Bureaucracy meets digital reality: The unfolding of urban platforms in European municipal governments

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Abstract

The rise of digital technologies provides an opportunity to study smart cities as new organizational forms. We ask whether and how digital platforms and ecosystems affect the bureaucratic governance of municipal governments. To this end, we offer a multiple case analysis based on rich empirical, longitudinal data of seven European smart cities. We find that the contradicting logic of platform governance creates organisational tensions within the bureaucratic municipal government and at the interface between the municipal government and its external partners. We distil a process that describes how these tensions are resolved through a temporary shift to a non-bureaucratic work mode, and the subsequent formalisation and institutionalisation of those practices as new bureaucratic rules. We make three contributions. First, we contribute to the smart-city literature by outlining an overarching process of how data-driven technologies affect bureaucratic municipal governments. Second, we contribute to the ongoing conversation about the changing nature of Weberian bureaucracy showing how bureaucracy preserves its core while simultaneously adapting to and shaping its environment. Third, we highlight the role of lower-echelon bureaucrats as change agents who devise rules at the intersection of technological and societal development.

Keywords

smart city, digitalisation, digital platforms, ecosystems, bureaucracy, Max Weber, technology, change, innovation

Introduction

One approach to conceptualising smart cities is to view them as municipality-based platforms with surrounding innovation ecosystems (Appio, Lima, & Paroutis, 2019). The platform serves as the core structure and several city constituents – such as citizens, research institutions and private companies – form the surrounding ecosystem. This approach to organising has been labelled 'government as a platform' (O'Reilly, 2010, p. 13), with municipal governments serving as providers of digital technologies and city-related data with the aim of facilitating data-driven urban services and digital entrepreneurship (Barns, 2016; Barns, Cosgrave, Acuto, & Mcneill, 2017).

The promise of a more efficient organisation that enables economic value creation based on data has sparked the interest of many bureaucratically organised municipal governments. In Europe, 120 municipal governments[1] are implementing smart tools to enhance their services (EU SCIS, 2022). However, despite the scholarly attention recently paid to this phenomenon (Appio et al., 2019; Mora, Deakin, & Reid, 2019), we lack empirical investigations of the encounter between Weberian government-bureaucracy and this new organisational form (i.e. a platform and its ecosystem) (see Kornberger., Meyer, Brandtner, & Höllerer, 2017, for a notable exception). We also have few insights into how municipal governments cope with the tensions that arise in such contexts. As Alaimo (2022) emphasizes:

> Data objects [the aggregation of data and meta-data that form a new digital entity] and their technological infrastructure radically redraw the links between

> institutions and bring new modes of knowing and acting which crucially remake the space of individual and organizational agency. (Alaimo, 2022, p.1092)

To address this issue, we ask the following question: How do urban platforms and ecosystems affect the bureaucratic governance of municipal governments? More broadly, we aim to examine 'the extent to which decentralised management approaches [such as platforms] alter, replace, or reinforce bureaucratic authority systems' (Lounsbury & Carberry, 2005, p. 515). Given the lack of empirical studies on this phenomenon and the call for more research on public organisations in general (Arellano-Gault, Demortain, Rouillard, & Thoenig, 2013), we use an inductive multiple-case methodology (Eisenhardt, 1989; Eisenhardt & Graebner, 2007) to cross-examine seven bureaucratic organisations (i.e. municipal governments) in Europe. We document a process of organisational adaptation that deals with the decentralising principles of the government-as-platform approach, and depicts 'the changing nature of Weberian bureaucracy' (Kornberger et al., 2017, p. 181).

Our contributions are threefold. First, we contribute to the smart-city literature (Appio et al., 2019; Coletta, Heaphy, & Kitchin, 2019; Kitchin & Moore-Cherry, 2020) by outlining an overarching process of how 'data-driven technologies' influence 'the forms and practices of municipal government' (Kitchin & Moore-Cherry, 2020, p. 10). We show that senior officials provide the initial strategic impetus for platform governance projects, which is then significantly shaped by cross-functional project teams on the fringes of

bureaucracy. The logic of platform governance contradicts bureaucracy and thus creates organisational tensions within the bureaucratic municipal-government (official competencies) and at the interface between the municipal government and its external partners (official secrecy). We describe how these tensions are resolved through a temporary shift to a non-bureaucratic work mode inside the municipal governments, which encompasses experimentation and novel practices, and the subsequent formalisation and institutionalisation of those practices as new bureaucratic rules, roles, and processes.

Second, we contribute to the debate about the changing nature of Weberian bureaucracy (Byrkjeflot & Du Gay, 2012; Courpasson, 2000; Greenwood & Lawrence, 2005; Kornberger et al., 2017) in the context of smart cities (Pansera, Marsh, Owen, Flores López, & De Alba Ulloa's, 2022). Our data suggest that modern government bureaucracies are adapting to the changing environment while preserving their core. To increase their flexibility and innovativeness, bureaucracies have developed a repertoire of add-on possibilities, which include tasking teams with projects that reach across several functional areas and departments. In addition to enhancing flexibility, bureaucracies understand the importance of data for societal development. They combine their administrative capabilities with their regulatory competencies to design rules that inform and govern local data-driven innovation ecosystems with a particular emphasis on civil rights.

Third, we contribute to work on the changing nature of Weberian bureaucracy by highlighting the roles of upper-echelon bureaucrats as initiators of strategic change and lower-echelon bureaucrats as change agents who devise rules at the intersection of technological and societal development. We show that although the platform teams in our case studies were keen to collaborate with external technology partners, they were careful to retain control, and to ensure that technology did not 'interfere' in the shaping of society and democracy in the urban sphere. Thus, we observe that lower-echelon officers simultaneously serve as change agents and preservers of municipal bureaucracy.

Theoretical Background

Platforms and innovation ecosystems in smart cities

Digitization introduces a new relationship between the environment, technology and organisation (Mikołajewska-Zając, Márton, & Zundel, 2022). Digital platforms are the most "revealing instantiation" (Mikołajewska-Zając et al., 2022, p.1130) of this new relationship and can be defined as:

> Evolving organisations or meta-organisations that: (1) federate and coordinate constitutive agents who can innovate and compete; (2) create value by generating and harnessing economies of scope in supply or/and in demand; and (3) entail a technological architecture that is modular and composed of a core and a periphery. (Gawer, 2014, p. 1245)

Notably, this conceptualisation of platforms regards "technology as that by which organisation arises as a possibility" (Beyes, Chun, Clarke, Flyverbom, & Holt, p. 1003, 2022) instead of confining it to a tool that is being used by humans (Beyes et al., 2022). Due to their layered modular architecture, platforms often provide the technological core for innovation ecosystems. Multiple actors can connect to a platform through shared or open-source technologies and/or technical standards (Gawer, 2014; Jacobides, Cennamo, & Gawer, 2018). These actors increase the platform's value for its users because of 'the collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution' (Adner, 2006, p. 98).

Appio et al. (2019) suggest the application of the platform/ecosystem concept to the smart city.[2] Based on work by Hutchison, Bedford, and Bedford (2011) and Giffinger et al. (2007), their framework depicts platforms and ecosystems as the nexus between the physical infrastructure and the quality of life in smart cities. Conceiving of smart cities as urban platforms instead of just 'places' significantly shifts the ways in which cities might function (Bollier, 2016), due to the role of technology as a mediator of everyday life (Beyes et al., 2022). Municipal governments converge towards the role of platform provider in smart-city ecosystems because of their status as local authorities and as a result of the 'step change in urban data' (Kitchin, Maalsen, & McArdle, 2016, p. 93) generated by embedding digital technologies into urban infrastructure. By running their governments as platforms (Appio et al., 2019; Kitchin et al., 2016; O'Reilly, 2010),

municipal authorities seek to create a single core data structure (Kitchin et al., 2016) that software developers can access through standardised interfaces to build applications for citizens.

This approach to conceptualising smart cities extends beyond the idea of government smartness (i.e. capturing real-world data, using platforms to make the data accessible and available for data-based decision-making) (Gil-Garcia, Zhang, & Puron-Cid, 2016). Moreover, it emphasises co-creation and innovation in efforts to 'better solve collective problems at a city, state, national, and international level' (O'Reilly, 2010, p. 11). Thus, the government-as-platform approach to smart-city design embraces three core principles: transparency, participation and collaboration (O'Reilly, 2010).[3]

While the government-as-platform approach promises to create social, environmental and economic value in cities, some scholars question its relevance. The main critiques highlight the complexity of urban life and the inability of technology to accurately replicate reality (Hollands, 2008, 2015; Kitchin, 2015). Platform applications are not exact mirrors of reality – those working with the data construct their own visions of the city (Kitchin et al., 2016; Shaw & Graham, 2017). Consequently, the outcomes of government-as-platform projects depend on the people working on those projects and political circumstances (Coletta et al., 2019). For example, Peter and Meyer (2022) find that visionaries in African smart cities neglect the marginal poor and informal sector, as they wish to avoid the 'messiness' (p. 9) of African cities. Critics also stress that placing

digital affordances in the hands of a small group of software entrepreneurs may have a splintering effect on society (Hollands, 2008). Van der Graaf and Ballon (2019) describe the complex interactions between the multiple stakeholders as 'digital standoff' (p. 356) between city planners and application providers regarding who drives the design of future smart cities. Moreover, the effects of this process on municipal governments remains unclear (Kitchin & Moore-Cherry, 2020), with scholars suggesting wider structural changes and the generation of new modes of municipal governance (Kitchin, Coletta, Evans, Heaphy, & Mac Donncha, 2017). Given these critical voices, this paper sheds empirical light on how European municipal governments adapt their bureaucratic governance to accommodate urban platforms and their ecosystems, with a focus on tensions and organisational changes.

