6. The coordination of smart cities: insights from a cross-case analysis on the implementation of smart city strategies

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INTRODUCTION

Cities around the world strive to strengthen digital innovation, attract economic activity, and create public value by becoming 'smarter' (Estevez et al., 2021; Meijer and Bolívar, 2016; Neumann et al., 2019). As intersections of economic, cultural, and social activity, they have been at the forefront of exploring the potential of technology to tackle increasingly complex societal problems (Barber, 2013; Drapalova and Wegrich, 2020; Landry, 2006).

While initial approaches to capturing this movement – such as Dutton et al. (1987) recognise only one networked city (Wired City) – a smart city today is regarded more as a gradual concept where cities are not 'smart or dumb', but their *smartness* is determined by 'its capacity to attract and mobilise human capital in collaborations between various actors through the use of information and communication technologies' (Meijer and Bolívar, 2016, p. 398). Put differently, what today constitutes 'smart' is, in addition to the pure networking of information and communication technology (ICT), the pluralism of actors and technologies like artificial intelligence, self-learning algorithms, and the internet of things. This makes control and thus the public management of smart city processes a particularly complex challenge (Ruhlandt, 2018). In this regard, it is often emphasised that competencies on the part of the city administration need to be strengthened to adequately face these challenges, and governance must become smart as well *(smart city governance*). Only this way would local actors be able to comply with tasks and make independent decisions for the good of their city (Bolívar, 2016). As a result of the plurality of actors and high-end technologies, smart cities could be regarded as prime examples to study collaboration in a digital transformation context.

Although there seems to be a normative consensus on the mutually positive effects of collaboration as 'ends and 'means' of smart city initiatives, empirically based studies on network dynamics from an intra- and intergovernmental perspective remain scant, with an even greater need for systematic cross-national research (for some exceptions see, e.g., Pereira et al., 2017; Sancino and Hudson, 2020).

While the collaboration rhetoric in the digital realm has gained scholarly attention in recent years (Anthopoulos and Reddick, 2016; Mergel, 2016; Neumann et al., 2019), it often neglects the fact that stakeholder interaction can take on multiple facets, with collaboration being only one of them. From this perspective, it is questionable whether the frequent use of the analytical concept 'collaboration' adequately captures what is meant by navigating collective action towards desired smart city outcomes. However, because different intensities of partnerships may have distinct demands required for their governance, a more nuanced understanding is important for finding targeted public management interventions to guide smart city dynamics effectively. We take up this ambiguity in the literature and seek to explore the question: How does collaboration manifest in smart city networks?

To address this question, we draw on the theoretical notions of the 3C concept (e.g., Keast et al., 2007), which recognises varying degrees of partnerships along, as we argue, three key dimensions: interdependence, trust, and commitment. This helps us find evidence of cooperation, coordination, or collaboration in joint smart city efforts, ranging from the least to the most integrated and connected form. To this end, we conduct a comparative case study using archival data and semi-structured interviews. For the empirical setting, we select cases based on their similarities: the Belgian city of Antwerp and the German city of Darmstadt, both embedded in a distinct *Rechtsstaat* tradition and nationally known as digital pioneers, to investigate how they strategically proceed to master (novel) tasks of joint public management. This is done to hold the institutional logics constant to some extent, to isolate the role of project governance and its arrangements in dictating partnership dynamics (Wang and Feeney, 2016), while also exploring the extent of smart city governance variations across Europe.

This chapter is organised as follows. First, the theoretical framework is outlined; we elaborate on three intensity degrees of partnerships using the 3C framework and its core dimensions. Second, we move to our empirical analysis as we present the genesis and partnership arrangements of our two case studies, to which the framework is subsequently applied. Finally, we provide a comparative discussion of the results.

THEORETICAL FRAMEWORK

The '3C' Framework and Intergovernmental Relation

'Collaboration' is a term commonly applied in the context of smart cities to describe a set of organisational actors working together to achieve joint goals (e.g., Grossi et al., 2020; Meijer and Bolívar, 2016; Neumann et al., 2019; Pareira et al., 2017). This 'smart collaboration' is, in theory, often attributed to high-intensity interaction between actors, entailing a pronounced transformation (Meijer and Bolívar, 2016) through 'collective learning' (Meijer and Thaens, 2018, p. 367) and 'promoting communication, interaction, … participation in decision making and direct democracy' (Pereira et al., 2018, p. 144). In contrast, Dameri and Benevolo (2016) and Gil-Garcia et al. (2015) highlight the various types of partnerships at play in smart city environments, such as networks, engagements or collaborations, which involve the activities of sharing, communication, and integration and, thus, surpass mere collaborative components. The sparse empiricism on smart collaboration echoes this discrepancy. In their study on UK smart city initiatives, Sancino and Hudson (2020), for instance, aim to investigate 'collaborative projects' (p. 706). However, their case selection reflects loose arrangements that are intended to facilitate platform interaction yet that have significant communication barriers. Moreover, in most smart city studies, 'collaboration' refers to relationships between governmental and non-governmental organisations (e.g., Meijer and Thaens, 2018; Wang et al., 2018; Zvolska et al., 2019), rarely examining whether this stands up to the test of 'true' collaboration, and even less so, how this plays out at other structural levels of smart city efforts within and between governments.

