

Article

Transition towards Smart City: The Case of Tallinn

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Abstract: The main interest of this paper is to analyze the gap between an existing city and its future vision set in the strategy, with a focus on the transition path towards becoming a Smart City. For the analyses, we used the example of Tallinn, a middle-sized European capital city acknowledged in innovation reports as a good example of a Smart City development. This is a qualitative case study with data based on the Tallinn 2035 strategy document and on the interviews conducted with city officials. We mapped the current situation in regard to the four Smart City strategies dichotomies framework in order to understand if and how the future vision of Tallinn differs from the present. The results indicate that the current direction deviates in several ways from the future vision set in the strategy, and that to be able to move towards the vision, strategic changes are needed. With this paper we hope to add some insights to the literature about the knowledge gap between Smart City theory and implementation from the perspective of a present situation versus long-term strategy.

Keywords: Smart City; sustainable urban development; Smart City transitions; development process; strategy



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1. Introduction

As many authors have argued [1–3], there exists a knowledge gap between Smart City (SC) theory and implementation that is well worth further investigation, and this is what we aim to do in this article, using the city of Tallinn as an example. Several explanations have been brought out as potential reasons for the implementation gap, e.g., overly ambitious visions and unrealistic goals as well as the reluctance of the city government to go along with the changes [4–6]. Ahvenniemi and Huovila [7] add as one potential reason the fact that most of the research about smart cities has been done by researchers with the very limited involvement of city government officials. Therefore, we aim to give an overview of the current situation in Tallinn from the perspective of city officials and analyze the gap between the current situation and the vision of the smart and sustainable city that was set in the Tallinn 2035 strategy document. Ahvenniemi and Huovila [7] also suggest that the Smart City originally focused on sustainability, and that smart urban technologies were considered as one of the potential ways (and not as the only way) for achieving the desired goal of the sustainable urban development [8]. In addition, the limited research about SC application is further complicated by the persisting disagreement among researchers about the status of Smart City development as well as about the definition of the SC concept itself [9–15]. Nevertheless, multiple attempts have been made to generalize the best practices, but as SC as a concept and practice is intervened with the constant change and innovation taking place in urban environment, society and technology, it is bound to remain open and destined to keep on changing. Therefore, it is plausible to believe that the literature about the best SC strategies will keep on growing.

In general, Smart City development from the local government's perspective can be considered to consist of three main building blocks—city policy, management and technology. In order to be able to generate change, innovation cannot be expected only from the field of technology, but it must occur on management and policy level as well. Simon

Joss [16] argues that the urban future is now seen dominantly through the SC perspective, promising to offer more efficient resource use and better governance through technology, e.g., like data-based decision-making, including the citizens assigned new entrepreneurial roles as co-producers of data-driven information. Joss suggests that to properly involve the public with the future city discussion, the transparency and accessibility of institutional decisions of how and where to implement future city programs should be improved by imbedding it to the established planning structures and processes, e.g., city strategy. Joss stresses the need for the innovations made under the banner of future city to justify and demonstrate the claim that “the people will inhabit a central place in the future city” [16] (p. 3). Nevertheless, the involvement of the citizens remains a very big challenge, both conceptually and empirically.

Lu et al. [17] point out that the decision-making processes on Smart City projects, as well as in case of eco- and low-carbon-city initiatives, have been understudied, resulting in a limited understanding of why urbanization processes do not always proceed in the desired direction. They emphasize the importance of strong political support and will, without which the development of Smart and Sustainable Cities is almost impossible, but as the political support tends to be unstable, they suggest that further rules are needed to put the environmentally sustainable Smart City initiatives in practice. They also bring out as one of the potential threats or barriers for developing sustainable Smart City, that the most sustainable choices and ambitions, set as a goal in the city strategy documents, might be discarded in the implementation phase by politicians who are afraid to lose the support of more conservative voters. Nam and Prado [18] also consider the public sector as less friendly for innovation, as there is no competitive pressure to innovate and city governments are expected to perform their core tasks with stability and consistency and to resist disruptions, which innovation inevitably is. The research gap, as far as the authors know, is the lack of empirical evidence on where cities are now and where they wish to be in terms of Smart City progress. Thus, we focus on the different paths towards Smart City transition. This paper is novel in providing insight from a perspective of a capital city on how this transition is perceived internally.

The purpose of this paper is to advance the discussion on the knowledge gap between the theory of a smart and sustainable city and the actual implementation of the strategy by the city government. The paper, using as an example the case of Tallinn, seeks to map the current situation in Tallinn in the context of the SC best practices to understand how far Tallinn is from reaching the targets set in the new city strategy. As a qualitative method, a combination of document analysis and interviews with city officials is applied. The paper is divided into four sections: 1. Introduction with Literature Review; 2. Conceptual Framework and Methods; 3. Results; and 4. Discussion and Conclusions.

1.1. Literature Review

This section provides an overview of the SC definitions that contribute to building the conceptual framework of this paper. This framework includes the SC best practices and different collaboration models for applying and developing SC as well as the most common barriers for SC development and application. The suitability of the “SC handbook” approach that generalizes different SC experiences into one transition strategy is briefly discussed.

1.2. Definition of the SC Concept

Over the years, many researchers have contributed to the definition of a Smart City in the extensive literature published on the subject, but still there is no universal definition of a Smart City [19–21]. The reasons why a Smart City definition has remained so elusive stand in the fact that all smart cities projects are unique because of their geographical and cultural-technical context. Innovation, an integral part of the Smart City concept, is constantly reinventing itself, and therefore, the concept of a Smart City is always changing. Thus, there cannot be a consensus on the main factors that should be considered to make a

city smarter and more sustainable [22]. According to Matos et al. and Dameri [22,23], a Smart City should be regarded as a living organism with reasoning and learning capabilities rather than as a static concept. The involvement of citizens and communities are becoming more important, considering technology not as an end by itself, but as a tool in service of the users, creating a public value for the whole society. As Dameri puts it [23], “a Smart City is a well-defined geographical area, in which high technologies such as ICT, logistic, energy production, and so on, cooperate to create benefits for citizens in terms of well-being, inclusion and participation, environmental quality, intelligent development; it is governed by a well-defined pool of subjects, able to state the rules and policy for the city government and development”.

