US, Europe, but significant differences between governance systems led to a more particular Chinese orientation; 10 dimensions were considered in the first phase of Ningbo Smart City development (2011–2015) with three selected for further development.

between government and private sector actors were initially multiple and non-binding. In 2014, a formal Memorandum of Understanding was signed between the City and Cisco. More influential, however, was the passing of an official digitization strategy. Actors have attempted to embed smart experimentation much more in formal policy strategies, in which actual experimentation has become much dependent on success or failure in securing formal funding in EU support schemes. In Ningbo, finally, smart city development is firmly embedded in formal legal agreements early in the process, such as the creation of legal bodies of expert and advisory committees. In Ningbo, it was rather important to link up with national-level policy processes (Ningbo as one of China's key pilot smart cities) to secure public funds (either directly or through state-owned corporate involved), which then enabled a rapid growth of smart city experiments.

Regarding normative elements, we want to highlight norms, values and roles internalized in the behaviour of actors through socialization. Implicitly, the actor coalitions in Amsterdam, Hamburg and Ningbo all view their city as existing in a highly competitive environment of global cities. Smart city development is seen as a way to emerge on top in this struggle by signalling success to the outside world. It contributes to city branding and helps to attract knowledge workers and companies. Smart City initiatives are also seen as a way to foster efficient governance and therefore as socially legitimate. The main difference between the three cities is how they view this division of roles between citizens, governments and companies. In 'Amsterdam' 'the citizen' is much referred, and whilst this has been occasionally criticized, arguably on a general level, citizens' involvement is harnessed through the involvement of various civil society/bottom-up organizations in the informal networks sustained through ASC. In Hamburg, citizen involvement is said to be secured through the classical ideal of a representative democracy in which the state and the municipal government speak and act on their behalf, but with little direct involvement in ongoing experimentation. But for government stakeholders in a Chinese city like Ningbo, this conceptualization of the citizen or civil society in opposition to the government is alien. Instead, 'the people' are evoked as docile subjects whose lives are improved. Further use of terms such as 'people management' or 'social management' illustrates that no active notion of citizenship is implied in smart city experiments in Ningbo. Likewise, difference exists in terms of priorities of what smart cities should do. Whereas sustainability (and societal challenges more generally) is a key aspect in much of the rhetoric (and, at least compared to other cases, also in practice) in Amsterdam, Hamburg has re-framed its smart city strategy do a digital strategy, and in Ningbo sustainability is mostly disconnected from the smart urban development agenda, while laying emphasis much more on efficient city management.

Finally, regarding cognitive elements, we want to highlight the variety of logics that guide the actors in nurturing smartness and embedding it into the urban fabric. There are very different mental models at play that underpin how smart development is supposed to be up-scaled. Each of these models implies a particular actor coalition to take the lead in the process of experimentation and points to a distinct steering mechanism. In Amsterdam, the key metaphor is an eco-system: a broad and loose yet symbiotic coalition of actors initiating a large chaotic set of small experiments, it is not clear which actors and experiments will be successful in advance, but it is clear that the solutions demonstrated in successful experiments will manifest and its entrepreneurial initiators should be facilitated to scale up their experiments. In Hamburg, the idea of social learning

is crucial: experiments and learning processes are still open-ended and eventually lead to better mutual understanding between the actors as a way to upscale smart city development. Here the city state government plays a larger role than in Amsterdam. In Ningbo, a more conventional managerial model with even more central guidance underpins smart city development: experts at government agencies are seen as capable of steering smart city experimentation and of exercising direct effective control over the implementation of new technologies. These city managers select best practices, which are then to be rolled out throughout the city.