Bureaucratic organisations, platforms and innovation ecosystems

Weber (1921, 1976) introduced the *ideal type* of bureaucratic organisation in his seminal work *Wirtschaft und Gesellschaft*. He claimed that bureaucracies are technically superior to other organisations. Their rational and machine-like operations allow them to attain the highest degree of efficiency through precision, stability, reliability, unambiguity and strict subordination (Weber, 1946, p. 214). Authority and power are legitimised by law, and there are clear rules for exercising that authority that overrules actors' personal preferences. In addition, bureaucracy follows the principle of fixed and official competencies, which entails the explicit distribution of official duties – only people with

qualified competencies (i.e. experts) are given the authority to carry out official duties (Weber, 1946, p. 216). Bureaucracy also follows the principle of office hierarchy – a fixed system of superordination and subordination in which higher offices supervise lower offices. Management is based on written documents or files. These files, together with the continuous operations of the office, constitute the *bureau*. The recording and filing of official decisions are important devices for the practice of bureaucracy (Weber, 1946, p. 197).

Weber views bureaucracy as the most rational organisation of control. The source of this superiority lies in the control of technical knowledge and in the documented processes of how bureaucracies conduct their business (Weber, 1946, p. 214). These internal documents are kept secret and the concept of official secrecy is an important source of bureaucracy's prevalence. By dehumanising itself, bureaucracy – predictably and successfully – eliminates personal and emotional elements from business, thereby protecting itself from arbitrary actions.

Interestingly, while Weber regards technology as the 'pacemaker for bureaucratization' (1946, p. 213), digital technology has generated a shift towards networked organisational structures that foster knowledge-based work (Greenwood & Lawrence, 2005). Consequently, many scholars have proclaimed bureaucracy's downfall. However, bureaucracy might be more nuanced than previously believed (Adler, 2012; Adler & Borys, 1996; Kornberger et al., 2017).[4] For example, Courpasson (2000) finds that 'soft

bureaucracies' consist of structures of domination and legitimacy, which allow them to simultaneously pursue and control innovation. This suggests that the adaptability of bureaucracy has been underestimated (Gazell & Pugh, 1990). Moreover, some organisational scholars have criticised the oversimplified description of bureaucracy in the discourse concerning its end (Du Gay, 2005; Kallinikos, 2004).

In the empirical context of smart cities, some of the organising principles behind platforms and ecosystems seem to be theoretically at odds with bureaucracy. Decision-making processes are distributed among ecosystem members, who are loosely connected but interdependent actors (Jacobides et al., 2018). Innovation ecosystems rely on *openness* (Boudreau, 2010) and *generativity* (i.e. the ability of a self-contained system to produce something novel without input from the system's originator) (Cennamo & Santaló, 2019; Zittrain, 2008). By enabling generativity, platforms erode organisational boundaries (Yoo, Henfridsson, & Lyytinen, 2010), accelerating the extension of human organisation into the external sphere and thereby they transform the nature of managerial and social control (Mikołajewska-Zając et al., 2022). This requires a delicate balance between constraining actors to avoid value-decreasing activities and providing ecosystem members with enough autonomy to foster generativity (Boudreau, 2012; Wareham, Fox, & Cano Giner, 2014). A recent example of tight bureaucratic controls constraining citizen participation is Pansera et al.'s (2022) investigation of smart-city development in Mexico

City. Their findings suggest that bureaucratic and technocratic logics restrict the role of citizens to users instead of participatory co-creators of the urban sphere.

The extant smart-city and bureaucracy literature lacks a sufficient empirical focus on the adoption of the government-as-platform approach by municipal governments. Hence, we lack a clear understanding of *how* the distributed decision-making processes on platforms and ecosystems (Jacobides et al., 2018) affect municipal government bureaucracies. To fill this void, we inductively investigate seven bureaucratic municipal governments in Europe that tried to introduce the government-as-platform approach in their organisations.

Method

We followed the multiple-case methodology (Eisenhardt, 1989; Eisenhardt & Graebner, 2007). Specifically, we selected seven relevant cases and collected data from various sources within each case. We then undertook an in-depth within-case analysis for each case, followed by cross-case analysis (Eisenhardt, 1989). These analyses resulted in a 'process theory' (i.e. a common pattern of how an entity changes and develops;[5] Van de Ven, 2007) of how smart cities adopt platforms and how this changes their bureaucracies. We treated the cases as 'multiple experiments' to confirm or disconfirm patterns found in the other cases (Yin, 1994). As our findings are grounded in empirical evidence from

multiple cases, the resulting process (a pattern that is common across cases) should be more valid and generalisable than results from a single case study (Eisenhardt & Graebner, 2007).

Research context and sample

We studied municipal governments located in smart cities because these public organisations are well-suited for studies of organisational change infused by novel technologies (Greenwood & Lawrence, 2005) and, more generally, studies of the changing nature of Weberian bureaucracy (Arellano-Gault et al., 2013; Kornberger et al., 2017). We focused on the municipal governments of Munich, Lyon, Vienna, Rotterdam, Stockholm, Santiago de Compostela and Barcelona.

We adopted the following theoretical sampling strategy (Eisenhardt, 1989). First, we selected cases that fulfilled the criteria of Weberian bureaucracy to ensure that they fit our research focus (Eisenhardt, 1989). Based on interviews, archival data (organisation charts and other internal documents) and observations, we confirmed that all sampled cases had the 'core features of the bureaucratic form' (Adler & Borys, 1996, p. 61): 'hierarchy, workflow formalization, specialization' (p. 61) and legitimacy by law (Table I, available as online supplementary material). Second, we sought similarities within the set of potential cases that could aid in comparison and replication. All of the selected cities were supported by the European Commission's Horizon 2020 'Smart Cities &

Communities' programme, which distinguished them as leading European examples of smart-city initiatives (European Commission, 2018). The programme revolved around energy, urban, technical, financial and social 'smart' solutions, and emphasised big data, data management and digitalisation (European Commission, 2018). Finally, we sought heterogeneity to enhance representativeness in the sample and increase generalisability. We chose municipal governments in cities of different sizes, in different geographical contexts and with different starting dates for their platform-projects. The characteristics of the municipal governments are summarised in Table II (available as online supplementary material).

Data collection

Our data collection stretched over three years. We used different data sources: semi-structured interviews, e-mails, follow-up calls, archival data and observations (see Table 1). The bulk of our data came from semi-structured interviews with informants directly involved in government-as-platform projects in smart cities. The archival data and the observations expanded our understanding of each case and the broader context and offered insights that corroborated or rejected our interview findings (Yin, 1994).

Interviews. We conducted a total of 76 semi-structured interviews between August 2017 and August 2020. Of the interviewees, 73 were directly involved in the design and development of the government-as-platform projects. Three were independent experts on

urban-data platforms with extensive experience in European government-as-platform projects who were able to corroborate our findings. We talked to people across varying levels and disciplines, including officers responsible for: (1) the technical development of the urban platform, (2) urban planning, (3) use-case development, (4) energy and (5) transportation. To include the most knowledgeable informants, we used a 'snowball' technique in which we asked each initial informant for recommendations on additional interviewees. The interviews lasted an average of 80 minutes, and they were recorded and transcribed verbatim. The interviews were undertaken in German, Spanish and English. We wrote the case notes within 24 hours of each interview (Eisenhardt, 1989; Miles & Huberman, 1994).

Our interview protocol revolved around tensions related to collaboration, organisation and data privacy. Notably, we did not directly ask about tensions. Rather, we started with general questions (Spradley, 1979) about the informant's role in the city, and about the project, their tasks and their relationships with employees in other departments. We encouraged respondents to wander freely in their narratives and probed whenever possible. After each interview, we assessed the interview protocol and re-designed some of the questions. We continuously and systematically iterated between analysis and data collection in order to become increasingly focused in our interviews (Glaser & Strauss, 1967). We conducted additional and follow-up interviews until we achieved theoretical saturation (Strauss & Corbin, 1990).