In the collaboration literature, strictly speaking, 'collaboration' refers to a specific form of working together (Huxham, 2000) and does not consider the varying degrees of actor commitment, engagement, and integration. In practice, however, partner-like relationships can be broken down into different facets of how intensively people work together and what they endeavour to do (Keast et al., 2007). Reflecting this, the '3C' concept has emerged, referring to 'cooperation, coordination, and collaboration' with its implications extending well beyond semantics. In the literature, there is a growing tendency to use 'cooperation', 'coordination', and 'collaboration' interchangeably or subsume them under each other. In fact, they can be placed on a horizontal continuum of increasingly intense partner interactions within a network (Costumato, 2021; McNamara, 2012).

Accordingly, each step along the continuum involves the stronger integration of 'mission and tasks, risks and rewards, and authority and accountability'

(Mattessich et al., 2001, p. 61; Thomson and Perry, 2006) and consequently greater interdependence between partnering organisations (Elston et al., 2018). We will position each of the Cs on this continuum, which allows us to work out and delineate them according to their core dimensions, and ultimately make the case for a more nuanced understanding of partnerships within smart cities.

Cooperation

Cooperation can be understood as a starting point for further, more intense interaction usually accompanied by low structural linkage and, thus, high fragmentation. Information sharing is the preferred choice of exchange and formal, binding agreements are dispensed with (McAllister and Taylor, 2015). This is often associated with the actors' low commitment and low willingness to relinquish their autonomy, which can partly be explained by the anticipated risk that others will behave opportunistically (Keast et al., 2007). Therefore, a lack of or underdeveloped trust plays a decisive role in this form of partnership (O'Leary and Bingham, 2007). However, the risk and rewards of interacting are comparatively modest (Sedgwick, 2016).

Coordination

Coordination becomes necessary when specialisation and more formalised, repeated interaction is desired (De Pourcq and Verleye, 2021). It has a more instrumental function, presupposing a basic concern between partners to act in concert by structurally adapting to each other (Ansell, 2000). While this may involve the pursuit of a common predetermined goal, it is task-oriented and does not necessarily require cultural adjustment or a loss of individual autonomy of the partnering organisations. The partners exchange not only information but also resources, which entails greater risk and potentially greater benefit from the partnership (Keast et al., 2007; Mattessich et al., 2001).

Collaboration

Collaboration refers to the most intensive and comprehensive mode of interaction that promotes mutual dependence, goal alignment, and joint planning and action, often accompanied by a structural and cultural blurring of organisational boundaries (Gray, 1989; Sedgwick, 2016; Thomson et al., 2009). Partners are more proactive and 'whole-hearted' (Keast et al., 2007, p. 17), involving a higher level of trust. Simultaneously, this includes a more decentralised form of power-sharing where all members are responsible for controlling the network. With it, the risk and the potential reward magnify (Ansell and Gash, 2018; Whelan, 2015).

The 3C Dimensions: Interdependence, Trust, and Commitment

A closer inspection of 3C concepts reveals that they differ analytically along three interrelated dimensions: interdependence, trust, and commitment (see Figure 6.1 for the horizontal partnership intensity continuum). We will briefly outline what the collaboration literature understands through these dimensions and finally use the framework to compare our two cases.

Figure 6.1 Horizontal partnership intensity continuum

Interdependence is understood as the extent of connections between elements of a system or 'nodes connected to other nodes' within partnerships (O'Leary and Bingham, 2009; Whelan, 2015). Hence, interdependence implies connectedness and decreasing autonomy of partners as it relates to the position that actors take within the structural linkages or ties that connect them (Lewis et al., 2016). It also refers to the types of assets shared. These can be tangible or intangible, ranging from the sharing of information to resources to power. Interdependence occurs whenever 'one actor does not entirely control all of the conditions necessary for the achievement of an action, or for obtaining the outcomes desired from the action' (Pfeffer and Salancik, 1978, p. 40).

Similarly, building *trust* stimulates partnerships by reducing the transaction costs of oversight and more formalised governance (Ring and van de Ven, 1994) and, thus, the risk of adverse strategic behaviour (Kwon and Suh, 2004). Trust is broadly defined as 'expectations that any information or other resources provided will not be used by the other in ways that could do harm to oneself' (Wiedner and Ansari, 2019, p. 200). This effect is potentially enhanced by face-to-face dialogue and frequent exchanges (Ansell and Gash, 2008; Lasker and Weiss, 2003).

