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Sustainable Smart City – the Path of Vienna

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1 ABSTRACT

Urban development faces numerous challenges in the 21st century and a central task is the sustainable and liveable design of the city. Can the concept of a Smart City be a tool to making cities more liveable and sustainable? To find out, we chose a biographical method to analyse the steps towards a successful Smart City and to better understand the structures behind it. We combine the innovation biography method with a process model from sustainability governance research, namely Steurer's sustainability governance model and apply them to Vienna's Smart City, especially the preparation of the Vienna Smart City framework strategy (Steurer & Trattnigg, 2010). On the one hand, this article shows that a transfer of the innovation biography method to urban research can generate deeper insights on urban development processes in general. On the other hand, the approach chosen can show that Vienna integrates the sustainable urban design into the process of Smart City design. So the smart and sustainable city design, often called for in theoretical contributions, is practised in Vienna. Due to its reconstructive character, the biographical method has revealed that it is possible to govern sustainability by using Smart City as an umbrella strategy, as long as one manages it in an integrated and holistic way, recognises trends and is able to acquire and use research funds effectively and efficiently.

The knowledge gained from the new method for urban and Smart City research is twofold. Firstly, the transfer of the method previously developed in the human sciences and subsequently for organisations, institutions and products and services also works in urban research. Second, the innovation biography provides in-depth insights into the process towards the Smart City and the stakeholders involved. The use of the biographical method highlights the relevance of good governance in terms of interdisciplinary cooperation on the one hand and high political commitment on the other through the micro-level perspective and is also sensitive enough to highlight the importance of an appropriate narrative in and for the process towards the Smart City.

Keywords: Innovation Biography, Smart City Governance, Vienna, Sustainable Smart City, SDG 11

2 INTRODUCTION

In the last 20 years, numerous Smart Cities have emerged all over the world. The Smart City remains a black box in several ways: regarding its external perception, its understanding of internal processes and outcomes produced. It is often unclear how the city became a Smart City, who was involved and why a Smart City is being created at all. In theory, the Smart City is often associated with sustainable urban design. But whether this is a normative idea or really implemented in practice must be considered on a case-by-case basis. Digitisation has the potential to make the city more sustainable, but is does not have to. Just managing all the data that a Smart City must collect takes a lot of energy (Höfner et al., 2019, Jones, 2018). An analysis of inputs and outcomes is needed. The latter must include the environmental effects along the entire value chain if we are serious about sustainable development.

By adopting a micro-perspective, the innovation biography method aims to clarify how the process towards a Smart City is shaped, how knowledge is shared in this innovative process and who cooperates with whom for this purpose (Butzin et al., 2012, pp. 123-124). The fact that knowledge is of great importance for innovations and will continue to gain relevance in a knowledge society is sufficiently proven (Dannenberg & Junges Forum, 2009, p. 191). The analysis of the Smart City by using an (innovation) biographical method offers the possibility of recording the process.

The biography of a Smart City is created by going all the way from the first ideas to the actual implementation of the innovation – in our case the Smart City. As a case study, Vienna is selected as a city that not only ranks high in the target dimension 'smart' in the well-known city rankings, but also in the target dimensions 'sustainable' and 'liveable'. The reason for the complementary selection of the target dimension 'smart' with the target dimensions 'sustainability' and 'liveability' is twofold. On the one hand, it is the

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normative idea that digitalisation does not serve an end in itself and should be used to make the city sustainable, inclusive and liveable in the sense of SDG 11 (Günthner et al., 2017). Furthermore, this requirement for a modern urban design coincides with the current definitions and descriptions of sustainable Smart Cities in science (Treude, 2021, pp. 2-4). So the sustainable Smart City "[…] meets the needs of it`s present inhabitants without compromising the ability for other people or future generations to meet their needs, and thus, does not exceed local or planetary environmental limitations, and where this is supported by ICT." (Höjer & Wangel, 2015, p.14).