Archival data. We gathered written documentation from the municipal governments and their project partners to corroborate our findings. We collected internal documents, such as presentations, studies, press material, project books and other deliverables for the European Commission. In addition, we gathered materials that the cities distributed externally, such as press articles, presentations, websites and other publicly available material. In the project's initial phases, we used these materials to confirm the informants' reports about the bureaucratic nature of their organisations. In later phases, we used this archival data to corroborate data from the interviews and to identify other avenues worth exploring.

Observations. Between September 2017 and October 2019, we observed city-internal workshops, cross-collaboration workshops, meetings of representatives of all Horizon 2020 projects and telephone conferences. We also observed knowledge-exchange meetings organised by the European Commission with focus groups working on topics such as data platforms, the digital twin (i.e. a three-dimensional model of the city), smart energy and smart mobility. We documented our observations in writing and engaged in numerous informal conversations regarding the municipal governments' views on platforms in smart cities.

Insert Table 1 about here

Data analysis

Our analysis followed a systematic and iterative approach in line with Glaser and Strauss (1967) and Miles and Huberman (1994). We moved back and forth among the data, emerging patterns and extant literature to better understand the organisational challenges faced by the municipalities during their platforms' unfolding.

First, we analysed the data by building individual case studies synthesising the interview transcripts and archival data (Eisenhardt, 1989). To categorise the raw data, we followed a technique suggested by Van Maanen (1979) in which we coded the interview data using in vivo codes (i.e. first-order codes composed of language used by informants) or descriptive phrases when in vivo codes were not available. This allowed us to gain initial insights into the challenges associated with coordinating different stakeholders, collaborating on tasks without clear goals, and dealing with issues like data quality and data privacy. Two researchers independently coded all interviews. Coding discrepancies were resolved through discussion, which occasionally involved a third colleague as a moderator.

Second, we searched for links among the first-order concepts. This enabled us to group the first-order concepts into second-order themes. A crucial aspect of this inductive analysis was that the codes emerged from the data rather than from pre-defined hypotheses (Strauss & Corbin, 1990). The preliminary results of this stage were shared

with several trusted senior-level respondents in order to incorporate their views. This within-case analysis focused on describing the process experienced by each individual municipal government.

Third, we moved from within-case analysis to cross-case analysis. Using standard cross-case analysis techniques (Eisenhardt, 1989; Miles & Huberman, 1994), we searched for similar concepts and categories by comparing the second-order themes of each case. We also compared case pairs to identify similarities and differences (Eisenhardt, 1989). Similar themes were aggregated into dimensions, which served as the building blocks of the emerging framework. To label these dimensions, we looked for similar descriptions of organisational challenges, tensions and potential solutions. To achieve interrater reliability, we involved a second researcher, who probed the labels, and occasionally a third colleague as a moderator. Disagreements were resolved through discussion and additional rounds of probing until the coders reached agreement. We refined emerging relationships by revisiting the data to determine whether each case demonstrated the same pattern, using charts and tables to facilitate comparison (Miles & Huberman, 1994). The process was iterative and lasted five months. The coding structure is illustrated in Figure 1.

Insert Figure 1 about here

Findings

We investigated how a platform and its surrounding ecosystem (i.e. government-as-platform) affected municipal government bureaucracy in seven European smart cities. Despite some practice-differences among the cases (e.g. outsourcing the technology versus developing it in-house; see Table III available as online supplementary material for more information), we observed an *overarching pattern*. Specifically, we uncovered a process on the fringes of bureaucracy through which municipal government officers resolved organisational tensions arising from the bureaucracy-opposing features of platforms as well as the subsequent institutionalisation of new roles, rules and processes to incorporate urban platforms in municipal bureaucracies (see Figure 2).

First, project teams were tasked by upper-echelon officials with projects (i.e. designing urban platforms) that reached across the functional areas of bureaucracy. Second, these teams identified platform features that enhanced or contradicted bureaucracy. Third, tensions arose from dealing with the poorly fitting platform features. Fourth, the tensions were resolved through a temporary shift to a non-bureaucratic work mode. Finally, new roles, rules and processes were developed to 'marry' the new logic of platform governance with the bureaucratic organisation. These new rules were then swiftly institutionalised via written files — one of the most important tools of bureaucracy.

Insert Figure 2 about here

In the following sections, we elaborate on our findings. In line with the comparative case-study method, we do not present individual case narratives. Instead, we structure the findings around the overarching pattern (i.e. the concepts and the process we observed) (Eisenhardt & Graebner, 2007). We present key evidence in two forms: a) 'power quotes' in the text, which are compelling bits of data that serve to illustrate a point, and b) 'proof quotes' in tables (see Tables 2a-2e), which provide evidence of the point across the cases (as advised by Pratt, 2008). We determined the strength of the evidence for each code and case (i.e. strong, moderate, weak) by assessing its frequency as well as the tone used by informants, and we corroborated this evaluation with archival and observational data. Examples of how we assessed the strength of the evidence can be found in Table IV (available as online supplementary material). Finally, to further illustrate the process for an individual case, we present an example of an unbroken narrative for Munich in Table V (available as online supplementary material).

Government-as-platform project initiation: Top management's strategic impetus is picked up on the fringes of bureaucracy

> If you really want to develop an urban platform that is used by the whole municipality, you must develop it across functions. (C2)

The initial strategic decision to pursue a government-as-platform approach was made by the municipal governments' top management with the aim of building a digitally

enhanced backbone for decision-making processes. However, despite the approval of these projects, their scope and details were not further defined. Instead, responsibility for the government-as-platform projects was passed down to lower-echelon officials. Subsequently, these bureaucrats took the initial steps towards the projects' realisation through the creation of cross-functional teams. In Vienna, officers from the IT department formed a team with officers from the energy department. In Lyon, a small data-specialist team inside the municipal government joined forces with the urban planners of the Lyon Confluence project. While Vienna and Lyon did not initially hire additional staff to handle the platform's development, Munich created a team consisting of new and existing officers. The teams differed in size but typically did not include more than seven members. Larger teams generally included more than two functions (e.g. IT specialists, urban planners, energy experts).

Notably, the change towards 'government as platform' happened on the fringes of municipal bureaucracy. Upper-echelon bureaucrats provided the initial strategic impetus, but the project teams were generally composed of lower-echelon officers who had little hierarchical power. Thus, the teams had to rely on their ability to convince powerful officers within the bureaucracy of the relevance and legitimacy of the initiative.

Platform features that enhance bureaucracy: Data centralisation and system integration

From the interviews with the project teams, we identified two platform features that enhanced the municipalities' bureaucracy. The informants repeatedly emphasised the importance of data as a tool that fosters the core bureaucratic principle of *impersonal authority*. By centralising the data on the platform, municipalities created 'a joint map of the data' (C7). This increased the information available to government officers, who could use it 'to make strategic decisions for tomorrow' (B4). Most importantly, the ability to cite data points as the basis for decisions and use data to measure key performance indicators helped to legitimise actions, thereby fostering impersonal authority.

Moreover, in the spirit of bureaucracy, municipal government officers aimed to leverage platform technologies to increase *efficiency* by integrating the IT infrastructure into a single digital platform. As stated by the team leader for data services in Munich:

> The city has developed a strategy for the different departments to run and implement their own digital solutions. It is important that we integrate those solutions into the new platform. (A1)

Efficiency was enhanced by upgrading the physical and digital infrastructure by installing 'a number of different sensors' (E2) around the city. In Munich, for example, sensors

were integrated into ‘intelligent lampposts’ (A2). In Lyon, they were used to measure energy flows in a new zero-energy district.

Platform features that contradict bureaucracy: Generativity and stakeholder alignment

> This agile and open innovation process is unique and not very typical for our city. (E1)

The project teams also identified two platform features that clearly contradicted bureaucracy. The bureaucratic municipal governments lacked the processes and experience needed to enable the platform feature of *generativity*. While it was important to co-create innovative services together with external and internal partners to build a ‘community of knowledge’ (D1), the platform teams did not know where to start. Informants stated that they ‘did not know what to do’ (D2) because they were not accustomed to this type of work. Participants emphasised that they were ‘experimenting’ (A1, C4):

> The platform will not deliver the use cases by itself. We need to figure out which data are interesting and what we want to use them for. (C3)

One data specialist stated that the municipality’s official bureaucratic processes made it ‘much more difficult’ (D2) to find the right people. Moreover, even when the right partners were identified, it still took ‘a lot of time’ (D2) to determine how to structure and manage a use case. A project manager in Barcelona added that it was difficult to decide

which use cases ‘made sense’ (G3). A project manager in Stockholm explained that the departments were not asking the right questions (e.g. ‘How do we collect data so that they support our use case?’) because city officials were ‘not accustomed to working like that’ (E1).