1.3. Overview of SC Collaboration Models and Best Practices Literature

The literature on Smart City collaboration models concentrates mostly on the double-helix (DH), triple-helix (TH) and quadruple-helix (QH) theories. The TH model (university–industry–government relations) is more in line with the Smart City definition as technology driven, and the QH model (university–industry–government–citizens relations) is connected with citizen- and smart community-centric approach [24,25]. The DH model is usually seen as a collaboration between industry and government, where industry takes the lead role [26,27]. According to the several service science researchers [28,29] the roles in the Smart City collaboration models are usually distributed as follows: cities as enablers; universities as providers, firms as utilizers and residents as users. One recent study [30] also involved resident representatives and added other emerging actors (e.g., start-up companies, social entrepreneurs). The QH model is more in line with the holistic approach to the SC development, where the cities tend to be the ones who take the lead role as enablers, setting the long-term vision and strategy for the Smart City, involving universities as providers of expertise and knowledge, the private sector as technology providers and citizens as the end-users. Renata Dameri [31] added another stakeholder to the model—the linking role played by consulting companies, offering direction services in complex projects. The lead role can be fulfilled by each of the three main stakeholders, but the top-down or bottom-up approach depends mostly on the role taken by the city government. The bottom-up approach of a Smart City tends to happen when the lead role is taken by a university or industry.

The frameworks for developing a Smart City can be general, but what works well and what does not, in the context of certain urban areas and sociocultural contexts, can be understood only through applying the theories in practice. The perception that the knowledge gained from one city can function as a roadmap for other cities interested in applying SC theories in practice has inspired many researchers. Multiple attempts have been made (see Figure 1 describing five generalized SC transition paths by Mora and Angelidou, 2019 [32] to generalize the best Smart City practices through an extensive literature review or by analyzing different case studies on SC initiatives or strategies, either considered successful or not, hoping to learn from the practical experiences of the cities and to map the drivers and barriers of the SC transition [9,33–35]. This kind of research is a never-ending quest, as the best practices change depending on the time and context, with, for example, the new discoveries in technology. As several authors have pointed out [32,36–39], there is a high expectancy from the policymakers that by implementing a Smart City transition they will be able to tackle all kinds of urban challenges in a sustainable manner, but the theoretical and practical ambiguity surrounding SC development and the coexistence of several urban transition theories leave many knowledge gaps about how to assemble and set up the SC transition and what direction to take.

Angelidou [33] as well as Nam and Prado [18] pointed out that Smart City strategy is an ideal vision of a future city and represents the city’s effort to make itself smart. Sadowski and Bendor [40] claim that the roots of imaginary Smart City are bounded with the narrative of cities facing urban crises and salvation is offered by technology, and that this narrative originates from the technology providers themselves, like IBM’s and Cisco’s

respective visions of smart urbanism. According to Sadowski and Bendor [40] as well as Alizadeh [2], the technology company-led vision helps the tech providers to sell their products to the city governments, offers a one-size-fits-all solutions to different urban challenges disregarding the complexity of the urban ecosystem and overshadows other potential alternative interpretations of smart urbanism. Many authors have been critical to the “one-size-fits-all” innovation strategy approach that is disconnected from the local context, starting from Tödtling and Trippl [41], followed by Kitchin [37] and Alizadeh [2]. Still, these generalized best practices help to understand how the SC policies have changed over time. Furthermore, an overview of the best practices is useful for the city governments interested in a SC transition, as it helps them to design the most suitable vision for their city, set the targets in city policy and strategy documents and choose the most adaptable SC transition path for their context. The best practices could serve also as an example while communicating internally (to other city departments) and externally (to citizens, e.g., inviting them to take part in city strategy co-creation) about the ambition and expected benefits of Smart City transition.

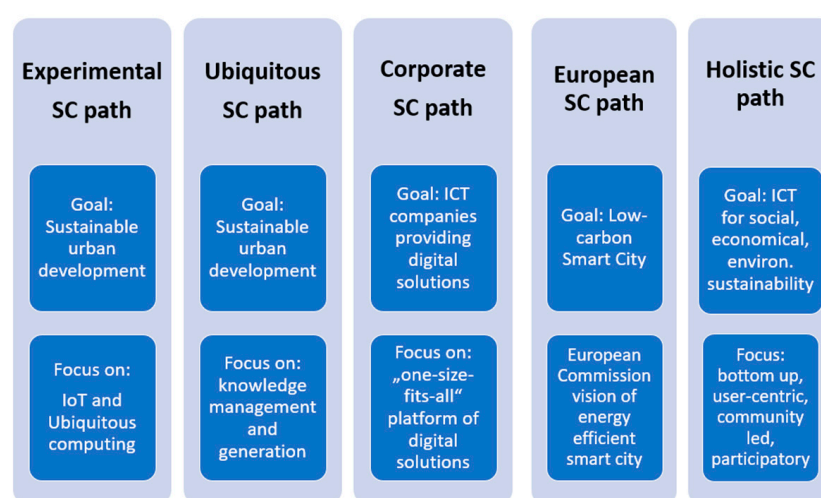


Figure 1. The five main Smart City (SC) transition paths (Source: the authors’ adaption based on Mora and Angelidou [32]).

1.4. Smart City Barriers

Tödtling and Trippl [41] argue that even though the policy conclusions drawn from the analysis of best practices are of limited use for less favored regions due to different available resources and innovation capabilities, it does not mean that no lessons can be learned from the success stories and from the experience of the leading regions. They emphasize the need for more differentiated innovation policies and research about barriers in different types of regions.

Several researchers [18,42] have generalized the main barriers for the SC transition and some of them suggest dividing the barriers into technical and non-technical (see Figure 2).

Pierce and Andersson’s [42] recent research about the main barriers of SC development from the perspective of the city officials showed that municipal decision-makers mainly perceive challenges with non-technical issues such as collaboration, finances, governance and capacity building, skills and awareness of technology, but surprisingly, they did not perceive security as one of the challenges. Gil-Garcia et al. [43] also mostly emphasized the non-technical issues as challenges or barriers for applying and developing SC strategies.