Trust has been shown to be positively related to *commitment* (Gray, 1989), the willingness of partners to invest in a relationship. More precisely, interparty commitment, or attachment, can be defined as an 'inertial or binding force between exchange partners that can lead to the maintenance of an existing relationship to the exclusion of alternatives' (Seabright et al., 1992, p. 126). A strongly committed partnership includes partners who recognise mutual dependence and exert mutual control while empowering each other to initiate actions (Ansell and Gash, 2008). Like trust, commitment is attributed

to vulnerability as it is highly contingent upon partners' agreement on values and goals (Talay and Akdeniz, 2014).

However, this continuum, with its dimensions outlined, does not imply a normative view that assumes that greater intensity is accompanied by an increase in partnership effectiveness. In fact, for instance, while interdependence can be seen as the key rationale for forming partnerships (Gray, 1989), too much interdependence can drive up transaction costs and increase the perceived or objective management burden resulting from the partnership (Elston et al., forthcoming). Overdependence can also create tensions as organisations tend to value their autonomy (Seabright et al., 1992). Additionally, while trust is a desirable prerequisite for partnerships (Huxham and Vangen, 2005), overreliance in relationships may lead to negligent behaviour. This risks exploitation and brings strategic disadvantages, especially in opportunistic environments. In a similar vein, over-commitment in the face of disconfirming evidence or changes in resource fit can lead to holding on to something shown to be ineffective (Jarvenpaa and Majchrzak, 2016; Seabright et al., 1992).

As commitment and trust are built through interaction and joint experiences of success (Ansell and Gash, 2008; Vangen and Huxham, 2003), collaborative intensity can be assumed to vary within partnerships. By engaging in joint efforts over time, actors can get to know each other and build up expectations of reciprocity and shared meaning, lifting the intensity level of the partnership (Liu and Zheng, 2018). Following Ansell and Gash (2008) and Emerson et al. (2012), interactions within a partnership are also influenced by structural conditions including the establishment of hierarchies, process rules or arenas for interaction. As a consequence, we expect the intensity of interactions to vary by temporal and structural features within partnerships.

By applying this relevant distinction of working in partnerships to our empirical context of two Western European smart city networks, we explore along the 3Cs and their dimensions the extent to which they involve more intensive collaboration or represent alternative forms of partnership, such as coordination. This considered, we extend the initial research question, asking: What level of partnership intensity manifests in smart city networks and how do time and structural differences affect this level of intensity?

To this end, we drew on document analysis of items including case-related strategic documents, meeting agendas, minutes, and newspaper articles in both countries. Semi-structured interviews were then used to verify initial findings and gain complementary insights from those involved in setting up or maintaining the smart city cases. This resulted in a total of 12 interviews, six in each country, with bureaucrats (non-politicians) representing different interests and positions to ensure a balanced picture (see Table 6.1 for interviewee details). Interviews were each conducted by native interviewers at participants' workplaces between September 2019 and March 2020 and lasted up to 90 minutes.

Table 6.1 Overview of interviewees and their professional positions with numbering in brackets referred to in the main text

Case	Country	Senior mgmt.	Middle mgmt.	Total
Antwerp's smart city policy	Belgium	3 [A1:A3]	3 [A4:6]	6
Digitalstadt Darmstadt	Germany	4 [D1:D4]	2 [D5:D6]	6
				12

They were recorded and transcribed verbatim and coded along with the selected documents using MAXQDA software. This served to systematise the rich material in line with our research aim.

CASE INTRODUCTION

In the following sections, we give a brief description of the background and context of the cases under study. The cases selected are smart city projects in two medium-sized Western European cities: the smart city policy of Antwerp in Belgium and the Digitalstadt Darmstadt project in Darmstadt, Germany (see Table 6.2 for key case characteristics). Both cases can be characterised as Anthopoulos's (2017) model 1, where the city itself or one of its outsourced entities takes over the management of the smart city – a common model used in other cities such as Amsterdam, Barcelona, or Vienna.