6. Conclusions

This paper asked how and why smart city experimentation differs across urban contexts, where we expected to find answers by exploring and comparing emerging institutional arrangements across three cases and their situatedness. Our analysis indeed has found that there are substantial differences in the ways in which smart urban experimentation is unfolding in relation to institutional dynamics. Moreover, the analysis suggests that there are place-specificities at play, though not necessarily only embedded in local or regional scales (such as particular economic and industrial foci, or the presence of particular knowledge institutes). Rather, each case is imprinted as much by what, arguably, are national characteristics, such as those visible in national governance styles and policy programmes. Examples hare are the 'polder-model' in the Netherlands, or the strong role of states and municipal governments in Germany, or the top-down style and the omnipresent presence of the national political machinery in China), or the ways in which citizen engagement in public affairs more generally is recognized in each country.

Likewise, in each case, strategic work to develop local institutional arrangements tapped into the wider institutional environments across national boundaries (such as EU-funding in Amsterdam and particularly Hamburg, and transnational learning in Ningbo). Indeed, the 'situatedness' (Karvonen & van Heur, 2014) of smart developments in each city has to be understood as co-evolving out of a (possibly unique) combination of dynamics at multiple spatial scales (Binz & Truffer, 2017).

Although it may appear tempting to contrast a Western European model against an Asian model, our findings do not warrant such a generic conclusion. One would rather recognize certain typical national features in each of the three city models: in Amsterdam, loosely coupled (semi) private sector initiatives are adopted by public authorities and given a rather loose public cloak as often happens in the Netherlands; in Hamburg public–private collaborative arrangements are given more structural and lasting, formally institutionalized shape; and in Ningbo, central government is at least officially setting local agenda in a top-down fashion, although unofficially the latter enjoy much practical discretion (Knill & Lehmkuhl, 2002; Pollitt & Bouckaert, 2011; Saich, 2015). Had we studied cities from other nations, such as France, Britain, South Korea and Indonesia, we would have found other models still. Two important qualifications are therefore in order. First, individual cities in each of these nations obviously do not operate all in exactly the same way: the different actors enjoy certain degrees of freedom within the bandwidth of their national institutional context and reflexes and they use such freedom often to strategically position their city as outstanding exemplars. Second, it is reasonable to expect that the variety of institutional arrangements far exceeds those of the three cities under

study here. Future empirical work should further demonstrate this variety and possibly make an attempt at coming to a certain typology based on quintessential features found in the various cases examined.

This paper has built upon Scott's institutional pillar's framework to analyse and compare smart city developments in three cities. Generally, this framework allowed to create a good understanding of how and why smart urban experimentation and their institutional arrangements are similar or different across urban contexts. We note here, however, that although we have used the framework in a somewhat dynamic way by analysing the ways in which institutional arrangements for smart cities developed in each case, the framework is essentially a 'static' framework. In other words, the framework does not have a well-developed conceptual apparatus of how and why institutional arrangements change, for instance because of lessons or controversies emerging out of urban experiments. Such a dynamic framework, however, could be further developed by building upon recent neo-institutional literatures such as institutional work (Lawrence, Leca, & Zilber, 2013). Specifically, this could entail a more explicit analysis of the strategies of actors to bring lessons from urban experimentation into, for instance, regulatory reforms, normative debates on smart urbanism, or mental models of upscaling.

Notes

1. See http://www.smart-eco-cities.org.
2. http://www.hamburg.de/buergermeister-reden/.

Acknowledgements

We would like to thank the participants of the 8th International Sustainability Transitions Conference (Gothenburg, 2017), the Ecocity World Summit (Melbourne, 2017), the workshop on Imaginations, Institutions and Transitions (Utrecht, 2017) and the 2017 conference of the World Interdisciplinary Network for Institutional Research (Utrecht, 2017), two anonymous reviewers and the editorial team for constructive feedback on earlier versions of this article.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This research has been kindly supported by the Netherlands Organisation for Scientific Research (NWO) with project number 467-14-153, the Deutsche Forschungsgemeinschaft (DFG) [grant number SP 1545/1-1], The National Natural Science Foundation of China (NSFC) [grant number 71461137005] and Dutch Academy of Sciences (KNAW) [grant number 530-6CD108].