Angelidou [33] argued, after analyzing the SC strategies of 15 cities, that a SC should be developed on the basis of the explicit city strategic frameworks, involving experts from different disciplines in the planning process and adopting it to the local context. As one significant challenge, Angelidou considers the difficulty for the cities to secure and manage resources needed for SC transition (financial as well as human capital), a barrier that could

be overcome with strong political support and long-term visions for social and economic development, as well as by enhancing collaboration with the private sector. On the basis of her research, Angelidou [33] found that there does not exist one common way to plan a SC transition; instead, the best approach that the cities can take is to consider their own mission and goals and local context during the Smart City strategy planning process.

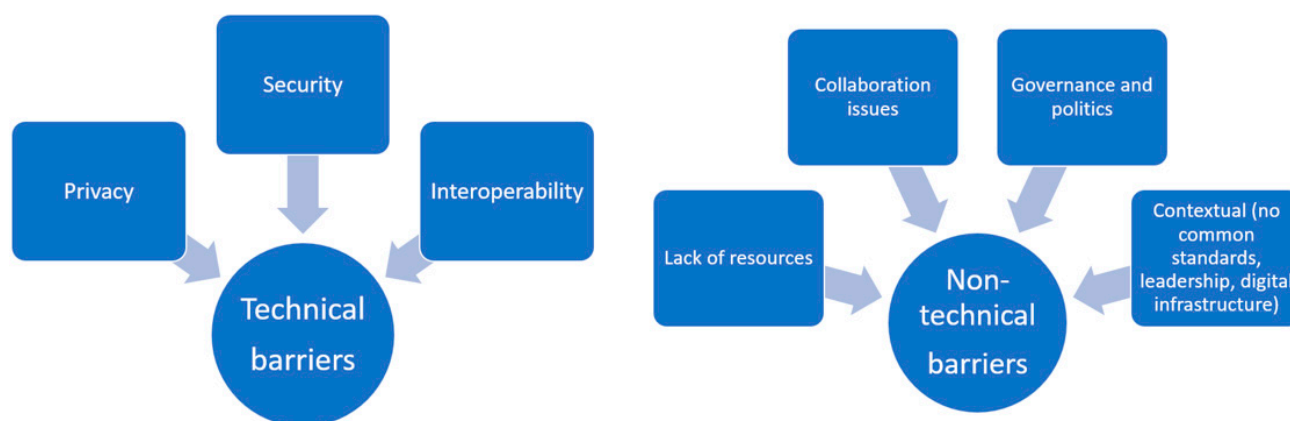


Figure 2. Most common barriers for SC transition (source: the authors' adaption based on Pierce and Andersson).

2. Conceptual Framework and Methods

According to Yin [44], a case study method is most suitable for investigating a contemporary phenomenon within its real-life context, especially in cases where the boundaries between phenomenon and the context are not clearly evident. Therefore, the chosen method for this research paper is a descriptive case study. Data for the study were collected through semi-structured interviews with the city officials and analyses of the Tallinn 2035 city strategy document, using as basis for the analyses Mora et al.'s [45] four Smart City strategy dichotomies framework, which is described in more detail below. The SC strategies dichotomies framework was chosen after reviewing research papers about conceptualized SC strategies and approaches, and the search was done by using academic literature databases. The new Tallinn city strategy was used as an additional document analysis because it is an important component for evaluating how smart a city is, as it describes the future vision of the city and the instruments and institutional arrangements applied to reach this vision [43].

Applying Mora et al.'s SC dichotomies approach seemed the most suitable for the first brief analysis of the recently approved city strategy, as it is still too early to draw any conclusion about its implementation. The chosen approach seemed promising for getting a general idea about the ambitions, visions, targets and directions chosen by the Tallinn city government in the multitude of the existing SC definitions, strategies and transition paths, as described in Section 3.

The semi-structured interviews with the city officials, working in the key positions for smart and sustainable city strategy implementation and development, provided an input for mapping the current situation in Tallinn and creating a baseline to evaluate the ambitiousness of the vision and targets set in the Tallinn 2035 strategy compared to the existing situation. The presence of the most widespread barriers for SC development, mentioned in the literature review in Section 2.2, were also analyzed on the basis of the interviews.

Tallinn was considered as most appropriate city for the case study for the following reasons: already in 2011, Tallinn was mentioned in SC literature among other cities highlighted for the best practices of SC development [9,46], and a workshop about SC development organized by the authors in 2019 with the participation of the Tallinn city officials and other relevant local stakeholders clearly showed serious shortcomings in

applying the SC theories in practice [47]; Tallinn adopted a new city strategy, co-created with citizens and relevant stakeholders, on 17 December 2020, with an ambition to become a greener, more citizen-friendly city by 2035. Therefore, it seemed to be an interesting research subject for shedding some light on the SC implementation gap.

2.1. SC Dichotomies Framework

Luca Mora et al. claim that the Smart City framework research circles are based around the dichotomies of whether the Smart City development should be (1) technology-led or a holistic strategy, (2) a double- or quadruple-helix model of collaboration, (3) a top-down or bottom-up approach and/or (4) using mono-dimensional or integrated intervention logic, and that this kind of division generates uncertainty and makes it difficult to decide which one of these directions should be followed in specific cases [43] (see Table 1). Mora suggests as one of the viable solutions for overcoming this dichotomy is a multiple-case study with a deductive approach to test the strategic principles for Smart City development that each dichotomy stands for.

Table 1. Smart City development dichotomies overview (source: Mora et al. [45]).

Dichotomies	Strategic Principle
Dichotomy 1: Technology-led or holistic strategy	Hypothesis 1.1: Technology-led strategy Hypothesis 1.2: Holistic strategy
Dichotomy 2: Double- or quadruple-helix model of collaboration	Hypothesis 2.1: Double-helix model of collaboration Hypothesis 2.2: Quadruple-helix model of collaboration
Dichotomy 3: Top-down or bottom-up approach	Hypothesis 3.1: Top-down approach Hypothesis 3.2: Bottom-up approach
Dichotomy 4: Mono-dimensional or integrated intervention logic	Hypothesis 4.1: Mono-dimensional intervention logic Hypothesis 4.2: Integrated intervention logic

On the basis of their own research and literature review, Mora et al. [45], suggest preferring the following two out of four dichotomies: 1. Holistic strategy; 2. Quadruple-helix model of collaboration as the best practice for generating innovation in the cities, involving the most relevant stakeholders for SC development, industry–government–research–citizens relations or public–private–people relations and research. Mora et al. emphasize as a benefit of the Q-H model its ability to crowdsource innovative solutions from the public and to better understand the actual needs of the citizens, so that the supply is based on the demand, and not vice versa.