Another feature of platform governance that respondents found at odds with their municipal bureaucracies was that of *aligning* stakeholders. A data officer explained:

> There are so many stakeholders, and we are not able to assemble all of them in one room. Therefore, we are trying to act as the interface for everyone. (A3)

The task of finding solutions to ‘bigger problems’ (B1) required the coordination and alignment of actors from multiple departments. While the municipal government officers hoped the platform would facilitate coordination, it proved difficult to align multiple parties. Our respondents emphasised that they could not ‘give orders to other departments’ (D2) to ensure alignment. Similarly, a data-services officer stated that ‘we are stuck in discussions, and we do not even know what we are talking about’ (A5). Another informant highlighted confusion about ‘how to provide all of the information to the right people at the right time’ (G3). A data-services officer from Munich further outlined this issue, stating ‘coordination becomes more complex, and we have to invest more time and resources into coordinating all of the partners’ (A3).

Emerging organisational tensions

> Two worlds are colliding: the rapid speed of digitalisation and the municipality with its rules. (A1)

While the platform teams realised that the platform requirements for generativity and horizontal alignment conflicted with the bureaucratic structures, they were still surprised by the practical difficulties of overcoming this discrepancy. The lack of alignment between bureaucratic structures and platforms surfaced as a pair of organisational tensions. Not only was internal collaboration among departments obstructed by the bureaucratic principle of official competencies, but official secrecy also prevented municipality officers from pursuing projects with external partners that were not part of the official procurement and outsourcing process.

Official competencies obstructing internal collaboration

Convincing other municipal departments to collaborate on the platform proved difficult for two reasons. First, municipal government officers were mainly focused on their areas of expertise and their official roles. Our informants referred to these departmental separations as ‘silos’, as there was ‘a lot of resistance to working together’ (G4). In the silo structure, every department had its own budget and its own internal processes. Therefore, the departments coexisted but were independent from each other. A senior official from Stockholm explained:

> What we saw as a challenge was [that] the city departments were not used to getting together to create common solutions to their common problems. (E3)

Members of the platform teams explained that other departments did not see a need to support the platform's development. Data officers from Vienna suggested that this was due to the lack of an 'official mandate' requiring other departments to engage in the project. Departments not originally part of the platform team were often quick to state that 'this is not our responsibility' (A5, C2). As each department focused on its own function and area of expertise (A5), the joint development of use cases or applications for the platform was viewed as 'intrusive' (A1).

Interestingly, many departments began to develop their own platforms and did not see a reason to join the larger platform project (A4). Respondents from Stockholm and Barcelona explained that this was a question of 'funding and resources' (E1, G4). The departments were unwilling to contribute resources to a project they did not feel would directly support their functions. Some informants said it was 'typical' for 'everyone [in their organisation] to just do their own thing and not talk to each other' (A5, G5). One data officer explained that people were accustomed to working with their own tools and technologies (G4). He emphasised that an organisational culture change was needed to help people understand that integrated services in a holistic system could offer support instead of 'making their lives harder' (G4).

The second issue restricting internal collaboration was a lack of understanding of other departments' needs. This became evident when platform teams tried to develop cross-departmental applications. One respondent stated that the fact that one department's data could be useful for other departments was a 'revelation' (E7) to many in the organisation. The platform teams realised that the development of use cases and demonstration projects was more about identifying the needs and processes of other departments than addressing the technical challenge. In other words, the problem was related more to creativity (i.e. to designing solutions) than to technical skill. As described by one data specialist:

> Data, IT and technology are not important. It is more important to understand what you are trying to do and what your needs are. (E2)

Consequently, the platform teams were caught in a difficult situation. They could not develop prototype applications that might convince departments to support the platforms because they did not know what the departments needed or 'how they worked' (B3). At the same time, departments did not approach the platform teams to request new applications because they lacked an understanding of how the platform might deliver value to them (A2, C2). One data specialist discussed the situation in the municipal government in Barcelona: '[The project team] has come to a screeching halt because it has a million solutions and no one talks to each other' (X3).

Official secrecy blocking external collaboration

External collaboration was impeded by organisational tensions regarding official secrecy. First, departments resisted sharing their data with other departments and external partners (D2) because they regarded their data 'as their own assets' (G6) rather than a shared resource of the municipal government. This caused problems for the platform teams trying to develop new solutions that required data inputs from multiple departments:

> We call it 'data hogging'. People [inside the municipality] are hogging data because they do not see the purpose of others using their data (D2).

One data specialist explained that some departments saw no reason to collaborate with external partners, as they thought 'maybe *we* can build an application or earn money from this' (D2). Another cause of the resistance to data sharing was an unwillingness to accept standardised data formats. Some departments felt that because 'we own the data, we can define how we share it' (E1). These tailor-made solutions for data formatting allowed each city to address the individual needs of its departments. However, they reduced the ability of technology companies to offer scalable, standardised solutions, thus making smart cities a less attractive business case for them. A representative of a large multinational technology company stated: 'It is very difficult for us to support these cities in an efficient way' (G7). For instance, Stockholm decided to use only a fraction of the functions embedded in its platform, which was designed by a large technology partner. A

representative of the technology partner indicated that this decision created tension: ‘our whole approach to smart cities has changed’ because ‘we could not implement a one-size-fits-all solution’ (E5).

Second, the municipality departments were concerned about potential violations of data-privacy standards. One data officer stated that even when departments were convinced to share their data, they were concerned about compliance with data-privacy regulations: ‘The data that include interesting information are difficult to share’ (G3).

In fact, the biggest challenge in relation to privacy regulations was whether the aggregation of different types of open data could lead to breaches of privacy. A data and technology specialist explained that this ‘purple Lamborghini problem’ prevented officials from sharing data with external partners:

> When you know, for example, that Michael Jackson always visits a particular restaurant at a particular time and you observe that there is always a purple Lamborghini parked somewhere around that location, then you know that Michael Jackson drives a purple Lamborghini. (D2)

This statement highlights how the combination of seemingly impersonal data points can generate highly personal information. While this might seem like a minor problem given people’s willingness to share their data on social media, our respondents emphasised that the cities wanted to be perceived as ‘the good guys’ (A5) with respect to data protection.

They also wanted to set an example in data governance. The lack of legal frameworks created even more ambiguity, as the cities did not know which data they could share. The European Union introduced the General Data Protection Regulation (GDPR) in May 2018, which reduced this ambiguity, but many ‘shades of grey’ (C7) remained. The fear of misconduct inhibited the flow of information. For example, a special team of data-privacy specialists was established in Rotterdam to handle data-privacy ambiguity. The team adopted a conservative approach and advised colleagues to refrain from publishing ‘risky data’ (D2).

Moreover, the platform teams started to take back some of the tasks they had outsourced to technology companies because of inherent mistrust. Our respondents felt that they had to ‘ensure that the know-how is inside the city’ (C5) and that they could control the servers storing the data. They suggested that private companies might ‘treat data privacy rather lightly’ (B1), while municipal administrations had to ensure high standards of accountability with respect to data management. To this end, the cities went as far as blocking important private partners from their platforms. In Lyon, for example, an international software company unwilling to sign a data-usage agreement was blocked from accessing the software interface (B3).

A temporary switch to a non-bureaucratic work mode: Breaking away from the ordinary

> Have the courage to implement things and do not ask legal experts for permission – just do it and see what happens. (C4)

Our informants indicated that platform-team leaders decided to switch to a different work mode to resolve the tensions. While working at the fringes of municipal bureaucracy, platform teams switched to a non-bureaucratic work mode characterised by informal collaboration among the city's departments and an open network that included external partners.

To enable informal collaboration, the platform teams negotiated access to resources because they had 'no official mandate' (A5) to give orders to other departments. Confronted with the long-established silo thinking, the platform teams focused on showing the other departments how they could benefit from the platform. Their ultimate aim was to develop and demonstrate 'win-win situations' (C4) to ensure buy-in. For example, with the assistance of a business school, the platform team in Barcelona calculated how much time and money the municipality's departments could save by storing information in a central data repository on the platform. They asked the departments to invest some time and resources in harmonising and standardising their data in order to profit from considerably leaner processes in the future: 'The role of the

data office is to break through the municipal government's silos to extract and derive value from data for all departments' (G4).

Another example was discussed by the senior director of the Environment and Health department in Stockholm, who was working on a smart-lighting project. High-ranking city officials could not be convinced to collaborate because 'the old system had worked fine for literally 100 years' (E3). However, the director succeeded in convincing the city's governing body to grant his team a small area in which to demonstrate the application of smart lightning using funds provided by the European Union. The demonstration won the local government over, and it 'decided to change most of the streetlights' (E3) because of the considerable energy savings. The informant summarised the new way of working: 'Most of our work involves persuading people from other departments to work with us'.