References

ASC. (2017). Retrieved from https://amsterdamsmartcity.com/p/about

Baron, G. (2013). Smartness from the bottom-up: A few insights into the Amsterdam Smart City programme. *Metering International*, *3*, 98–101.

Binz, C., & Truffer, B. (2017). Global innovation systems – a conceptual framework for innovation dynamics in transnational contexts. *Research Policy*, *46*, 1284–1298. doi:10.1016/j.respol.2017.05.012

Blumer, H. (1954). What is wrong with social theory? *American Sociological Review*, *19*(1), 3–10. doi:10.2307/2088165

Bolívar, M. P. R., & Meijer, A. J. (2016). Smart governance: Using a literature review and empirical analysis to build a research model. *Social Science Computer Review*, *34*, 673–692. doi:10.1177/0894439315611088

Bond, A. (2017). *Smart eco-cities in France: Trends and city profiles 2016*. Exeter: University of Exeter (Smart-eco project).

Bulkeley, H., & Castán Broto, V. (2013). Government by experiment? Global cities and the governing of climate change. *Transactions of the Institute of British Geographers*, *38*, 361–375. doi:10.1111/j.1475-5661.2012.00535.x

Bulkeley, H., Coenen, L., Frantzeskaki, N., Hartmann, C., Kronsell, A., Mai, L., … Voytenko, Y. P. (2016). Urban living labs: Governing urban sustainability transitions. *Current Opinion in Environmental Sustainability*, *22*, 13–17. doi:10.1016/j.cosust.2017.02.003

Caprotti, F., & Cowley, R. (2016). Interrogating urban experiments. *Urban Geography*. doi:10.1080/02723638.2016.1265870

Caprotti, F., Cowley, R., Flynn, A., Joss, S., & Yu, L. (2016). *Smart eco-cities in the UK: Trends and city profiles 2016*. Exeter: University of Exeter (Smart eco project).

Carvalho, L. (2015). Smart cities from scratch? A socio-technical perspective. *Cambridge Journal of Regions, Economy and Society*, *8*, 43–60. doi:10.1093/cjres/rsu010

Coenen, L., Benneworth, P., & Truffer, B. (2012). Toward a spatial perspective on sustainability transitions. *Research Policy*, *41*, 968–979. doi:10.1016/j.respol.2012.02.014

Crivello, S. (2015). Urban policy mobilities: The case of Turin as a smart city. *European Planning Studies*, *23*, 909–921. doi:10.1080/09654313.2014.891568

de Jong, M., Joss, S., Schraven, D., Zhan, C., & Weijnen, M. (2015). Sustainable–smart–resilient–low carbon–eco–knowledge cities; making sense of a multitude of concepts promoting sustainable urbanization. *Journal of Cleaner Production*, *109*, 25–38. doi:10.1016/j.jclepro.2015.02.004

Evans, J., Karvonen, A., & Raven, R. (2016). *The experimental city*. London: Routledge.

Geels, F. W. (2004). From sectoral systems of innovation to socio-technical systems. Insights about dynamics and change from sociology and institutional theory. *Research Policy*, *33*, 897–920. doi:10.1016/j.respol.2004.01.015

The General office of CPC Ningbo municipal committee and Ningbo govenrment. (2011). *Ningbo Shi Jia Kuai Chuang Jian Zhi Hui Cheng Shi Xing Dong Gang Yao (2011–2015) ('Action Outline of Accelerating Smart City Development of Ningbo (2011–2015)') [宁波市加快创建智慧城市行动纲要(2011—2015)]*.