Similarities in System Context

As mentioned, both cases represent leading digital cities within their countries. Hence, some similarities between the cases can be found in their system context. The first similarity is both cities' economic position within their region or country. Antwerp is the largest city in the Belgian Flemish region. In 2015, it won the first Global Startup Nations Award for Local Policy Leadership (TakeOff Antwerp, 2015). In traditional economic sectors like logistics and retail, Antwerp has one of the most important concentrations of economic activity due to its central location in Europe, close to numerous European highways and railroads. Additionally, the Port of Antwerp is one of the largest seaports in Europe and hosts the largest integrated chemical cluster in the world. Located close to the Rhine River and between big industrial cities like Frankfurt-am-Main and Mainz, Darmstadt is situated in the economically prosperous Hesse region. The Rhine-Main-region is dominated by activities in manufacturing, pharmacy, chemistry, and biotechnology. In 1997 Darmstadt was awarded the title of *City of Science*. Several scientific institutes are located in Darmstadt including the European Space Operations Command (ESOC) of the European Space Agency. Further, the Technical

University of Darmstadt (TU Darmstadt) is one of the most important research universities in the country. Darmstadt has also been awarded for its efforts in digital transformation. Additionally, the city has been honoured as the most sustainable German city four years in a row by a well-established magazine called *Wirtschaftswoche* (Bitkom e.V., 2019).

A second similarity in the cases' system context can be found in the political environment of both cities. Both Germany and Belgium are federal states with smart city competencies regarding innovation and digital transformation mainly located at the regional and local levels. Additionally, both municipalities could rely on strong support from the regional level. In 2012, a centre-right coalition took office in Antwerp with an economically liberal agenda focussing on innovation and economic development. In 2014, a coalition represented by the same political parties took office in the Flemish government with a similar economic agenda. The Flemish region invested in digital transformation in its coalition agreement and put this into practice by launching the Smart Flanders programme, in partnership with IMEC, around the same time the city of Antwerp launched its local Smart City Programme in partnership with IMEC. Darmstadt is a so-called *kreisfreie Stadt*, which means that it directly falls under the regional *Länder* policy level, which is similar to Antwerp's position within the multi-level structure of the Belgian state. Darmstadt found support at the regional policy level for its smart city projects as the Hesse region declared Darmstadt a model municipality (*Hessische Modellkommune*), which subsequently became the support of €5 million for the smart city projects.

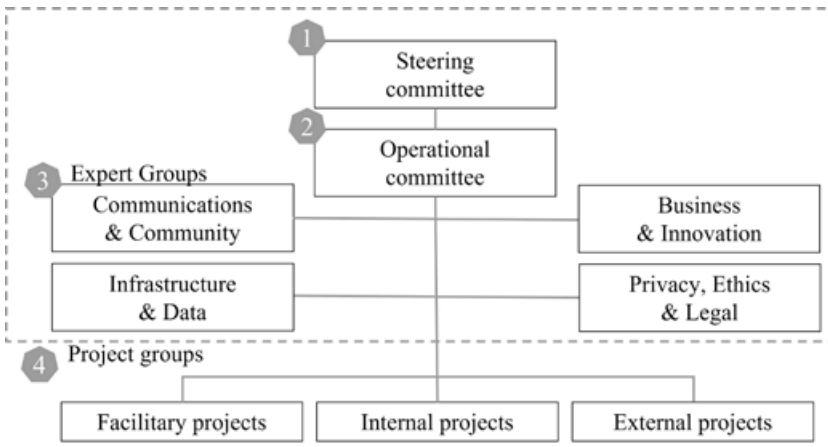
Antwerp's Smart City Policy

The smart city policy of Antwerp was formally kicked off in 2016 when the city council signed a covenant with IMEC, a research centre renowned for its work in digital transformation and smart cities. The general strategy for smart city projects in the city revolves around five 'building blocks': a digital transformation of the city administration's front and back office, the creation of a single digital platform, the creation of Europe's biggest open laboratory, an open data policy, and an ecosystem for digital innovations. The most important output of the smart city policy leading up to the time of data gathering at the end of 2020 has been several digital innovation projects conducted in the open laboratory also referred to as the 'smart zone'.

IMEC and the city of Antwerp have a quite elaborate history of joint working, as they have been co-partners in several research projects funded through the European Commission's Horizon 2020 programme or innovation programmes of the Flemish regional government. A third important actor in the smart city policy is Digipolis. Digipolis, at the time of the inquiry, was an 'inter-municipal association', which is an autonomised legal structure

to which governments can delegate certain public services. Digipolis was responsible for all IT-related activities of the city of Antwerp, including digital infrastructure.

Regarding the governance arrangements of the partnership, the backbone of the smart city activities is a covenant between the city of Antwerp and IMEC in which they agree on a central strategy for the smart city policy of Antwerp and on the covenant budget, for which they each contribute equally (650,000 euros for the duration of the covenant). After an evaluation of the first years of the covenant, an addendum was added in which a formal governance structure of smart city projects was implemented. A schematic representation of this governance structure can be found in Figure 6.2.



Source: Stad Antwerpen (2020).