In the case of choosing between top-down or bottom-up approach, Mora et al. suggest, on the basis of multiple case study analyses, a mixture of both, because, even though the collaborative environment is of utmost importance for the success of SC development, so is strong political support. They bring out the following aspects to describe how the state actors can influence positively the SC development: (1) encourage strategic interactions between different social groups; (2) create room for experimentation; (3) make sure that the process remains open, inclusive and cohesive; (4) support interested parties who might not be heard; (5) break silos; (6) facilitate interactive learning related to urban issues, needs and possibilities; (7) guide technology developers in their decisions; (8) orient search and selection processes of Smart City innovations; (9) keep the transition process oriented towards a fully sustainable path.

Finally, Mora et al. suggest preferring the integrated intervention logic.

2.2. Semi-Structured Interviews with Tallinn City Officials

For a 3 month period (from the end of June 2020 until the end of September 2020) approximately 1 hour long, semi-structured interviews were conducted with Tallinn city officials holding key positions for SC-related innovation. The interviews took place face-to-face and the city officials were approached via email and/or phone to set up an interview. The questions were divided between general questions about innovation generation in

Tallinn and feedback to the recent Smart City collaboration project “TalTechCity” between city of Tallinn and Tallinn University of Technology. We conducted expert interviews with eight city officials working for the city of Tallinn, mainly with decision-makers like the Vice Mayor for Innovation, the Head of Strategy, the Director of Finance, the Head of Tallinn Smart City Competence Center and the Chief Innovation Officer (see Table 2). The interviews took place a few months before major internal structural changes in the city government. At the moment of the interviews, there were not many city officials involved in Smart City development and this is the reason for the limited number of interviewees.

Table 2. The overview of the interview conduction.

Interview	Role	Why Is Relevant for SC Development	Date
Interviewee #1	Head of Strategy	Leader of the Tallinn 2035 strategy workgroup	26 June 2020
Interviewee #2	Head of Tallinn Smart City Competence Center	Responsible for collaboration with International City networks, R&D project development coordination (H2020, Inrterreg, Urbact, UIA and others)	29 June 2020
Interviewee #3	Director of Finance	Responsible for the City finances	8 July 2020
Interviewee #4	Project manager at Tallinn Smart City Competence Center	Responsible for smart and sustainable city project development	10 July 2020
Interviewee #5	Vice Mayor of Innovation	Responsible for the innovation generation	4 August 2020
Interviewee #6	Business Adviser at Tallinn City Enterprise Board	Works on collaboration with companies, offers training and support to start-ups and collaboration with universities.	4 September 2020
Interviewee #7	Lead specialist in the City Survey subunit	Works on collaboration with universities and research institutions	9 September 2020
Interviewee #8	Chief innovation officer	Background in technology companies, from 2021 Head of Future City unit (data, digital and innovation)	21 September 2020

Interview questions were sent beforehand to the interviewees, but as the interviews were conducted with a semi-structured approach, deviations from the original questions were acceptable. The greater aim was to get a more thorough feedback from the city officials and not to constrict them to very specific questions—the questions were used as general focus points and pointers for the direction of the interview. The interviews were transcribed afterwards.

2.3. Description of the Tallinn 2035 City Strategy

To co-create the Tallinn 2035 strategy, the city government held (starting from 2018) four rounds of consultations with around 5000 city residents, including via workshops and seminars in each of the eight city districts. The summary of the strategy document is provided in the Table 3.

The SC is mentioned in action plans for developing a better and more competitive business environment: (1) entrepreneurial lifestyle, entrepreneurs with a growth ambition, top-level knowledge and skills; (2) an environment open to internationalization and cooperation between stakeholders; (3) Smart City program; (4) attractive physical environment for business development; (5) awareness of Tallinn as the tourist destination and balanced tourism development.

The target goal for the Smart City program and the connected most important directions of activity are described as follows: (1) creation of data-based digital urban management system; (2) increasing the share of urban digital services in public services and their continuous renewal; (3) the city taking more responsibilities as a customer and initiator of the innovation through innovative public procurement, public service design, demo projects, etc., (4) encouraging the development of new, future technological solutions and

their implementation in the urban environment (e.g., pilot project of self-driving cars, free internet, smart solutions for Tallinn residents and guests) and (5) the implementation of Tallinn–Helsinki joint projects.

Table 3. The overview of the Tallinn 2035 strategy document.

No. Inhabitants	Length and Structure of the Strategy	Main Values and Principles of the City	Does the City Indicate Clear Targets, Measures and in What Way Is the Performance Towards the Targets Measured?	CO ₂ Target
437,619	63 pages with no illustrations or photos. There is also an interactive web application with maps, illustrations and photos.	Strategy focuses on sustainability and urban development, education and digitalisation. Six main targets are: 1. Friendly urban space, 2. community, 3. green revolution, 4. world city, 5. proximity to home (15 min to city) 6. healthy and mobile lifestyle. The five main values to follow are: 1. purposefulness in achieving targeted results and curiosity for finding best solutions, 2. cooperation and independence, 3. wisdom and courage to make decisions and take responsibility, 4. reliability and openness of city officials and 5. customer focus and friendliness.	Targets are clearly expressed and monitored yearly (e.g., +2% of enterprises per year for 1000 inhabitants, among top 10 in the rankings of digital and sustainable cities like CityKeys, European Digital City Index, etc.). Measures are described through action plans for each of the six main targets/goals of the city strategy, with sub-targets. There are 30 targets set for 13 different fields: 1. entrepreneurship promotion and innovativeness, 2. education and youth work, 3. environmental protection, 4. safety, 5. culture, 6. mobility, 7. urbanscape, 8. city planning, 9. preservation and development of urban property, 10. social care, 11. sport and recreation; 12. infrastructure and 13. health and healthcare	–40% by 2030 compared to 2007

The values of the Tallinn 2035 strategy are as follows: (1) purposefulness in achieving targeted results and curiosity for finding the best solutions, (2) cooperation and independence, (3) wisdom and courage to make decisions and take responsibility, (4) reliability and openness of city officials and (5) customer focus and friendliness. The elements of SC are present in other sections as well, and are not limited only to the business environment development part of the city strategy.