Gibbs, D., Krueger, R., & MacLeod, G. G. (2013). Grappling with smart city politics in an era of market triumphalism. *Urban Studies*, *50*, 2151–2157. doi:10.1177/0042098013491165

Glasmeier, A., & Christopherson, S. (2015). Thinking about smart cities. *Cambridge Journal of Regions, Economy and Society*, *8*, 3–12. doi:10.1093/cjres/rsu034

Hamburg Senate. (2015). Digital city strategy. Retrieved from http://www.hamburg.de/pressearchiv-fhh/4435132/2015-01-13-bwf-digitalisierung-der-grossen-stadt/

Hodson, M., Geels, F. W., & McMeekin, A. (2017). Reconfiguring urban sustainability transitions, analysing multiplicity. *Sustainability*, *9*, 299–319. doi:10.3390/su9020299

Hommels, A. (2005). Studying obduracy in the city: Toward a productive fusion between technology studies and urban studies. *Science, Technology and Human Values*, *30*, 323–351. doi:10.1177/0162243904271759

Howells, J. (2006). Intermediation and the role of intermediaries in innovation. *Research Policy*, *35*(5), 715–728. doi:10.1016/j.respol.2006.03.005

Karvonen, A., & van Heur, B. (2014). Urban laboratories: Experiments in reworking cities. *International Journal of Urban and Regional Research*, *38*, 379–392. doi:10.1111/1468-2427.12075

Kitchin, R. (2014). Making sense of smart cities: Addressing present shortcomings. *Cambridge Journal of Regions, Economy and Society*, *8*(1), 1–6.
Knill, C., & Lehmkuhl, D. (2002). The national impact of European Union regulatory policy: Three Europeanization mechanisms. *European Journal of Political Research*, *41*(2), 255–280. doi:10.1111/1475-6765.00012
Lawrence, T. B., Leca, B., & Zilber, T. B. (2013). Institutional work: Current research, new directions and overlooked issues. *Organization Studies*, *34*, 1023–1033. doi:10.1177/0170840613495305
Lawrence, T. B., Suddaby, R., & Leca, B. (2009). *Institutional work. Actors and agency in institutional analysis of organizations*. Cambridge: Cambridge University Press.
Luque-Ayala, A., & Marvin, S. (2015). Developing a critical understanding of smart urbanism? *Urban Studies*, *52*, 2105–2116. doi:10.1177/0042098015577319
May, T., & Perry, B. (2016). Cities, experiments and the logics of the knowledge economy. In J. Evans, A. Karvonen, & R. P. J. M. Raven (Eds.), *The experimental city* (pp. 32–46). London: Routledge.
McCauley, S., & Murphy, J. T. (2013). Smart growth and the scalar politics of land management in the greater Boston region, USA. *Environment and Planning A*, *45*, 2852–2867. doi:10.1068/a45307
MoU Cisco - Hamburg, Cisco International Limited & Free and Hanseatic City of Hamburg. (2014). *Memorandum of understanding between Cisco International limited and free and Hanseatic city of Hamburg*.
Ningbo Development and Reform Committee & Ningbo Smart City Construction Working Leading Group Office. (2016). *Ning Bo Shi Zhi Hui Cheng Shi Fa Zhan Shi San Wu Gui Hua ('The Thirteenth Five-Year Plan of Ningbo Smart City Development').*宁波市智慧城市发展"十三五"规划. [2016] 596. Retrieved from http://www.nbeic.gov.cn/art/2016/11/14/art_1013_985997.html
Ningbo municipal party committee and the municipal government. (2010). *Zhong Gong Ning Bo Shi Wei Ning Bo Shi Ren Min Zheng Fu Guan Yu Jian She Zhi Hui Cheng Shi De Jue Ding ('Decision of Building Ningbo Smart City')* 《中共宁波市委宁波市人民政府关于建设智慧城市的决定. Retrieved from http://www.pdxxh.gov.cn/pdxxh2010/content-402-4165.html
Ningbo Municipal Statistics Bureau. (2015). *2015 Nian Ning Bo Shi Chang Zhu Ren Kou Wei 782.5 Wan Ren (The resident population of Ningbo reaches 7.825 million in 2015) 2015*年末宁波市常住人口为*782.5*万人. Retrieved from http://www.nbstats.gov.cn/read/read.aspx?id=29005
Perkmann, M., & Spicer, A. (2008). How are management fashions institutionalized? The role of institutional work. *Human Relations*, *61*, 811–844. doi:10.1177/0018726708092406
Pollitt, C., & Bouckaert, G. (2011). *Public management reform: A comparative analysis – new public management, governance, and the Neo-Weberian state*. Oxford: Oxford University Press.
Raven, R. P. J. M., Ghosh, B., Wieczorek, A., Stirling, A., Ghosh, D., Jolly, S., … Sengers, F. (2017). Unpacking sustainabilities in diverse transition contexts: Solar photovoltaic and urban mobility experiments in India and Thailand. *Sustainability Science*, *12*, 579–596. doi:10.1007/s11625-017-0438-0
Saich, Y. (2015). *Governance and politics of China*. Basingstoke: Palgrave Macmillan.
Scholz, O. (2016a). *Grußwort zur Eröffnung der IT solutions*. Hamburg. Retrieved from http://www.hamburg.de/buergermeisterreden-2016/6872150/it-solutions-2016/
Scholz, O. (2016b). *Universitätsgesellschaft – Digitale Stadt Hamburg*. Hamburg. Retrieved from http://www.hamburg.de/buergermeisterreden-2016/5965618/2016-05-02-universtaetsgesellschaft/
Scott, W. R. (2008). *Institutions and organizations. Ideas, interests and identities* (4th ed.). Los Angeles: Sage.
Sengers, F. (2016). *Smart-eco cities in the Netherlands: Trends and city profiles 2016*. Exeter: University of Exeter (Smart-eco project).
Sengers, F., Späth, P., & Raven, R. P. J. M. (in press). Smart city construction: Towards an analytical framework for smart urban living labs. In S. Marvin, H. Bulkeley, Q. Mai, K. McCormick, & P. Voytenko (Eds.), *Urban living labs: Experimentation and Socio-technical Transitions*. Routledge.
Sengers, F., Wieczorek, A., & Raven, R. (in press). Experimenting for sustainability transitions: A systematic literature review. *Technological Forecasting and Social Change*.