Figure 6.2 Governance structure of Antwerp's smart city projects and general policy

The governance structure is made up of hierarchical levels where different roles of governing different parts of smart city activities were assigned to different partners within the governance structure. For example, at the steering committee level, the global strategy of the smart city is laid down and decisions about the covenant budget are made. Members of the city administration, the mayor, and the alderman of Economy and IMEC are represented. On the second level is the 'operations team'. It is an in-between level where the decisions of the steering committee are translated into concrete actions for the projects. Here, the members of the steering committee are represented, along with operational managers of both IMEC and the city administration. Often, representatives of

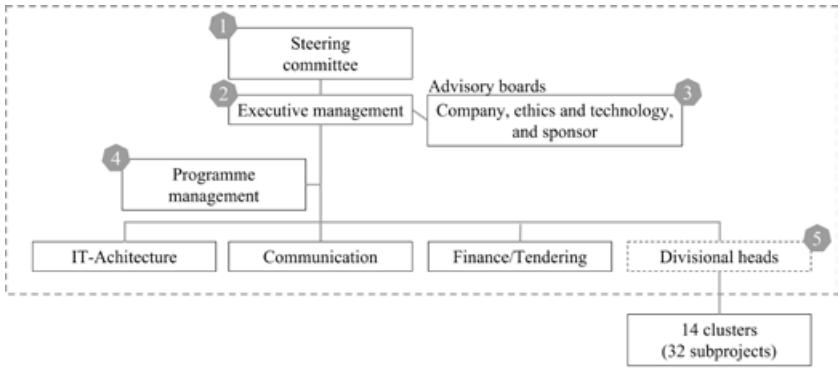
ongoing projects are invited as well. Important to note is that this body has no formal decision-making power, but they do prepare the agenda for the steering committee. Third, expert groups debate on specific, thematic issues that arise in the projects. The fourth level comprises the actual project teams, where the different smart city projects are executed and implemented.

Digitalstadt Darmstadt

Our second case, the Digitalstadt Darmstadt smart city project developed from 2016 onwards. After winning the 'Digitale Stadt' competition in 2017, several stakeholders engaged in partnerships with the city of Darmstadt. A total of 32 funded projects were set up in accordance with an overarching smart city strategy. This strategy was already in place before the Digitale Stadt competition but as the competition approached, it was aligned with the city's existing economic strategy (HEAG, 2018). The projects encompass 14 areas of digital innovation: administration, mobility, trade and tourism, health, culture and Industry 4.0. Examples of projects are intelligent traffic light control, smart parking, a House of Digital Media Education, multimodal mobility and patient data networking. These projects are developed in partnership with several external partners like the University of Darmstadt, Fraunhofer Research Institutes, companies, or the city administration.

Like in Antwerp, the activities of Digitalstadt Darmstadt are also structured in a separate governance structure. In 2018, a limited liability company was founded under private law. This 'GmbH' was established as a subsidiary outside the core administration's structure. Digitalstadt Darmstadt GmbH is a 100 per cent subsidiary of the city of Darmstadt, there is a 95 per cent funding quota from external donors (5 per cent own funds). Bitkom with its private sponsors as well as the Hessian Ministry, therefore, play a crucial role in how the projects evolve. Besides these, the broader network consists of 50–70 'strong partners' (Digitalstadt Darmstadt, 2018), from politics, business, and science such as the Technical University of Darmstadt or several Fraunhofer research institutes, who have all contributed additional financial or technical support for individual project implementations.

Quite similar to the Antwerp case, the governance structure is made up of different hierarchical levels where different roles regarding governance are separated across actors. The strategic committee comprises top-level decision-makers with no direct connection to the projects on the ground. These are the mayor, the funding office of the Hessian Ministry for Digital Affairs, the Chief Digital Officer of the City of Darmstadt, the two managing directors of the GmbH, as well as the head of the Department of Urban Development and Economics and the CEO of HEAG, who were already actively involved in the competition participation. The second level is comprised of two exec-



Source: Authors' illustration based on Roland Berger (2018).

Figure 6.3 Governance structure of Digitalstadt Darmstadt

utive managers employed by the GmbH to provide the expert groups with information and serve as a link between them and the steering committee. Additionally, they are responsible for leading the internal organisation of the GmbH's own departments such as programme management, IT, communication, or tenders (represented by level 4 in Figure 6.3). Lastly, the divisional heads make up another hierarchical level and they represent the project groups towards the executive management and the GmbH's departments.

ANALYSIS AND RESULTS

In this chapter, we look at two cases of smart city partnerships to explore the different guises of interactions in digital transformation networks. Smart city initiatives in two cities nationally leading in digital innovation were analysed through a document study and qualitative analysis of 12 interviews (six for each case) with non-political practitioners active in different roles and positions within the partnership.

Our analysis reveals that stakeholder interaction within smart city innovation partnerships comes in many shapes and is more nuanced and dynamic than often assumed in current scholarship on collaboration in digital transformation. We find two main dynamics in our data along which the level of interdependence, trust, and commitment varies and, as a consequence, the intensity of interactions varies.