3. Results

3.1. Interview Results from the SC Dichotomies Perspective

From the transcribed interviews we looked for the references to the four dichotomies. In the Table 4 (see below), it is visible how many out of the eight interviewees made a reference to one or another of the SC strategies. As an overall picture of the current situation, the interview results showed that the city of Tallinn tends to be more technology-led with main collaboration model leaning towards the double- or triple-helix model. The governance of Tallinn was described as representing the top-down approach. It was complicated to understand from the interviews whether the last dichotomy of the mono-dimensional versus integrated approach was preferred, as all of the interviewees talked generally of city services, their digitalization, development and the importance of user-centricity and not so much about focusing on the mono-dimensional approach in service development. Though, the need to define and focus on so called “flagship smart city projects”, representing the primary interests of the city, were mentioned several times. As these “flagship projects” were not defined by the time of the interviews, it was not possible to draw conclusions on whether they would be representing mono-dimensional or integrated approach. Therefore, we were not able to detect clear enough information to be able to divide the responses either under mono-dimensional or integrated approach.

Table 4. Key dichotomies in the city of Tallinn (interview results). Source: authors.

No. of “Pure” Dichotomy		No. of Mixed	No Data	Dominant Result
Technology-led: 3	Holistic: 1	3	1	Technology-led approach
Double-helix or triple-helix–6	Quadruple-helix	2	0	Double- or triple-helix
Top-down–4	Bottom-up–1	3	0	Top-down
Mono-dimensional	Integrated			No data

3.1.1. Technology-Led versus Holistic Approach

As overall result, the preferred strategies were technology-led and a mixture of both strategies, making technology-led a dominant strategy. Only one city official made a clear reference to a holistic approach.

Interviewees #3, #5 and #7’s responses referred to the technology-led approach. Interviewee #3 considered it important for Tallinn to move towards data-based decision-making. As a starting point for this transition, interviewee #3 suggested to focus on capacity building and internal communication, explaining the benefits of why and how data-based decision-making is useful for the city, to set common standards and procedures for data collection and sharing. As a second step, interviewee #3 suggested, the city government should focus on motivating the city officials to collect data according to the standards that would make the data interoperable. For analyzing the potentially vast amount of data, interviewee #3 saw a solution in integrating AI-based solutions for data analyses. Nevertheless, interviewee #3 also highlighted the need for capacity building and skills development, so that the city officials would be able to understand how to mix data from different sources to get the bigger picture needed for adequate decision-making. Interviewee #5 considered the cost of innovative technology as one of the major challenges in developing SC. Interviewee #5 also added that, even though the city government considered applying several innovative technological solutions, they had to give up on a number of them that proved to be too expensive. Thus, interviewee #5 believes that the new technologies come into our daily lives anyway, and therefore, the local authorities should not be obliged to be an innovation testing laboratory at their own expense. However, almost market-ready solutions could be tested, e.g., smart traffic lights, asphalt that generates energy, and other similar practical solutions. If the city is interested in moving towards data-based decision-making, interviewee #7 estimated that this kind of impact assessment is particularly important as big data can create incorrect assumptions.

Interviewees #2, #4 and #8’s responses were interpreted as a mixed approach, without choosing either the holistic or technology-led approach. Interviewee #2 considered it important that the city has a vision of where it would like to arrive with the SC projects, and a clear understanding of what would be the actual problems that could be solved through these projects, as well as having an overview of the fields and themes where new innovative knowledge and technological solutions are most urgently needed. Interviewee #2 emphasized that, even though some of the answers and general direction for everyday decision-making is findable from the city policy and strategy documents, the fact remains that some choices need to be made daily and based on the actual situation and context; thus, priorities need to be mapped and reviewed constantly alongside “flagship project” themes. These “flagship projects” can consist of smaller components and should altogether create kind of database of prioritized themes. Interviewee #2 commented that in the case of Tallinn, most of the focus has been so far on developing internal digital systems, and not so much on the digital services meant for the citizens. Interviewee #2 concluded that as a result of this, the digital solutions aimed for the citizens are seriously lagging behind, which was made quite clear when the COVID-19 pandemic hit. Interviewee #2 pointed out that all the solutions that Tallinn has been praised for as a Smart City are not directed to the citizens, and the city has not done much in order to turn its services into more user-

friendly and smart options. Interviewee #2 nevertheless considered the developments that Tallinn has made to be more service-based, and not at all social-value-based approaches, but interviewee #2 did not evaluate the existing service-based approach very highly and called it very limited. Interviewee #2 added that the COVID-19 pandemic also brought out, among other urban challenges, the digital divide among the residents. Interviewee #4 considered that if the city would set clearer priorities in testing innovative approaches, it would be able to use its resources, both human and financial, more efficiently and be more agile in testing innovative solutions. According to interviewee #8, the technology side of SC development (IOT, 5g, big data) is primarily a tool. Interviewee #8 found that smartness and innovation can be created through helping others, e.g., as was the case at the beginning of the COVID-19 pandemic, and through encouraging cooperation among relevant stakeholders. He added that Tallinn should not focus only on a technology-led approach in SC development, but instead on some other clear Smart City-related strength that would make Tallinn stand out among the other cities developing a SC.

Interviewee #1 was the one to prefer the holistic approach to technology-led one. It is also important to mention that he was at the time leading the new city strategy workgroup. He compared the innovation management of Tallinn with other European cities and concluded that even though the general overview is given about the innovation management, it is still complicated to get a clear understanding of how these systems are internally structured and what is their context, making it complicated to learn from the best practices and experiences of other cities. Interviewee #1 considered it important that the city would put the citizens first, but mentioned that sometimes technology for technology's sake can be part of important innovations like in the case of the smartphone—before it was invented, nobody knew that they would want one.