The innovation biography is intended to complement Smart City research with a process-oriented method that allows the relevant determinants behind the process towards a Smart City to be presented. At the same time, this should expand the application areas of innovation biographies with those of urban research and test it on the Smart City in its processes, structures and procedures. Every city has its own economic, political, socio-cultural conditions; accordingly, the drawing of a blueprint by means of the innovation biography of the Smart City is not possible. But the understanding of shared networks, transdisciplinary collaboration, the importance of visions and shared narratives, the relevance and mapping of actors, governance and the role of the community and policy makers can be adapted to other cases. In the definition of a sustainable City, we are guided by the United Nations Goal 11: "Make cities and human settlements inclusive, safe, resilient and sustainable", which includes, among other things, participatory, integrated and sustainable human settlement planning, as well as climate change mitigation and adaptation.

We begin with a brief introduction to innovation research, the description of the method of innovation biographies and their current scope of application, followed by the methodological approach to the case study for transfer: the Smart City Vienna. This is followed by the results of the research and a discussion of the methodological transfer on the one hand and the results that emerged from the biography of Vienna on the other hand. Finally, a conclusion is drawn and the need for further research is identified.

3 FROM INNOVATION TO INNOVATION BIOGRAPHY

An innovation is "[...] basically the purposeful implementation of new technical, economic, organisational and social solutions to problems [...]". (Vahs & Brem, 2015, p.1, own translation). The Smart City is characterised by its innovative power in different areas. Based on Schumpeter's cases of innovation, it is at least a new sales market, and therefore also a structural innovation, since it involves innovations in organisation and governance (entity). If one follows further subdivision into categories or types of innovation, the Smart City represents also a process innovation, since processes and procedures in a Smart City (should) be subject of change (Schumpeter, 1997, p. 101). The fact that the Smart City is an innovation has already been elaborated elsewhere (e.g. Angelidou, 2017, Nam & Pardo, 2011). The relevance of networks as important drivers for innovation are also undisputed (Kleinaltenkamp, 2006, p. 93, Benkler, 2006, pp. 1 f.). The same applies to innovation-networks and the know-how formed within them, which is often newly acquired and coordinated (Benkler, 2006, Cooke, 2007).

Van Der Duin et al. further classify innovation processes into four generations along structures and collaborations of the innovation process: „In the fourth generation, innovation processes have become innovation systems." (Van Der Duin et al., 2007, p. 200). The fourth generation (from the mid-1980s to the early 2000s) is characterised not only by a network of partners, but also by parallel processes within the innovation process (ibid., p. 200). The complexity in these increases accordingly, so that one no longer speaks of individual innovations, but of innovation systems (Cooke, 2007, p. 54). And the emergence of networks in this system is a long process: „[…] relationships within a network or system do not form overnight but need some time to develop. Long-term relationships are the result of a mutual trust that is reinforced by repeated innovation successes." (Van Der Duin et al., 2007, p. 211). The relevance of networks, cooperations and their meaning in the process of becoming a Smart City will be elaborated by the method of innovation biographies. It will be applied here for the first time in urban and Smart City research. Following Van Der Duin et al., the Smart City can be understood as a regional innovation system. To investigate this innovation system of a Smart City, the innovation biography can offer an adequate methodological framework.

Innovation biographical research belongs to the methods of biographical research, which have their origins in human and social sciences, as well as in sociology (Keupp & Weber, 2001, p. 266-275, Bohnsack, 2010, pp. 57 ff., Schulze, 2010, pp. 1-15, Schütze, 1983, pp. 283-293 as well as Butzin et al., 2012). In the interplay of

spatial perspective, knowledge creation and diffusion, and the underlying actor network, innovation biographies can outline the paths towards an innovation. The individual steps towards an innovation biography for a Smart City as well as the expected challenges and how to deal with them are listed in table 1 under Results.

4 CASE STUDY SELECTION AND PROCEDURE

The case study for applying the innovation biographical method is the Smart City Vienna. The process started about ten years ago and has been performing well for years in available Smart City Rankings as well as in the Sustainable City and Liveable City Rankings (Treude 2021, p. 11). Vienna is one of nine federal states of the Republic of Austria and its capital. 1.92 Million people lived here in the year 2020 on an area of about 415 km2 (Statistics Vienna, 2020). According to Roland Berger 2020, Vienna has one of the best Smart City strategies, which is the decisive criterion of successful Smart Cities (Roland Berger, 2020, p. 3). These characteristics make Smart City Vienna an interesting case study for the transfer of the innovation biography method: there is a long process to analyse and it is widely considered successful.