Table 6.2 Key characteristics of the smart city cases

Case	Smart City Policy, Antwerp	Digitalstadt Darmstadt, Darmstadt
Country	Belgium	Germany
State structure	Federal	Federal
Project duration	2016–2019/no ongoing due to renegotiation	2018–21/now ongoing due to new funding
City size (population as of 2019)/ structure	525,936/monistic	159,103/dualistic
Primary motives	Efficiency and quality improvement/voluntary	Quality improvement/voluntary
Main partner responsible	City countil and IMEC	Digitalstadt GmbH

Temporal Dynamic

First, we distinguish a *temporal dynamic* where the intensity of partnership interactions varies across time.

The origin of both cases lies in interactions with a high level of intensity of a small, select group of influential collaborators. In Darmstadt, a close group of assertive and influential people teamed up to prepare Darmstadt's participation in the Bitkom competition. This 'inner circle' [D3] including the mayor, the chairman of the board of HEAG Holding AG, and the head of the urban development and economy department was driven by high levels of commitment and interdependence, the interactions between these collaborators had a high level of intensity that resembled collaboration (Keast et al., 2007). As they prepared a joint bid for the competition, mutual alignment of goals and joint action were necessary to outline implementation structures and to enthuse the local ecosystem. These horizontal interactions, with weekly meetings over an extended period of time, resulted in winning the competition and kickstarted the Digitalstadt Darmstadt project.

In Antwerp, the partnership originated in a rich prehistory of collaboration between a limited group of core partners. IMEC, the Department of Innovation and Digipolis had partnered in various digital innovation and smart city projects in the past, funded by a variety of government programmes including the European Commission's Horizon 2020 and the Smart Flanders programme. The interdependency that became apparent, and the trust developed in these projects, can be seen as a breeding ground that created an opportunity to engage in a more intense form of interaction that resembles elements of coordination, with a more formalised interaction through the signing of a joint covenant, and collaboration, with the alignment of goals and the planning of joint action that entailed some blurring of structural and eventually cultural

organisational boundaries. 'We did many things from Antwerp, we did many things in Antwerp. We did some things with Antwerp already. So, why not do these smart city activities together with the city', one core partner recalled [A1].

In both cases, however, the intensity of the departure of the partnerships was only temporary. As the networks grew and external partners were included, loss of autonomy, conflicting interests, and increasing risk became more salient. Many projects in both cases, therefore, started off slowly, with very little output in the beginning. In Antwerp, time was needed for goal alignment and the development of mutual understanding, where trust and commitment were at a lower level resulting in less intense interactions resembling cooperation, mainly revolving around the exchange of information, and characterised by a reluctance to exchange other resources. 'The hard thing was that we had different finalities, I think. And this came through to the working floor as we asked how we will set up these projects?' 'I have to say that the core partners did find each other eventually, but in the beginning, it was hard', a core partner recalled [A2]. The interdependence created in the period of interactions with a high intensity revealed value conflicts among the more peripheral actors in the network.

In the project teams, the intensity of interactions was also impeded by a lack of commitment from the city departments. As they did not have the capacity, nor the knowledge to fully commit to the projects, goal alignment and joint action were impeded [A6]. The intensity level of interaction, therefore, resembled cooperation. In Darmstadt, the fast growth of the network also required the projects to slow down in the beginning. Constant dialogue and communication were required to sustain the Digitalstadt network, however, this also resulted in tensions with managing the projects. A step-by-step approach proved to be effective, although time-consuming, to manage the different complexities that come with a large and diverse network. In other words, while there were not necessarily issues of trust and commitment, connections between the different parts of the network had to grow and this limited the possibilities for joint action and goal alignment. In this phase, the interactions between the partners in the network were 'stuck' at the level of cooperation. 'First, think in large dimensions and then break it down into actionable measures', an interviewee explained [D2].

The above-mentioned *growing pains* could be resolved by continuing interactions between partners, but by lowering the intensity of the interactions. In Antwerp, for example, tension arose about the use of (public) data within smart city projects. While these are integral aspects of most smart city innovation projects, the use and reuse of public data are also highly controversial, especially for public organisations [A4]. Further, data standards are very important to enable the use of data for smart city innovations. These tensions

became more salient as projects moved on and as the intensity of the partnership and the exchange within developed, which caused many projects to stall. By implementing a data charter and the aforementioned formal governance structure with expert groups who could advise on these issues, these issues were eventually resolved [A1; A2; A4]. Organisational boundaries were re-emphasised (e.g., as a data supplier and a data user), which created clarity and reduced the risk of committing to the projects. The first target agreements in the Digitalstadt Darmstadt projects were also respectful of organisational identities and cultures. Later on, regular round tables were introduced where core partners of the smart city partnership could meet with external players in the ecosystem to generate and develop ideas which caused 'the network to get stronger', as one respondent formulated [D4].