Interviewee #6 provided no data on this issue.

3.1.2. Double- versus Quadruple-Helix Model of Collaboration

To describe the current situation, six out of eight city officials considered Tallinn to follow a double-helix or triple-helix collaboration model with other relevant stakeholders, and two provided mixed evidence, confirming that currently QH model is not being applied, and considered moving towards the QH collaboration model as the right direction. Therefore, we can conclude that currently the DH or TH model is prevailing, and when considering in what direction to move, four out of eight city officials actually prefer the QH model.

Interviewees #1, #3, #4 and #8 preferred the QH collaboration model, whereas interviewee #1 and #4 interpreted this as a strategic goal. Interviewee #1 saw as the future vision the QH model, but considered it important that the city would take more active role than it does currently in different SC collaboration models that represent DH or TH models, especially in collaboration with the private sector and research institutions. Interviewee #1 commented, as a feedback to the collaboration that the Tallinn University of Technology and the City of Tallinn had under a SC-focused initiative “TalTechCity”, that the city should take the lead in the collaboration models, and the university, instead of being the one executing SC projects, should rather fill the role of being a knowledge provider. Interviewee #1 concluded that as a first step towards this change, the city would need to know what kind of knowledge it needs from the universities for SC development. Similarly, interviewee #4 preferred the QH collaboration model as a future vision for SC development in Tallinn, but said that currently it is not applied as it should be. Interviewee #4 considered the city's ability to involve citizens and local communities in the transition process as one of the shortcomings in SC development in Tallinn. Interviewee #4 considered as equal challenge the initiation and enhancement of interdisciplinary and horizontal collaboration within different city departments. Interviewee #4 emphasized as one of the most important benefits of co-creation among different interest groups and stakeholders the feeling of ownership that participants get, and that as a surplus value, these kinds of collaborative projects tend to be much more sustainable and able to find additional funding to reach their

collaboratively set goals. Tallinn should move more towards a QH model and use Helsinki as an example from whom to learn about SC approaches, concluded interviewee #4.

Interviewees #3 and #8 focused on strategical partnerships in their responses on QH model. For interviewee #3, one of the barriers for more meaningful collaboration with relevant stakeholders—like research institutions, private sector and local communities—stands in the difficulty of getting timely and clear answers from the decisionmakers. Interviewee #3 suggested that more independence at lower level would accelerate decision-making processes in the city departments and would make the city more competitive partner for other stakeholders. The interviewee #3 supported the QH approach and emphasized the importance of involving private sectors and enhancing the collaboration with companies that can contribute to the SC development. Interviewee #3 considered local communities and citizens as important stakeholders in this collaboration with the private sector and suggested that the communication and engagement of the local communities could be organized through city district governments and as a two-way communication. The current challenge in citizen engagement, according to interviewee #3, is that the communication works only in one direction—the local communities tell the city government what they want the city to do or ask for money to do the things they consider important, but often do not consider the bigger picture that the city must keep in mind. Interviewee #8 argued that Tallinn should collaborate more with the private sector and move towards a QH approach. As one of the barriers for SC transition, interviewee #8 pointed out that in Tallinn, the city government is stuck in the fact that “we’re waiting for some innovative smart solutions, but at the same time there are already existing global trends with what the city could join the forces and have a head-start”. Interviewee #8 believed that it would be worth it to further collaborate with Helsinki on developing a smart twin-city, as on its own, Tallinn is rather small, but together with Helsinki, the smart cross-border twin-cities approach would be much stronger and more attractive for investors.

Interviewee #2 and #6 both made a reference to both DH and TH models. Interviewee #2 preferred DH and TH models of university–city–government collaboration or industry–city–government–university collaboration, with the focus on capacity building, skills development and knowledge dissemination, all of which is achievable through a closer collaboration with universities. Interviewees #2 and #1 emphasized that, first of all, the city needs to agree upon its priorities to be able to enhance the collaboration with relevant stakeholders from private and public sectors. Interviewee #2 brought out as an example that after mapping and agreeing upon the priorities, the city can approach the research institutions with concrete urban challenges and propose collaboration in trying to find suitable smart solutions. Interviewee #6 was working on everyday basis with the private sector and research institutions, representing DH or TH model of collaboration. Interviewee #6 was advancing collaboration between universities, the private sector and the city of Tallinn since 2015, when Tallinn started to organize trainings for the entrepreneurs in collaboration with the local universities. According to interviewee #6, about 1300 entrepreneurs a year participate in the trainings that are organized once a month in a free-form debate, and several universities are collaborating with the city to offer and design suitable courses for the start-ups.

Interviewee #5 and #7 both focused on the DH model. Interviewee #5 considered double-helix model of collaboration as the most suitable model for Tallinn. According to interviewee #7, the current collaboration between relevant stakeholders is mostly a needs-based approach, whether by the need of a university or by the city. For example, one department in the city needs to find a solution to a certain urban challenge, and then interviewee #7 brings them together with a suitable partner from among the universities. The format of more targeted cooperation meetings is most efficient, concluded interviewee #7.

3.1.3. Top-Down versus Bottom-Up Approach

To describe the current situation, four out of eight city officials considered Tallinn to follow a top-down approach, one emphasized the importance to move towards bottom-up approach and three gave mixed evidence.

Interviewees #2, #4, #5 and #8 all described the current approach as top-down. Interviewee #2 considered as the essential step for a city that is interested in testing out the SC solutions, the political will and decision to follow this path. The goal to develop a SC must be shared throughout the city government, from highest level to the specialist level. Interviewee #2 saw as the main barrier for turning Tallinn into a SC as the political commitment to this goal. Interviewee #4 suggested that the priorities for SC development should be co-created in workgroups consisting of city officials from different city departments, thus contributing to the horizontal information exchange and collaboration and helping to reach to a common understanding of the meaning of the SC. Interviewee #5 added that the residents are already involved, as they have elected their representatives and the elected politicians are representing the residents. Therefore, interviewee #5 saw no need to further engage the residents in the SC development. Interviewee #8 believed that in order to develop a SC, Tallinn should have stronger urban management, in which it would be possible to ask the following “if I had this information, would it help me to achieve the set goals?”. He added that within the city, attitudes towards SC need to be changed, as “at the moment it is a schizophrenic situation where some come up with good solutions and others do not support them”.