For gaining a reconstructive process description of the innovation Smart City, a description of the course of the innovation is needed, the interactions within the organisation, as well as relevant actors and stakeholders, who have been actively involved in the process. For this purpose, the innovation biography combines a number of qualitative methods in a multi-stage and iterative procedure (see working steps in table 1). The innovation biography consists of three main components/elements, namely the biographical approach, the ego-centred network analysis and the space-time path (Butzin et al., 2012, pp. 131-134). In this multi-stage methodology, we first conducted a document analysis of freely accessible websites and documents of the City of Vienna as an introduction to the preliminary investigation. The document analysis "[…] is a hermeneutic procedure that is assigned to qualitative social research. It is about an understanding of the meaningfulness laid down in the respective documents and then, in the next stage, a socio-historically guided, politically and sociologically informed contextualisation of ideas." (Salzborn, 2018, p. 24, own translation). Then an initial narrative interview was conducted with a key person in the Smart City Vienna process, which, in conjunction with the document analysis, formed the basis for the ego-centred network analysis: „Egocentric research is focused on individuals and their immediate social environment" (Perry et al., 2018, p. 25). This social environment in its composition and combination is important for the individual. The individual (in our study the individual is the Smart City itself) is influenced and shaped by this social environment (and the actors involved). So, the ego in the egocentric network analysis is used for the current focus of attention – in our case: The Smart City Vienna.

Based on the ego-centred network analysis, another 15 stakeholders from all three identified areas (politics/administration, science, and business/consultancy) were chosen to be interviewed, drawing from around 140 stakeholders in the process for the Smart City framework strategy Vienna (or 270 stakeholders in the further development in 2019). Six of the respondents belonged to the administration of the city of Vienna or to city enterprises. Another person belonged to the administration of another city. Here, the "outside perspective" very much coincided with the view from "inside". Six of the interviewees were part of the scientific community at the time of the development of the framework strategy, but not all of them at the present time (2021). Some of the actors in Vienna`s Smart City process have changed their professional position over the ten years. Three of the interviewees stem from business and/or consulting.

The egocentric network analysis was considered complete when none of the respondents mentioned any new stakeholders that had not yet been mentioned. To this end, we asked each time at the end of the interviews: "Who else should we talk to about the process from your perspective?" A total of 16 interviews were conducted accordingly. We chose free storytelling in the narrative interviews because it sometimes leads to subconscious structures of meaning, that would be lost in systematic questioning, as is the case with the questionnaire (Mayring, 2008, pp. 72-73). The 15 interviews that followed the first interview were conducted face to face within 2 months (February-April 2021). This is the preferred survey method of ego-centred network analyses (Perry et al., 2018, p. 45). However, due to the ongoing global Corona Pandemic, these were conducted via online conferencing tools and lasted about an hour each (for more information on the advantages and disadvantages of face-to-face interviews see among others, Perry et al., pp. 45-55). Afterwards the interviews were transcribed.

The narrative interviews were conducted in four steps (Mayring, 2008, p. 75):

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(1) Definition of the topic and open narrative invitation: "Could you tell me about the process towards Smart City Vienna?".

(2) Stimulation of the narrative through non-verbal communication patterns and the maintenance of the narrative structure.

(3) Return to the topic (in case of too much deviation).

(4) Questioning phase.

The analysis of the transcribed interviews was carried out as a reconstructive case analysis according to Rosenthal (Kaya, 2009, p. 91, Schulze, 2010, pp. 573-579, Fischer-Rosenthal & Rosenthal, 1997, pp. 152-146) and in accordance with Schütze, (1983) in six successive steps:

(1) Analysis of the biographical data with regard to the process

(a) Listing of what has been described

(b)Comparison with historical processes or background knowledge

(2) Text analysis and thematic field analysis

(a) Which issues were addressed, which were not? This step needs the alignment with step 1b.

(b)Why are some things told in brief, others in great detail?