Spaeth, P. (2017). *Smart eco-cities in Germany: Trends and city profiles 2016*. Exeter: University of Exeter (Smart-eco project).
Stadt Hamburg. (2016). *Hamburg – SmartCity – city for innovation (Broshure)*. Hamburg.
State Council. 2011. *Guo Wu Yuan Guan Yu Yin Fa Gong Ye Zhuan Xing Sheng Ji Gui Hua. ('State Council's Notice of Promulgating the Plan of Industrial Transformation and Upgradation (2011–2015)')[* 国务院关于印发工业转型升级规划*(2011—2015*年*)*的通知*]*. [2011] 47.
Tang, Y. T., Chan, F., & Griffiths, J. (2015). City profile: Ningbo. *Cities*, *42*(A), 97–108. doi:10.1016/j.cities.2014.10.001
Tan-Mullins, M., Cheshmehzangi, A., Chien, S., & Xie, L. (2016). *Smart-eco cities in China: Trends and city profiles 2016*. Exeter: University of Exeter (Smart-eco project).
Truffer, B., Murphy, J. T., & Raven, R. P. J. M. (2015). The geography of sustainability transitions: Contours of an emerging theme. *Environmental Innovation and Societal Transitions*, *17*, 63–72. doi:10.1016/j.eist.2015.07.004
Van der Laan, E. (2015). *A smart city is a city of people. Address to the smart city event 2015*. Amsterdam.
Vanolo, A. (2014). Smartmentality: The smart city as disciplinary strategy. *Urban Studies*, *51*, 883–898. doi:10.1177/0042098013494427
Van Winden, W., Oskam, I., Van Den Buuse, D., Schrama, W., & Van Dijck, E. (2016). *Organising smart city projects: Lessons from Amsterdam*. Amsterdam: Hogeschool van Amsterdam.
Wamelink, R. (2017). *NL smart city strategy. The future of living*. The Hague: Rehms Druck.