Interviewees #2, #4, #5 and #8 all described the current approach as top-down. Interviewee #1 preferred mixed method of bottom-up and top-down. On one hand, interviewee #1 emphasized the importance to develop a human-centric city, and on the other hand, the importance of vision and priorities set by the city government. Interviewee #3 considered the current situation in Tallinn as presenting the top-down approach to SC development, but as a future vision prefers a mixed approach. One of the main challenges for Tallinn in developing more agile and innovative city is, according to interviewee #3, the fact that currently, even quite trivial decisions need to be decided on the highest level, resulting in slow processes and loss of time. Therefore, the processes in the city take much more time than in the private sector, where there is no need for a CEO to be involved on every level of the decision-making process, and the heads of departments can decide with independence in the set budget boundaries. For the future developments, interviewee #3 would like to see the two-way collaboration between city and local communities. According to interviewee #3, the collaboration with bottom-up and top-down approaches should be like two-way communication, as the city is able to see an overall picture and evaluate how different initiatives suggested by local communities fit the overall development of a better urban environment. Interviewee #6 described the current situation in her field as practicing a mixed approach. Interviewee #6 collaborated closely with research and the private sector to understand the capacity building needs of the citizens interested in entrepreneurship. Interviewee #6 used a different methodology to get feedback and understand the needs and interests of their “clients”, the citizens with ambitions to start their own business in Tallinn. The city is trying to enhance the cooperation between companies and universities by providing companies with internship management support.

Interviewee #7 provided some evidence on the bottom-up approach and argued that the approach taken depends a lot on the willingness that the head of department has for collaborating with different stakeholders like universities or research institutions.

3.1.4. Interpreted Barriers for SC Development

As barriers for SC development in the Tallinn context, the interviewees highlighted mainly non-technical ones. However, there is no clear coherence among barriers mapped.

Interviewee #2 pointed out the following barriers: lack of political commitment, lack of clear understanding of what the actual problems would be that could be solved through SC projects, the existing digital divide among the residents and the lack of citizen-centric and

user-friendly approaches in digital services. Interviewee #3 complemented this list with more contextual barriers (lack of common standards and procedures for data collection and sharing) and a lack of resources (skills and knowledge). Also, interviewee #5 mentioned a lack of resources, but from the financial side. Interviewee #8 saw internal collaboration issues as a barrier that influence the agility of Tallinn in SC development. Interestingly, interviewee #4 pointed out the lack of a common shared vision of SC development, stating that if the city would set a clearer priority in testing innovative approaches, it would be able to use its resources, both human and financial, more efficiently and be more agile in testing innovative solutions.

3.2. Tallinn 2035 in the Context of Dichotomies

We looked for the information on the Tallinn 2035 city strategy document supporting either one of the four SC dichotomies. The analysis is text-based as there was not enough information about the implementation of the new strategy in the real-life context. Therefore, we applied a document analysis method to search for information indicating the direction that the Tallinn 2035 strategy is aiming to take from the perspective of the four SC dichotomies.

The technology-led versus holistic approach: the six main strategy targets of Tallinn 2035 are as follows: urban space, community, green revolution, world city, proximity to home, and healthy and mobile lifestyle. The six strategic goals are crosscutting and each field of activity contributes to the achievement of several, and often to all, the strategic goals. The 6 main targets are divided into 13 action fields with more concrete objectives. The 13 action plans all together have 30 set objectives. The strategy and its targets compliment and support each other in interdisciplinary way, technology having an important, but not primary, role as a tool for achieving the objectives and targets set in the strategy document. Therefore, we can conclude that the approach taken in Tallinn 2035 strategy is holistic.

The double-helix versus quadruple-helix collaboration model—collaboration with relevant stakeholders and local communities and citizens are mentioned under almost every action plan. In the context of innovative technologies, or testing new technological solutions in an urban environment, the private sector is mentioned more often, but it does not mean that other stakeholders like research institutions and citizen representatives are left out.

The top-down versus bottom-up approach: on page 16 of the strategy document, in the description of the action plan for strategic and financial planning, it is stated that:

“The city governance is based on a social agreement between the citizens, which is expressed in the city development strategy. The development strategy is the basis for general plans and sectoral development documents. Planning is an ongoing process in which plans are updated based on monitoring results. The decision-making process is open and involves citizens”.

The Tallinn 2035 strategy is a result of a two-year-long co-creation process and represents the bottom-up approach. Four rounds of consultations were held with approximately 5000 city residents, including via workshops and seminars in each of the eight city districts. In the introduction to the Tallinn 2035 strategy, the mayor Mihail Kõlvart states: “In a democracy, there is no top-down command, but leadership and mutual support. Tallinn 2035 sets milestones for us to move towards” (<https://strateegia.tallinn.ee/sissejuhatus> accessed on 24 February 2021). Therefore, we can conclude that the Tallinn 2035 strategy presents a mixed approach of top-down and bottom-up strategies.

Mono-dimensional versus integrated intervention logic: Tallinn 2035 represents integrated intervention logic. Digital services are seen as an important part of the development of a sustainable Smart City, but we did not detect any limits to the fields where the digital services are developed.

4. Discussion and Conclusions

This paper represents a qualitative case study of the city of Tallinn on analyzing the perceived gap between where the city is standing on its development path towards the transition to a Smart City, and where it wants to be in the future. In this paper, the differences between the vision of Tallinn 2035 are compared with the current situation on the basis of the input from the city officials' interviews. The barriers for reaching the goals were looked for in the interviews and are put in the context of the findings from the literature review in Section 1.4.

The findings from the research clearly show that the baseline, where Tallinn finds itself, differs from the vision set for the year 2035, which is of course no surprise. The data gathered via interviews showed that the current approach in the case of Tallinn is leaning towards a technology-led approach. The main collaboration model with other stakeholders currently either represents a double-helix or triple-helix model of collaboration. Prevalent is the top-down approach, but it is closely followed by a mixed approach of top-down and bottom-up. Unfortunately, there was not enough information gathered from the interviews to understand whether the interviewees preferred the mono-dimensional or integrated intervention logic for the development of smart and sustainable city.