Structural Dynamic

Aside from interaction intensity varying across time, we also find a *structural dynamic* where the intensity of partnership interactions varies as a function of elements within the partnership's structure like roles or hierarchical levels.

For instance, the position of the interaction within the governance structure of the network was of influence for the intensity of the interaction. For example, core partners who are represented at the higher hierarchical level find it easier to develop more intense modes of partnership interaction. In Darmstadt, this is partly attributed to the visionary mayor's leadership style. He deliberately installed a culture of trial and error by creating spaces for mutual learning and allocating time for personal interaction. As one interviewee emphasised, unlike in the city administration, 'we call each other by our first names' [D5]. High levels of interdependence foster more intense interaction, which creates opportunities to grow trust and commitment. Similarly in Antwerp, the core partners also put forward openness and transparency towards each other: 'I think we tried to have the core partners represented in everybody and every project. That is one thing. Another is to be as open as possible about the lessons learned and to make them available for each partner' [A3]. Core partners are generally included in the governance structure's top hierarchical levels. They, therefore, deal with issues that are strategic, broad and more encompassing of the entire smart city. This allows their exchanges to be more visionary while engaging in more abstract thinking and requiring a strong sense of commitment.

In lower hierarchical levels, however, like in Antwerp's expert groups and project teams or Darmstadt's project teams or programme management groups, the discussions are more operational and *hands-on*. In this environment, conflicting interests and risks are more salient and concrete. An example from the Antwerp case was a test case with smart streetlights. While this certainly fits into the general goal of enabling smart technologies in the urban environment,

there are several issues like altering the electric circuit of street lighting or the tramway overhead line to install a smart camera [A6]. In other words, when getting into the nitty gritty of such a project practical problems are created which have to be solved in a way compatible with the normal service delivery of the city administration [A5]. The commitment of city departments towards the smart city projects was low, as their focus is on the daily service delivery in the city. This prevents specialisation and joint action and limits the intensity of interactions within the project teams. Projects are then limited to experiments and do not evolve to a level of mutual goal development or the creation of a joint vision.

Another element creating variation in interaction intensity as a result of structural conditions is the capacity the individuals have to participate in smart city initiatives. This is generally higher when moving towards the upper hierarchical levels of the governance structure. In Darmstadt, for example, the GmbH Digitalstadt Darmstadt has employees on its payroll, including two programme managers. Their sole occupation is to manage the smart city programme of the city. In Antwerp, the city administration has a smart city director, as does IMEC. Both are represented in the steering committee with the task of developing the smart city policy in Antwerp. In the project teams, however, civil servants of city administrations or employees of private companies are included in the collaboration. They are indispensable to executing smart city innovation projects in a real-life *living* context, but they also have many other tasks within their job as a civil servant, for instance, in the Department of Mobility, or as an employee of a private company. This is also acknowledged by a respondent in the higher hierarchical level: 'It is not always clear for them what they have to win. They have to put a lot of time and effort into something that won't achieve their goal directly' [A2],

CONCLUSION

The purpose of this chapter was to shed light on how different intensity levels of collaborative interactions manifest in smart city innovation partnerships and how temporal and structural differences affect this intensity. In doing so, we sought to better understand whether these partnerships – as commonly assumed – involve more intensive collaboration between partners or instead represent alternative interactive forms such as coordination and what this implies for public management practice, drawing on the theoretical notions of the 3C concept (e.g., Keast et al., 2007). We focused on two cases in cities that are regarded as digital pioneers, the cities of Antwerp in Belgium and Darmstadt in Germany and conducted six interviews and a document study for each case. Both cases have relatively similar elements in their system context, which allowed our analysis to focus on the interactions between different

partners within the network to explore the different ways in which these interactions can manifest in smart city innovation partnerships. In this concluding section of our chapter, we highlight our findings and outline implications for practitioners and researchers.

The analysis revealed that in the cases under study smart city networks are not clearly collaborative, as lower intensities of partnership were primarily observed. The answer to the question of how collaboration within smart city networks manifests is, therefore, more nuanced and indicates a varying intensity of interactions depending on the project phase and structural level. More so, our results reveal a temporal dynamic and a structural dynamic in the intensity of interactions between the members of the partnership (e.g., Ansell and Gash, 2008).