The second strategy that platform teams pursued to enable informal collaboration was empowering lower echelons by educating them. For example, they facilitated knowledge exchange among the different departments and organised workshops with 'everyone in the room' (A1). This strategy of 'educating the people' was possible because the platform teams 'did not have to ask the mayor for consent every time' (A5), which created flexibility. The platform teams started by presenting potential use cases to forward-thinking department officers 'who were motivated' (A5) to join digital projects. After these gatekeepers were convinced, the platform teams presented the use cases to the departments that needed to be involved. Furthermore, the teams sought to demonstrate

theoretical use cases in cross-departmental workshops, which highlighted the platforms' potential to improve the organisational workflow. After a basic understanding of the platform and its role as an enabling tool that made use cases 'feasible' (E2) was established, people became more willing to engage. Empowered by new knowledge and the informal working-group set-up, people started developing their own ideas.

Some ideas could not be realised without involving external stakeholder groups, such as sensor providers and the 'community' (A1) (i.e. citizens). Therefore, the platform teams fostered an *open network* in order to engage external partners and citizens in value co-creation. For example, the platform team in Stockholm was 'dependent on external consultants' (E4). Barcelona also chose to 'open the ecosystem and have conversations with big and small companies' (G4). Our respondents described these collaborations as innovative and different from usual routines. This experimental mindset allowed them to 'try out new things and find what worked' (D2) without facing severe consequences for failure. In Munich, the platform team focused on collaborating with start-ups, which they perceived as more innovative than big companies (A5). Respondents from Rotterdam, Lyon and Vienna described similar attempts to foster open networks.

Another important pillar of the open network was citizen engagement. For example, the platform team in Munich used a group of 15 citizens that emerged from citizen-participation events as a sounding board on issues related to data protection in the city.

Notably, younger citizens were more open to sharing their data, while some older citizens had concerns, and emphasised that they did not want cameras or other kinds of surveillance (A5). Such community involvement was important for building trust between the municipal government and the public: 'Trust is the key ingredient for getting stakeholders on board' (D5).

In Lyon, the inhabitants of zero-energy buildings were open to the idea of sharing building-performance data (B1). Munich and Vienna stood out from the other the cities, as they engaged with their citizens via workshops and interviews. One data officer described Munich's approach:

> We wanted to know what our citizens thought were important data points that we could measure using our sensors. They were interested in traffic and air pollution – they wanted to take the fastest and cleanest route to work. … They did not want us to collect video-surveillance data. (A2)

In Vienna, workshops were held to increase acceptance of the collection of performance data from refurbished buildings, and to explain how the data would be collected and used. In addition, the municipal government collaborated with a local business to set up an open space near the refurbished buildings, where discussions on the data-collection issue could be held. The space was open for walk-ins during specific times, and the municipal government used it to report developments and decisions directly to the citizens.

Institutionalisation: The engine of bureaucracy

The temporary switch to a non-bureaucratic work mode characterised by informal collaboration and open networks allowed the platform teams to resolve the tensions related to official competencies and official secrecy. The bottom-up solutions developed through informal collaboration among the lower echelons were formalised and were subsequently institutionalised within the municipal bureaucracy. Institutionalisation was enabled through the establishment of new rules, processes and roles, which were recorded in writing. The new written rules and processes could guide and coordinate interactions, thereby allowing the platform teams to break with early problematic routines of 'going up the hierarchy to get support and down the hierarchy to collaborate with other departments' (A2). In addition, new digital innovation and data-governance roles were established, including 'process owner' (Rotterdam), 'data steward,' (Vienna) and 'data advisor' (Rotterdam). These new roles elevated initial, small-scale strategic efforts to an institutionalised, 'official' part of the municipalities. Those in the new roles worked in close collaboration with the platform teams and served as an enabling structure within the municipal governments. Top-level support was also key (C7) ('You need to make sure that the politicians support you because they also have the power to block you' (C4)), and our respondents indicated that the upper echelons' backing support for new leaders with new titles, such as 'chief innovation officer' and 'chief digital officer', helped to

legitimise their roles in the municipalities. In fact, the platform teams gradually moved from a peripheral, 'alien' (A2) position within their organisations to centre stage.

Moreover, data protection and data quality were ensured through clear accountability. This involved the development of new governance rules describing access rights to the data stored on the platform. In all of the municipal governments, only the data owners had unlimited access the data. Other departments that needed data for their operations had the next level of access. In some cases, external users could access the data, but only after submitting a request. Municipality officers with formal expertise in data management then checked whether the external parties' requests fit with the precisely defined data-usage rules. For example, Munich developed a 'data-gatekeeper' concept in collaboration with a leading research institution. The concept included detailed guidelines about data classification, data formats, data ownership and access rights.

Discussion

In this study, we examined how the decentralised governance of urban platforms affects municipal-government bureaucracy. We sought to address a call from organisational scholars to study public organisations (Arellano-Gault et al., 2013) to develop a better understanding of the changing nature of Weberian bureaucracy (Kornberger et al., 2017) under the influence of decentralised management approaches (Lounsbury & Carberry,

2005) and data-driven technologies (Kitchin & Moore-Cherry, 2020). Based on empirical data from seven smart cities in Europe, we showed that a government-as-platform approach to organising simultaneously challenges and reinvigorates bureaucratic organisations.

Our first contribution is to the smart-city literature on urban platforms (Appio et al., 2019; Coletta et al., 2019; Kitchin & Moore-Cherry, 2020). *We outline an overarching process of how 'data-driven technologies' affect 'the forms and practices of municipal government'* (Kitchin & Moore-Cherry, 2020, p. 10). We show that government-as-platform projects are initiated by strategic directives from high-ranking bureaucratic officials. However, the power centre's will does not simply propagate from top to bottom as one might expect from a classical bureaucracy. Instead, it is picked up and significantly shaped by cross-functional project teams operating on the fringes of bureaucracy. We then describe how the lower echelons steer municipal governments towards an adapted form of bureaucracy by experimenting with new ways of working and institutionalising some of those methods in new governance rules. We identify several platform features that reinforce the bureaucratic principles of impersonal authority and efficiency and demonstrate that other features related to managing the ecosystem create tensions within municipal governments. To address these tensions, the platform teams temporarily switch to a non-bureaucratic work mode inside the municipal governments, which encompasses experimentation with novel practices. The subsequent formalisation and

institutionalisation of those practices as new bureaucratic rules, roles and processes for platform-based collaboration leads to an adapted form of bureaucracy (platform-assisted bureaucracy), which allows for internal and external collaboration while maintaining stability through tight controls.

These bureaucratic controls constrain the influence of tech-savvy individuals (e.g., software entrepreneurs, IT specialists) on the development of urban platforms, thereby addressing a major critique of urban platforms (Coletta et al., 2019; Hollands, 2008; Kitchin et al., 2016). Our findings suggest that the role of technology companies in shaping the urban sphere seems to be over-estimated by some smart-city scholars (e.g. Hollands, 2008; Van der Graaf & Ballon, 2019). Contrary to existing smart-city research, we were not able to identify empirical evidence that portraited government-as-platform projects as 'divorced from actually existing urban politics' (Barns, 2016; Shelton et al., 2015) and vendor-oriented visions of ICT-led urban growth (Barns, 2016; Hollands, 2008). Scholars have also criticised the limited or negligible role of citizens in the co-creation of smart cities (Coletta et al., 2019). However, our findings show that cities such as Munich and Vienna emphasised the role of citizens and leveraged the government-as-platform approach to jointly develop new solutions with citizens.

Furthermore, our results describe how municipal governments take an active stance regarding the issue of open data. While Barns (2016) describes a process in which open data is transformed from being central to citizen-empowerment to only serving

entrepreneurial activities, we demonstrate that bureaucratic officials implement control mechanisms to balance public and private interests. Moreover, our results suggest that the government-as-platform approach is influenced by institutional norms and individuals' decisions, which relates to the study of Dashboards by Kitchin et al. (2016). Like the authors of this study, we observe that the building of the government-as-platform approach was shaped by the wider institutional landscape, and by complex social and economic constraints and power geometries. Finally, our findings support previous empirical results in the smart-city literature that outline the slow pace of change in municipal governments because 'city administrations are to a degree like an oil tanker' (Kitchin et al., 2017, p. 279), with bureaucratic departmental silos making it difficult to collect and locate data (Kitchin et al., 2016). We add to this stream of research by defining the root cause of this (perceived) inertia and describing how project teams were able to overcome these organisational challenges.

Our second contribution is to the ongoing conversation about the changing nature of Weberian bureaucracy (Byrkjeflot & Du Gay, 2012; Courpasson, 2000; Greenwood & Lawrence, 2005; Kornberger et al., 2017). *We explore and document how Weberian bureaucracies preserve their core while adapting to a changing environment and shaping that environment* (e.g. by enabling and governing local innovation ecosystems).