Even though Tallinn as a city has been doing quite well on different Smart City evaluation indexes (e.g., European Digital City Index, where Tallinn holds the 18th position among 60 cities), it has been in many ways a result of the efforts of the Estonian government and not the city government itself. For example, on the information sheet of the Smart City Index (where Tallinn holds the 59th position among 109 cities), the survey results indicate that the government-offered digital services were rated as highly satisfactory, and the digital services provided by the Tallinn city government tended to lower the score for Tallinn. The reason for this kind of difference in performance can be explained with political context. There has been limited coordination between the central and local governments in Estonia since 1993 and this has persisted until today [48]. The ambition of the Estonian government in e-governance and digital services has not always been shared on the local government level. On a state level, Estonia has been dedicated to developing digital services since the 1990s, taking the e-governance and e-services to another level in 2002 by introducing a new type of ID card, mandatory to the citizens, that functions as an access key to the digital services, as well as introducing the X-road that connects all public databases and contributes hugely to the interoperability of digital services that could be developed further into cross-border use [49,50].

The path that Tallinn currently seems to be following in the SC transition context, on the basis of the input from the interviews, indicates that it is mostly going towards a corporate path (see Figure 1 in Section 1.3), with a DH collaboration model where the technology companies are taking the lead and offering their solutions to the city, and not vice versa. As several interviewees highlighted, a shared vision is missing in regard to the needed digital solutions that would help the city to become more resource efficient and able to offer better services to the residents.

The new strategy document strongly supports the QH model of collaboration, and the document itself is a proof of the ambition of the city government to move towards the model, at least on the policy level. The new strategy for 2035 was co-created with citizens and different stakeholders, and for enhancing citizen participation, a process plan was created, and a handbook was put together. Participatory co-creation also took place internally and among different city departments, contributing to horizontal collaboration during the two-year-long city strategy preparation process.

It was interesting to see that the SC transition barriers from the Tallinn city official's perspective tended to be non-technological and were mostly related to lacking resources (both financial and human), skills, knowledge, political support and a lack of shared vision and commitment, in line with the work of researchers like Pierce and Andersson [42].

As was briefly mentioned in the introduction, the innovation in local government should occur equally on three levels—city policy, city management and technology. The

interviewed city officials were working mostly on the management and policy level, and therefore, it was only natural that they were more concerned about the non-technological barriers like working in silos, lack of resources and political support. The existing technological challenges were also briefly mentioned (e.g., problems with interoperability). We can conclude from the interviews that improvements are needed on all three levels to prove that the goals set in the Tallinn 2035 strategy were not overly ambitious. The first steps taken by the city government to move towards the goals set in the new strategy, which were co-created with the citizens, should demonstrate clearly the desire from the highest level to apply the vision described in the Tallinn 2035 strategy in the real-life context. Otherwise, it will become much harder for the city government to involve citizens in the next co-creation initiatives and to move towards the quadruple-helix collaboration model, which focuses on the transition towards a smart and sustainable city that puts the residents' interest at the center.

The path that Tallinn has described in the new strategy document seems to be a mixture between the European and holistic path. The Tallinn 2035 strategy document incorporates the themes of SC development, but is not only about SC (although Helsinki also does not have a separate SC strategy). In the Tallinn 2035 strategy document, many set objectives are related with sustainable development and connected to the European Commission's vision of smart and sustainable cities (e.g., ambition to become climate neutral by 2050).

Several interviewees emphasized the need for change and a vision of the SC development that is more in line with the ambitions set in the new strategy document. When the interviews took place, the final version of the Tallinn 2035 strategy was not made public, and structural changes were taking place in the city government. There was quite a bit of uncertainty and hope for change expressed by the city officials during the interviews. On the basis of the information gathered from the interviews describing the current situation and the quite ambitious targets set in the new city strategy, it seems like, even though the transition process is going to be complicated, there exists an openness for a change from the city official's part. This impression might, of course, be true for the city officials whose job is to contribute to innovation, capacity building and collaboration with different stakeholders. The picture might be different when selecting city officials who are less focused on the topics involving innovation and SC as interviewees.

The qualitative case study with the application of interviews and document analysis as a method proved itself to be suitable for understanding the internal situation in the city government on the verge of major changes. It offered a good insight into the local government perspective and explained the current difficulties and opportunities of SC development in Tallinn. Furthermore, it added insights to the Smart City development and transition from the city official perspective, a literature that is quite limited as Ahvenniemi and Huovila [7] have brought out. This kind of analysis, based on the interviews with city officials describing from an internal perspective the transition process towards a smart and sustainable city, and analyzed in the context of SC theories, seemed to offer promising feedback about the process. Thus, this analysis made it easier to notice deviations from the chosen path and to understand the reasons behind it, giving a possibility to change either the vision, chosen path or the process.

The interviews with local government officials also shed some light onto the decision-making processes on SC projects, a subject that has been understudied according to Lu et al. [17]. Several interviewees emphasized the need to map the "flagship SC projects", representing the priorities of the city government, as opposed to the current situation where the city has a more passive part as a partner invited to participate in the projects initiated by other stakeholders. Thus far, Tallinn has been mainly involved in mobility-related ones as an invited partner [51,52] from the perspective of SC. One of the limitations of this paper is that there are not yet many materials about the implementation process of the Tallinn 2035 strategy as it is still in its very early stages. The Luca Mora et al.'s four Smart City dichotomies approach is a good method for getting a quick general overview of the current

directions practiced by the analyzed city, but a second, more thorough analysis would be necessary within a year or two when there are more materials and information about the implementation process. In the current paper we were able to roughly distinguish the wideness of the gap between the actual situation and the future vision of Tallinn 2035, but we were not able to find out much about how to bridge the gap between the present reality and the future vision. For this aim, a comparison with other European capital cities could be beneficial. Thus, another important limitation is that this study represents only one capital city in Europe. For the future research, this framework could be adapted into a more complex city environment with smart concepts as interconnected parts [53].

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