These findings have several implications for both practitioners and researchers of smart city projects. First, it is important to recognise the dynamic nature of partnership intensity. Collaboration is resource-intensive and creates several challenges that must be overcome. Therefore, interactions within the network cannot always be highly intense. Rather, periods of intense collaboration are needed to lift the network into a different phase. For example, episodes of intense collaboration can lead to the formulation of joint goals or a compelling vision which can kickstart the formation of a formal network. However, a new phase of partnership creates new challenges, and the engine of collaboration can become overheated as complexities, interdependencies, and conflicting interests become more salient (Elston et al., forthcoming; Huxham and Vangen, 2005; Seabright et al., 1992). In this case, managers of smart city projects need to allow the partnership to slow down and gain some distance. This period of low intensity can support problem definition and the development of solutions like institutional design measures. These new, formal design elements can then serve as *handles* to increase the intensity again and continue working towards joint goals. Our results suggest periods of high, medium, and low intensity need to be alternated to resolve conflict and move forward.

A second dynamic in our findings is a structural one. We find that the intensity of partnership interactions within smart city networks is also a function of structural elements. In our results, we mainly find evidence to support the observation that intensity varies by position within the governance structure of the interaction. Interactions more easily evolve towards an intensity level of collaboration at the top hierarchical levels of the network, where strategic decisions are made, and discussions are likely to be more abstract and related to the overall objectives and vision of the network. In project teams, however, operational decisions are made, and these decisions are more prone to value conflicts and practical obstructions. Therefore, our analysis finds the interaction intensity at the project level to be more limited and needs to be designed with greater caution. Managers and scholars of smart city networks, therefore,

have to be aware that a network can be diverse, and that different forms of partnership and different challenges can arise in different areas of the network (Emerson et al., 2012). It is also important to align the strategic and operational perspectives on the problem. A two-way exchange between the top and the bottom is important to make sense of the bumps in the partnership road at the different levels.

Our nuanced perspective on partnerships with associated modes and intensities that has emerged thus suggests that a broad or fuzzy understanding of smart cities as collaborations falls short of adequately assessing what is needed to navigate network dynamics towards desired digital outcomes. Rather, it appears that public management practices must be attuned to varying degrees of intensity. In line with Keast et al. (2007), the suitability of each of the 3Cs is about 'getting the right mix' (p. 10) across structural levels within the partnership and over time (see also Ansell and Gash's 2008 'contingency approach'). This yields an important takeaway point of our chapter, that collaboration may represent the most intensive form of partnership but does not come without costs. It is difficult to achieve the intensity level of collaboration, and it can be resource-intensive, but it is even more difficult to sustain it (see also Keast et al., 2007). Therefore, managers should not aim for high-intensity interaction all the time and at every stage in the partnership, but rather find a balance between intense collaboration and less intense interactions where there is room for regrouping and reconsidering one's own values, resources, and objectives.

It is also interesting to note that in both Antwerp and Darmstadt, the project outcomes were moderate at the time of the interviews, three or four years after the formal founding of the partnership. Although the programmes and, in the case of Darmstadt, the funding period had already advanced, very few of the subprojects had entered the concrete implementation or scale-up phase. In addition to regulatory restrictions, especially with regard to legal uncertainties in the digital field, this is also due to the underestimated effort or time required to build and maintain fruitful networks. Given the volatile nature of interdependence, trust, and commitment, this may involve fragile phases of cooperation and collaboration and, as shown, more stable coordination in the longer term.

Again, important to note here is that collaboration, although the most intense form of interaction, is not always the adequate choice to achieve the desired partnership outcomes. Rather, intensive, shorter periods of collaboration with smaller groups of the right partners should be pursued only when most appropriate. During these short stints of intensive interactions, managers should build a trusting environment with regular yet informal exchange and strong commitment, while avoiding the exhaustion of partners' engagement and resources. In the long run, managers should also consider other, less intensive forms of interaction such as cooperation and coordination to ensure partner-

ship resilience in the face of both intentional and unintentional fluctuations in staff, rationales, and resources.

In fact, the analysis is a snapshot from the beginning of 2020. The smart city projects and thus the interactions taking place may have intensified and weakened again in the meantime. In Darmstadt, for example, the planning of an overarching data platform was discussed, in the course of which additional joint structures, visions, and a resource pool are to be created. This is further supported by a newly generated grant of 13.3 million euros from the Federal Ministry of the Interior (BMI), which is to ensure the continuation of Digitalstadt's endeavours for the next seven years (BMI, 2020). In Antwerp, the learning outcomes were regarded as the most successful at the time of the interviews. A positive evaluation resulted in a renewal of the covenant, also implying a further investment of financial resources, in which expectations and goals for the partnership were delineated more sharply (Stad Antwerpen, 2020).

Building on this empirical work and following up on recent project developments would be a promising starting point for future analysis. This can help to better understand potential shifts in collaboration and derive practical implications for leadership and institutional design, considering partnership intensity as a key factor in finding appropriate mechanisms for effective smart city governance in Europe and beyond.

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