In general, Weberian bureaucracies serve two major functions: (1) efficiency based on substantial procedures, hierarchies, staff and standards manuals (Adler, 1999); and (2)

legitimacy based on rule-bound bureaucratic processes designed to ensure procedural justice (Kallinikos, 2004). With regards to efficiency, our results suggest that bureaucracies have by now understood that they are not particularly well suited for adapting to environmental change. Therefore, they have developed a repertoire of add-on possibilities (i.e. enabling structures) (Adler & Borys, 1996) to improve their flexibility and innovativeness including, most importantly, cross-functional and temporary teams tasked with projects that reach across several departments. We describe how project teams and departments work together as well as what it takes for project teams to convince the decision makers in charge. With regards to legitimacy, municipal governments have apparently understood the importance of data not only for informing administrative processes but also as key aspect of civil rights and societal development. Therefore, they have integrated data governance into the municipal bureaucracy. In addition, they have combined their administrative capabilities with their regulatory competencies to design rules to inform and govern local innovation ecosystems, with a particular emphasis on civil rights. Our findings show that bureaucracy can remain flexible by 'reshuffling and re-assembling the roles and role patterns by which it is made' (Kallinikos, 2004, p. 13).

Moreover, our findings support Nelson's (2001) suggestion that 'non-hierarchical patterns can thrive' (p. 815) in bureaucratic organisations. We illustrate a process where bureaucratic officers engage in informal interactions with members of the municipal governments and stakeholders such as citizens outside of the organisation bypassing

bureaucratic structures. We therefore provide empirical evidence of how 'the informal organisation' (i.e. the project teams) deal with the paradoxical tensions and once these tensions are resolved, 'the formal hierarchy can codify the solution with minimal resistance' (Nelson, 2001, p. 817). In summary, our study not only describes how digital platforms affect bureaucracy, but also shows how bureaucracy 'strikes back' by adapting the platform approach so that it is coherent with its inner workings (a two-way street).

Finally, we *highlight the role of lower-echelon bureaucrats as change agents who devise rules at the intersection of technological and societal development*. We show that while the upper echelons approved or commissioned the government-as-platform projects, they did not define specific strategies or roadmaps. Instead, the projects became grass-root efforts driven by lower echelons. We note that the upper echelons played a dual supportive role: a) the concentration of high formal power at the top-management level of the municipal government bureaucracies (i.e. power awarded to organisational positions (Blau, 1964)) enabled strategic change (Greve & Mitsuhashi, 2007) by providing the initial impetus; and b) the upper echelons ultimately legitimised strategic change by formally acknowledging the new roles, rules and processes.

However, most of the work was carried out by lower-echelon officers, who adapted the existing bureaucracy in order to navigate the paradoxical organisational tensions. Therefore, our findings support and extend Greve and Mitsuhashi's (2007) work by showing that a high concentration of formal power triggers change. However, the

direction of change is determined by lower-echelon bureaucrats with low formal power, and by bureaucracy's core principles. Moreover, our research provides insights into the interplay between agency and structure (Tomaselli, Ebbers, & Torluccio, 2022) by outlining the two sources of legitimacy that elevate the new rules, roles and processes designed by the project teams to an adapted form of bureaucracy: the actions of bureaucratic senior officials (agency) and the legitimacy derived from bureaucratic rule-bound processes (structure).

Interestingly, although the platform teams were keen to collaborate with external technology partners, they were careful not to hand over control, and to ensure that technology did not 'interfere' in the shaping of society and democracy in the urban sphere. Specifically, while remaining open to external data contributions, municipal governments managed the ecosystem and tightly controlled the data (via new institutionalised rules and processes). In addition, relationships with ecosystem partners were not aligned through joint incentives (e.g., joint value propositions) (Adner & Kapoor, 2010; Jacobides et al., 2018), but instead through contractual relationships or license agreements. This suggests tight control mechanisms. Thus, we observe how variance-inducing mechanisms, such as experimentation, redundancy and the loose coupling of ecosystem stakeholders, led to stable outcomes (i.e. institutionalisation), while variance-decreasing mechanisms, such as routines, control and commitment, simultaneously enabled change (i.e. platform-enhanced bureaucracy) (Farjoun, 2010). Overall, our results support the duality

perspective on stability and change, which suggests that the two should be viewed as the two-fold character of one object and not as antithetical or separate concepts (Farjoun, 2010).

Implications for future research

Our research was motivated by the new conceptualisation of smart cities as platform-based ecosystems (Appio et al., 2019). While our study provides empirical insights into how bureaucratic organisations adapt their governance mechanisms to incorporate platforms, we encourage additional research on the effects of digital technologies on municipal governments. Specifically, we believe that future research could benefit from investigating how the management of the ubiquitous information flows stemming from a sensor-enhanced infrastructure shape bureaucracy.

Furthermore, organisation scholars acknowledge that organisational identity can foster or impede change (Dutton & Dukerich, 1991; Zilber, 2002). Our findings suggest that bureaucracies can renew themselves, as certain traditional values, such as efficiency and rationality, echo promises made by novel technologies. We believe that the smart-city phenomenon offers an opportunity to study how bureaucracies manage the broader tensions between identity and change, and to examine which elements of bureaucratic organisations allow them to sustain themselves over time. We strongly encourage additional research in this area.

Conclusion

In pursuit of becoming ‘smart’, some municipal governments are adopting a government-as-platform approach. This entails organising actors around a municipality-run, platform-based ecosystem to enable technology-driven urban entrepreneurship. In our study of seven European municipal governments, we outlined a process of how digital technologies affect municipal bureaucracy. We revealed how lower-echelon bureaucrats served as both change agents and preservers of bureaucracy by institutionalising change without contradicting key bureaucratic principles. We also offered insights into the changing nature of Weberian bureaucracy, and the valuable role of formalisation in enabling stability and change in platform-based ecosystems.

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Notes

[1] We added up the 48 Lighthouse cities and the 72 Fellow cities mentioned on the EU SCIS website on 01 May, 2022.

[2] While the definition of a smart city is currently 'still evolving' (Gil-Garcia et al., 2016, p. 524), we follow Kitchin et al.'s suggestion to describe a smart city as 'one that strategically uses information and communication technologies (ICT) and associated big data and analytics to improve existing city services and create new services, engage citizens, foster sustainability and resilience, solve urban issues and stimulate innovation and grow the local economy' (2016, p. 94).

[3] We note that government-as-platform is one approach to conceptualising and designing smart cities, but not the only approach. For an overview see Mora, Bolici and Deakin, (2017) and Mora et al., (2019).

[4] Research investigating the defining features of bureaucracy (i.e. extensive formalization and standardisation, specialised roles and departments, differentiated vertical hierarchy, centralized policy making and substantial staff departments) through a formal structure and structural contingency theory lens has sought to provide empirical evidence on the features of bureaucracy in organisations (e.g., Hall, 1963; Pugh et al., 1963; Pugh, Hickson, Hinings & Turner, 1968). Similarly, Hinings, Pugh, Hickson and Turner (1967) suggest breaking down grand concepts, such as bureaucracy, into measurable variables, such as specialisation. For a recent meta-analysis, see Walton (2005).

[5] This differs from a 'variance theory,' which involves propositions and relationships between variables.

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Appendix 1
Table 1: Case and data overview