(c) Which topics are related?

(3) Reconstruction of the case history and development of the chronology of the biography.

(4) Detailed analysis of selected interview passages for in-depth analysis of individual process steps.

(5) Comparison and generalisation

(6) Typification

The last two steps are mentioned here for the sake of completeness, but initially have no significance in the evaluation for the biography of the Smart City Vienna, i.e., an individual case study, because at this point in time neither generalisations are to be made (step 5) nor typologies derived (step 6). However, when comparing several Smart City biographies regarding their processes and networks among each other, these points are relevant. The same applies to step 2. It leads to a more detailed insight into the individual actors and their underlying positions within the whole process. This is interesting but less relevant for this article and in need of interpretation.

To complete this egocentric network analysis, archival methods were combined with the narrative interviews. These archival methods have the advantage of being completely independent of the researcher and can independently validate or supplement the network structures (Perry 2017, p. 58). The documents used were freely accessible documents and websites listing inter alia the actors in their functions of the respective departments and organisational units, and also 117 council resolutions of the City of Vienna from the years 2005-01/2021. These monthly meetings, documented in their wording, were, inter alia, intended to validate the start date or the start phase of Smart City Vienna mentioned in the interviews. In the ego-centred network analysis, the importance of the identified individuals of the network is also very relevant - their networking or non-networking with each other and their view of the cooperation and learning processes within the ten years leading to Smart City Vienna.

5 RESULTS

The results of the transfer are twofold. Firstly, the transfer of the method to urban and smart city research was successfully adapted. Secondly, the transfer provides results regarding the the process towards the Smart City of Vienna, the actors involved, the cooperation between them and the learning processes.

5.1 Transferring the innovation biography to Smart City research

The innovation biography method worked for the reconstruction of the Vienna Smart City process and it presents interesting results regarding the Smart City process, its structures and relevant networks. All steps necessary for the innovation biography method could be transferred to the Smart City (see table 1).

Innovation biography				
Theoretical procedure and working steps	**Conditions for the transfer to Smart City research**	**Potential Challenges**	**Dealing with challenges**	**Application to Smart City research using the example of Smart City Vienna**
1. Case study selection	Identifying a successful Smart City	For the definition "successful", grey litertaur is used: Smart City Rankings	Comparison of ranking systems with regard to indicators, inclusion of desktop resaerch	Vienna, due to numerous top placements in the Smart-, Sustainable- and Liveable City Rankings
2. Document analysis for the case study	Identification and collection of all relevant documentation	Planning documents and municipal decisions may not all be freely accessible	Request the city to be investigated for documents	Good data basis available, including publicly accessible council decisions from the years 2000 -2021 for reconciliation
3. Selection of a key actor	Often long processes towards a smart city, there may be several key players	Conducting several interviews already in the first round	Comparison of the processes described in the interviews	Good communication of the responsible key actors in the process
4. Conducting a narrative interview	No special conditions for the transfer to Smart City Reasearch	To elaborate the process towards the Smart City from the experiences of relevant actors	Strengthen narrative demand phase and evaluation on the basis of narrative-structural methods	No problems at all, even when requested for two-hour narrative interviews
5. Egocentric network analysis	The hub of the network analysis is the Smart City itself	The egocentric network analysis is selective with regard to the actors and	Combination of the ego network with geographical and temporal data	Draft of a first version of the life story possible
6. Further interviews	No special conditions for the transfer to Smart City reasearch	Identify and complete actors from the first interview	Strengthening the narrative demand phase from step 4 and deriving further actors from the following interviews	From the network analysis, the key actors quickly became clear. However, some of them have changed jobs
7. Triangulation of the data	Collect all data relevant to the innovation biography from and with involved actors	The aggregation and analysis of different types and amounts of data	Using triangulation as an approach to link the different research perspectives	Versatile data available. Selection challenge
8. Creation of the innovation biography	No special conditions for the transfer to Smart City Reasearch	Identification of a start and an end point for the innovation	Through the triangulation of the methods	The representation of the process is well possible, the representation of the networks is challenging due to the size and diversity and only possible in tabular form, therefore limited use of a space-time path
9. Analysis of procedural factors	No special conditions for the transfer to Smart City Reasearch	Derivation of procedural factors only determinable for the analysed city	Transfering of the analysed factors and cross-check in other smart cities or continuation of the innovation biographies in comparable Smart Cities	Procedures factors well derivable