City (*Population*)	Interviewees (# interviews) (individual identifiers)	Archival material	Observations
Munich (*1.5 million*)	Team leader—Data Services (1) (A1) Team leader—Geoinformatics Services (2) (A4) Team leader—Energy Refurbishment (1) (A11) Project manager—Car Sharing/Mobility Stations (1) (A8) Officers—Data Services (5) (A2, A3, A5) Officers—Car sharing/mobility team (3) (A7, A9, A10) Total: 13	Project books Presentations E-mails Posters Prototypes Website	Data-platform workshops (2) General assemblies (3) Peer-to-peer workshops (3) Smart-city and community meetings (4) Phone conversations
Lyon (*513,000*)	Director—Innovation and Economic Action (1) (B4) Team leader—Data Services (2) (B2) Project manager—Lyon Confluence (3) (B1) Project manager—Networks and Planning Unit (1) (B3) Total: 7	Project books Presentations E-mails Website	Data-platform workshops (2) General assemblies (3) Peer-to-peer workshops (3) Smart-city and community meetings (4) Phone conversations
Vienna (*1.9 million*)	Director—Data Governance (1) (C7) Team leader—Data Services (2) (C4) Officers—Data Services (4) (C1, C2, C3, C5) Officers—Mobility Team (5) (C6, C10, C11, C13, C14) Officers—Energy Refurbishment (3) (C8, C9, C12) Total: 15	Project books Presentations Website	General assemblies (3) Peer-to-peer workshops (3) Smart-city and community meetings (4) Phone conversations
Rotterdam (*624,000*)	Senior Program Manager—Digital City (1) (D1) Director—Data Analytics (1) (D5) Project Manager—Smart City (1) (D3) Specialists (data, urban platform, communications) (3) (D2, D4, D6) Senior executive—private company (D7) Total: 7	Project books Presentations Website Press releases Publications	Smart-city and community meetings (4) Cross-smart-cities and communities task group Phone conversations
Stockholm (*974,000*)	Lead Project Manager—Smart City Project (1) (E2) Project leader—IoT and Data Platform (1) (E1) Senior Director—Environment and Health Department (1) (E3) Officers—Smart City and Data Strategy (3) (E4, E5, E8) Specialists (sales, platform data architecture (2) (E6, E7) Total: 8	Presentations Website	Smart-city and community meetings (4) Cross-smart-cities and communities task group Phone conversations
Santiago de Compostela (96,000)	Officers—Data Services (5) (F1, F2, F3, F4, F15) Officers—Mobility Team (4) (F7, F8, F12, F13) Specialist—Energy Refurbishment (6) (F5, F6, F9, F10, F11, F14) Specialist—Application Development (1) (F16) Total: 16	Project books Presentations Website	Data-platform workshop (1) General assemblies (3) Peer-to-peer workshops (3)
Barcelona (*5.6 million*)	Senior Officers—Data Office (2) (G4 & G5) Project Managers—IT Department (3) (G1, G2 & G3) Specialist—Smart City and Business Models (1) (G6) Project Manager—private company (1) (G7) Total: 7	Website Presentations Internal documents Publications	Smart-city and community meetings (3) Cross-smart-cities and communities task group Smart-city expo (1)
Independent experts	Expert—Urban-data Platform/Geoinformatics (1) (X1) Expert—Urban-data Platform/EU Horizon 2020 (1) (X2) Expert—Open Data and Standards (1) (X3) Total: 3		

Appendix 2
Table 2a: Cross-case comparisons: Platform features that enhance bureaucracy

Notes regarding the strength of the evidence: *Strong*: repeatedly indicated by most interviewees; *moderate*: indicated by some interviewees. *weak*: indicated by few interviewees.

Impersonal authority		***Technology-driven efficiency***	
Centralisation of data	***Data-driven decisions***	***Integration of IT infrastructure into platform***	***Installation of sensors to monitor and control physical infrastructure***
Munich: Strong 'What we now need is data integration and centralisation.' (A4)	*Munich: Strong* 'Data helps those in charge make better decisions.' (A2)	*Munich: Strong* 'The system gives data to the geoportal, which sends it to the platform.' (A4)	*Munich: Strong* 'We are now measuring air quality, noise, traffic density, and some other things.' (A5)
Lyon: Strong 'The purpose is to have all data on this platform.' (B3)	*Lyon: Strong* 'We use aggregate information—aggregate data—to visualize and make strategic decisions.' (B4)	*Lyon: Strong* 'We are integrating the open data portal and the technical infrastructure with the platform.' (B3)	*Lyon: Strong* 'We are using sensors to measure energy consumption in our smart buildings.' (B2)
Vienna: Strong 'It makes a lot of sense to have everything on one platform and to continuously update the data.' (C5)	*Vienna: Strong* 'How do you make decisions without data?' (C7)	*Vienna: Strong* 'Our platform integrates the formally separated systems of public transport and our utility company.' (C7)	*Vienna: Strong* 'We are currently implementing 10'000 sensors across the city.' (C4)
Rotterdam: Strong 'The vision is to have one urban-data platform with all the data from the city.' (D5)	*Rotterdam: Strong* 'We want to use data to make better data-driven decisions and to make simulations of the future.' (D1)	*Rotterdam: Moderate* 'We want to automate certain services, so we need to integrate the different systems.' (D5)	*Rotterdam: Strong* 'We use different sensors for the different use cases.' (D5)
Stockholm: Moderate 'We need to consolidate the data now.' (E2)	*Stockholm: Strong* 'We want to create a better foundation for [data-driven] decision making.' (E6)	*Stockholm: Strong* 'We developed integration programs that would connect to vendor systems.' (E7)	*Stockholm: Strong* 'We are using multiple sensors and AI to improve traffic flows.' (E1)
Santiago de Compostela: Strong 'You have to connect the data from one department to the data from others.' (F4)	*Santiago de Compostela: Strong* 'We are planning to evaluate projects based on objective, data-driven metrics.' (F4)	*Santiago de Compostela: Strong* 'We want to integrate all our services on one platform.'(F1)	*Santiago de Compostela: Moderate* 'You need to put a sensor in every trashcan. That makes a city intelligent.' (F4)
Barcelona: Strong 'It is better to perform your services or reach your goals when you pour all the data together and share it.' (G4)	*Barcelona: Strong* 'We want to make use of that data for information, for predictions, and for analytics.' (G1)	*Barcelona: Strong* 'We have one internal platform that we want to connect to the sensor network and the open data platform.' (G4)	*Barcelona: Strong* '[Sensors] are a game changer in terms of how technology is implemented in the Barcelona City Council.' (G4)

Table 2b: Cross-case comparisons: Platform features that contradict bureaucracy

Hierarchical control	
Bureaucracy lacks processes or experience to support generativity	***Bureaucracy lacks mechanisms to promote alignment***
Munich: Strong 'It is an agile development process, so new questions are coming up all the time.' (A2)	*Munich: Strong* 'In general, it is difficult to talk to people inside the city without first going up the hierarchy.' (A2)
Lyon: Strong 'It is not easy in the public sector to have a big team for technical development. The process is very linear and not very agile.' (B3)	*Lyon: Strong* 'We clearly underestimated how difficult it is to coordinate the data providers, the technology company, and the city administration.' (B4)
Vienna: Strong 'It took six months just to publish the tender. Once the app was built, nobody was interested anymore.'(C4)	*Vienna: Strong* 'We need someone who owns and oversees the whole process.' (C2)
Rotterdam: Strong 'We are working on innovation, so it is all new to us all of the time.' (D1)	*Rotterdam: Strong* 'A big issue is the governance: Who owns it? who manages it?' (D6)
Stockholm: Moderate 'In this user-oriented innovation process, you have to understand the end user. That is not how we usually work here.' (E1)	*Stockholm: Strong* 'From the beginning, governance was a problem. Someone needs to be responsible in the city.' (E1)
Santiago de Compostela: Strong 'I do not know what the different phases are to reach those goals.' (F3)	*Santiago de Compostela: Strong* 'Coordination is very difficult.' (F4)
Barcelona: Moderate 'It was hard to define real use cases because you have to identify a real need.' (G3)	*Barcelona: Moderate* 'It is difficult to align the external developers with the slow machine of our administration.' (G2)

Table 2c: Cross-case comparisons: Organisational tensions

Official competencies obstructing internal collaboration		***Official secrecy blocking external collaboration***	
Focus on expertise and official roles	***Limited understanding of other departments' needs***	***Resistance to data sharing***	***Concerns about privacy of citizens' data***
Munich: Strong 'Collaboration is a difficult topic, because each department has its specific area of competence.' (A5)	*Munich: Strong* 'Each city department decides what it really needs.' (A5)	*Munich: Strong* 'Many of those involved were asking: What do you want with our data?' (A5)	*Munich: Strong* 'You need to check which data can be published and in which contexts. It is always about data privacy.' (A3)
Lyon: Moderate 'We do not know all the processes in the city and some departments are developing their own platforms' (B3)	*Lyon: Strong* 'It is not easy to understand what the others need.' (B4)	*Lyon: Strong* 'We don't want to share our data because we have to control it.' (B3)	*Lyon: Strong* 'We have a separate citizen platform because we could not combine the private data with the other data on the data platform' (B1)
Vienna: Strong 'We are not used to collaboration here. We usually focus on our own official roles.' (C1)	*Vienna: Strong* 'As long as we do not know what kind of data they need, we are having a hard time moving forward.' (C4)	*Vienna: Strong* 'It is 100% city-owned, but they refuse to share their data with us because it is a trade secret.' (C2)	*Vienna: Strong* 'When you have real-time data, that is a whole new privacy issue.' (C5)
Rotterdam: Strong 'People are focused on their tasks and they do not have the resources to support us.' (D2)	*Rotterdam: Strong* 'We have all these silos so we did not know which process fits everyone's needs.' (D3)	*Rotterdam: Strong* 'They were really reluctant to share their data.' (D2)	*Rotterdam: Strong* 'We have no idea how we can deal with that—when you combine open data with open data and it suddenly becomes private information.' (D2)
Stockholm: Strong 'We need to make people with different roles and different knowledge start working together.' (E4)	*Stockholm: Strong* 'It is quite difficult to know what information you have that could be of use to someone else.' (E8)	*Stockholm: Strong* 'Not many departments share data continuously.' (E4)	*Stockholm: Strong* 'They decided against publishing the data because of security concerns.' (E7)
Santiago de Compostela: Strong 'Everyone does his or her own thing and nothing more.' (F9) (F4)	*Santiago de Compostela: Strong* 'If I knew exactly what the others were doing, then we would know in what direction we should move.' (F1)	*Santiago de Compostela: Strong* 'They did not know why they should share their data with us.' (F4)	*Santiago de Compostela: Strong* 'If you can connect that information, it violates data-privacy protections.' (F4)
Barcelona: Strong 'We need each other, but we all have different functions.' (G1)	*Barcelona: Strong* 'People inside the organisation do not understand how their data can support other departments.' (G5)	*Barcelona: Strong* 'The biggest challenge is to convince the different departments to publish their data.' (G5)	*Barcelona: Strong* 'Some officials are extremely risk averse. They only publish aggregate data, which is not very useful.' (G6)

Table 2d: Cross-case comparisons: Non-bureaucratic work mode

Informal collaboration		*Open network*	
Bargaining for resources inside the organisation	***Empowerment of lower echelons***	***Value co-creation with external partners***	***Citizen engagement***
Munich: Strong 'We had to ensnare the other departments to get them to share their data.' (A1)	*Munich: Strong* 'We educated the others in our workshops, and you could watch them becoming experts themselves.' (A3)	*Munich: Strong* 'We collaborated a lot with start-ups because we thought they were much more innovative than we were.' (A5)	*Munich: Strong* 'We continuously talk with the community, and they tell us what kind of data they would like to have.' (A1)
Lyon: Strong 'It is not a big technical challenge, but you need to discuss and explain 'why.'' (B2)	*Lyon: Moderate* 'The platform is pedagogical. For example, we try to explain how to build a HTTP request.' (B3)	*Lyon: Strong* 'Our role was at the interface of the private and public sector. We built strong personal connections with experts of the respective companies and that allowed us to participate in each step of the process.' (B1)	*Lyon: Strong* 'We currently have 1,000 citizens testing the concept.' (B3)
Vienna: Strong 'We needed to get everyone on board.' (C4)	*Vienna: Strong* 'We educate and train our people. Otherwise, they do not know what to use the platform for.' (C7)	*Vienna: Moderate* 'We extended our OGD program so we could exchange more data with external parties.' (C5)	*Vienna: Strong* 'We are building new dashboards to help visualize more data.' (C6)
Rotterdam: Strong 'Internally, convincing needs to be done.' (D5)	*Rotterdam: Strong* 'We really educate the municipality staff on what is coming.' (D7)	*Rotterdam: Strong* 'It is really valuable to set up public-private collaboration.' (D5)	*Rotterdam: Strong* 'We want citizens to become active and to use the platform.' (D1)
Stockholm: Strong 'You have to have something you can offer the departments, so they see value in the platform and join the project.' (E1)	*Stockholm: Strong* 'We held many workshops until everyone could see the value of the platform.' (E1)	*Stockholm: Strong* 'People could then vote on this proposal. There it was—the co-creation and democracy process.' (E2)	*Stockholm: Moderate* 'There are many initiatives about data sharing and open data for citizens.' (E7)
Santiago de Compostela: Strong 'You have to convince them to do something this way or that way.' (F4)	*Santiago de Compostela: Strong* 'I got people to sit down and talk about smarter strategies for the city.' (F9)	*Santiago de Compostela: Moderate* 'We will solve this in collaboration with other cities' (F2)	*Santiago de Compostela: Strong* 'We need to give citizen participation more value through our e-administration.' (F16)
Barcelona: Moderate 'We need to build these capabilities internally at the city level.' (G4)	*Barcelona: Moderate* 'We organized workshops with people from different departments to help them understand the different needs.' (G6)	*Barcelona: Strong* 'We had workshops with external partners like big companies and start-ups.' (G6)	*Barcelona: Strong* 'We are running conversations, workshops, and conferences because the data is a public infrastructure.' (G4)

Table 2e: Cross-case comparisons: Institutionalisation

Formalization	
Record new rules, roles, and processes in writing	***Development of clear accountability***
Munich: Strong 'The data gatekeeper describes the whole data management process.' (A2)	*Munich: Strong* 'We are responsible for the access management of the platform and accountable in cases of misconduct.' (A5)
Lyon: Strong 'We have many new processes to ensure that the data gets to the platform.' (B3)	*Lyon: Strong* 'The city is accountable for data quality and data privacy.' (B2)
Vienna: Strong 'We have a new role, so-called 'data stewards,' in each department and a new data-standardization process.' (C7)	*Vienna: Strong* 'The departments are responsible for delivering the data in the correct format.' (C4)
Rotterdam: Strong 'We have a new role called 'process owner.'' (D2)	*Rotterdam: Strong* 'It is my responsibility to develop technical solutions inside the organisation.' (D3)
Stockholm: Strong 'We had some organisational changes, like creating a new department for that.' (E4)	*Stockholm: Moderate* 'One department is now responsible for the data.' (E4)
Santiago de Compostela: Strong 'We have a new, strict data-standardization process.' (F4)	*Santiago de Compostela: Moderate* 'We cross-reference the data before we publish it because we are responsible if it is not correct.' (F9)
Barcelona: Strong 'First of all, we created a data office because it did not exist yet.' (G4)	*Barcelona: Strong* 'Managing the platform is now the data office's responsibility.' (G2)

Figure 1: Data structure: The process of unfolding digital platforms in smart cities

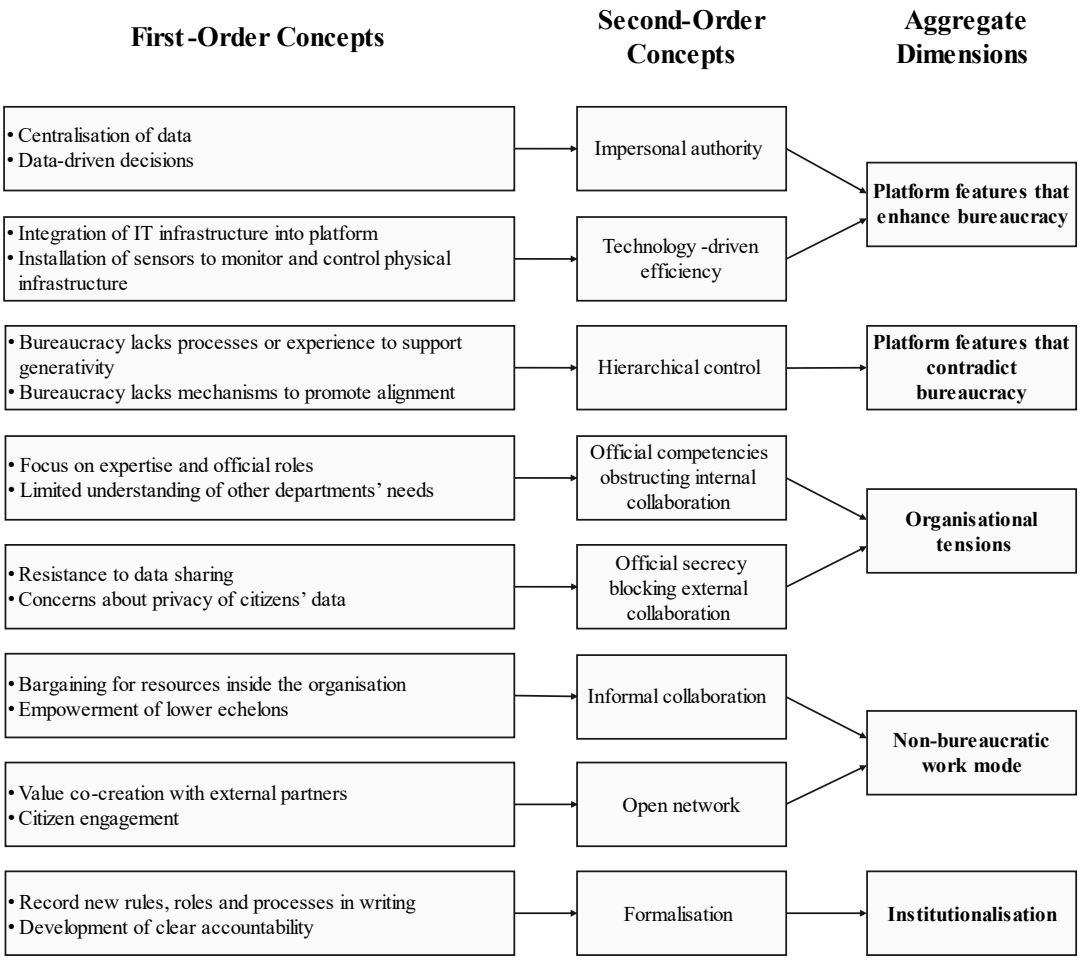

Figure 2: Visualization: The process of unfolding digital platforms in smart cities