Table 1: Theoretical challenges of applying the method of innovation biographies to Smart City reasearch and the transfer of nine individual steps. Source: Revised presentation based on Treude, 2021

To illustrate the innovation biography of the Smart City Vienna (working step 8, table 1), an actor network is presented (figure 1), a space-time path related to the Smart City framework strategy (figure 2) and a biography of important steps over time (figure 3). The individual process steps towards Smart City Vienna are presented based on success factors of a sustainability steering model according to Steurer from 2010 (figure 4). In the process for the framework strategy from 2014, there were almost 140 contributors from various municipal departments, institutions and companies of the city, other institutes and organisations as well as contributors and consultants from research and science. This was increased for the further development of the framework strategy from 2019. Here, almost 270 people were involved in the process. It is also not expedient for Smart City Vienna to present the components and actors in their spatiality, as almost all of the actors involved come from the city of Vienna. Therefore, this has been dispensed with. However, they are displayed visually in a complex network[1] (figure 1).

[1] This network was developed on the basis of the contributors mentioned in the 2014 and 2019 strategies. If other documents were added, e.g. the monitoring report or the current projects on the website https://smartcity.wien.gv.at/projekte/, the mapping would be too complex and confusing. For this reason, it has been dispensed with in this figure.

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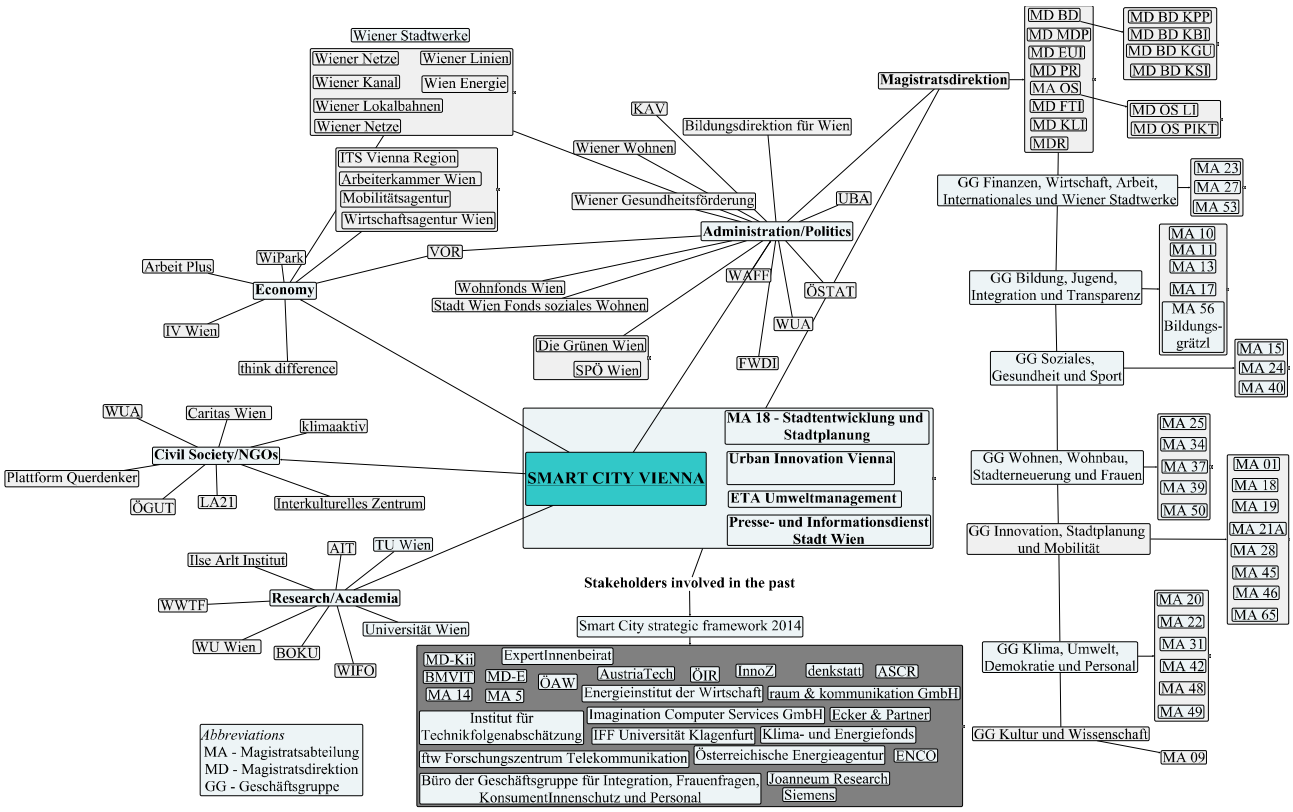

Figure 1: Network Smart City Vienna based on the contributors mentioned in the Smart City Vienna framework strategy (2014 and 2019). Source: Own Illustration, based on Magistrat der Stadt Wien, 2014 and Magistrat der Stadt Wien, 2019

The results from the narrative interviews provided much depth of procedural detail. They are compiled below using a governance model by Steurer 2010, which deals with the governance of sustainability at the strategic and political level. This model will be used to show how the actors have shaped their process towards the Smart City and what their success factors were.

5.2 Results of the innovation biography – The path of Vienna

Some of the interviewees date the beginnings of the Smart City Vienna to the beginninof the turn of the millenium, some even earlier. Thus, Smart City Vienna builds on good groundwork and activities in the field of social sustainability, such as social housing construction in Vienna. However, most of the 16 respondents (Interview Person 1-16: IP1-IP16) mentioned the years 2010 and 2011 as the main starting point. In 2010, the Smart City is mentioned for the first time in the Vienna City Council (Gemeinderat Stadt Wien, 2010) and named as „[…] strategy for the future […]“ at the meeting on March 2011 (Gemeinderat Stadt Wien, 2011a, p. 27, own translation). In the same year, the Vienna City Council discussed the advantages of a broad Smart City initiative and the possibility of becoming an international leader and learning from other leading cities (Gemeinderat Stadt Wien, 2012b, p. 45). In March 2011, this Smart City Initiative is then proclaimed by the Mayor (Gemeinderat Stadt Wien, 2012a, p. 20). Under the leadership of a central steering group, which currently meets about four times a year and has a high-ranking membership, the City of Vienna followed these main steps: (1) an inventory of existing structures, initiatives and Smart City definitions (2010/2011); (2) a broad participation process, in which a vision, a roadmap and an energy plan for the City of Vienna were developed (2011-2013); (3) developing of the Smart City framework strategy (2013-2014) (IP1). From 2013 until the finalisation in 2014, almost 140 people with their respective organisational units, research institutions, departments, etc. were involved in the process (almost 270 in the revision in 2019). The strategy development process for Smart City Vienna can thus be described as an open innovation process (Jaworski & Zurlino, 2009, p.18). The strategy is the central component of Smart City Vienna and is

therefore also the focus of the Smart City Vienna innovation biography (figure 2). All respondents agree: Smart City Vienna is based on its framework strategy. All references in the documents also lead back to this strategy. It serves as a basic framework for the governance process guided by an idea of “preventive innovation” (IP3). The respondents see the Smart City as a transformation programme and digitalisation as an innovation in this programme. However, no plans for a large-scale disruptive technologisation of the City of Vienna can be discerned, but rather a gentle digitalisation that reveals a digital humanism .

Already in the run-up to the development of the Smart City framework strategy in 2012/2013, there were numerous participation formats and topical workshops (see figure 3). One interview shows that more than a hundred interviews were conducted with the aim of sensitising the city administrations and magistrate departments to the upcoming processes and winning them over (IP6). The aim was not to adopt all the content without conflict, but to create a basis for acceptance and trust in the process. According to the respondents, this has been successful. Many council decisions, especially from the years 2014-2016, show the need for discussion and also critical queries from the members of the Vienna City Council, but also the legitimacy of the Smart City framework strategy from 2014 as an important milestone in the Smart City process (Gemeinderat Stadt Wien, 2014, p. 65). Almost exactly 5 years later, on 26 June 2019, the revised version would go through Council: "The Smart City Vienna framework strategy and its objectives presented in the updated version, which thus replaces the strategy adopted by the Vienna City Council in 2014, are adopted. [...] As an umbrella strategy, the Smart City Vienna framework strategy is a guideline for the organs of the City of Vienna, for all municipal departments and other institutions of the City of Vienna. Specialised concepts and strategies, as well as implementation activities and decisions that are important for the achievement of the objectives of the Smart City Vienna framework strategy must be oriented towards its objectives.“ (Gemeinderat Stadt Wien, 2019, p. 7, own translation). In 2020, the City of Vienna started a new roadmap within the framework of the EU initiative EIT Climate-KIC, which will define concrete measures and steps for implementation as a link between the Smart City framework strategy and the new requirements for a climate-neutral city (City of Vienna, Rathaus, no year).

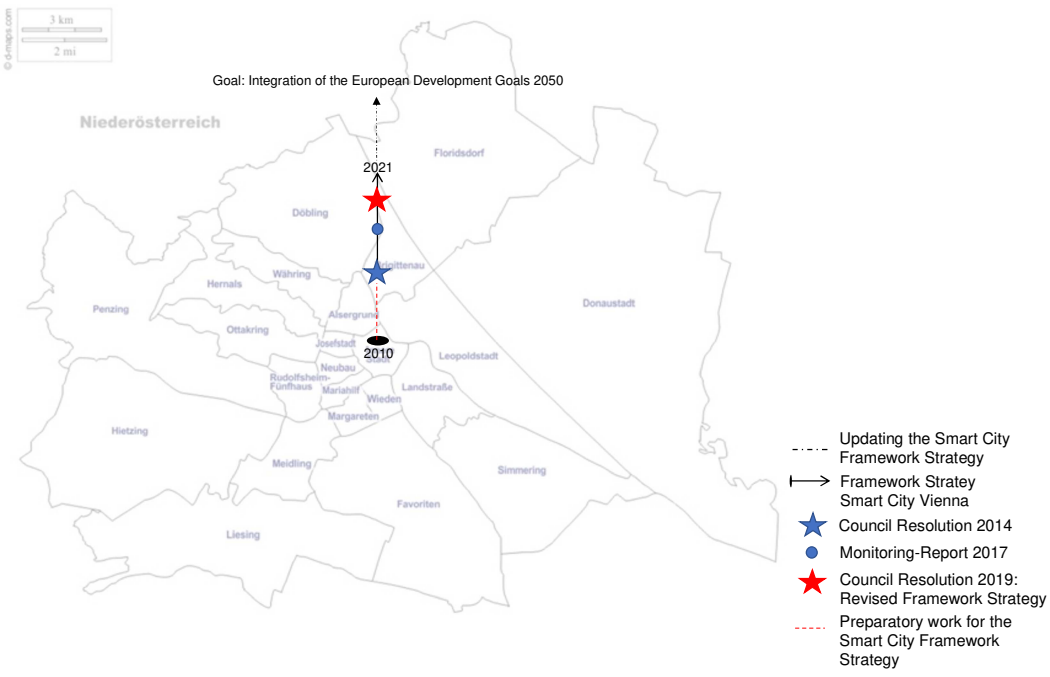

Figure 2: Space-time path of the Smart City Framework Strategy Vienna. Source: Own Illustration

The Smart City actors shaped the process in Vienna like a funnel. Thus, at the beginning, the process was very broad on the administrative side, the topics were very wide-ranging and the criteria and goals were initially formulated qualitatively. The initial aim was to win over the entire administration and as many departments as possible to explore and take up topics that already existed through the numerous sectoral strategies in Vienna. There was a lot of preparatory work, among others in the two accompanying projects TRANSFORM and TRANSFORM+ (see figure 3). The jointly developed vision, the Smart City marketing

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and the story-telling about the Smart City Vienna and its framework strategy had an activating function, both internally to the administration and externally to the citizens of Vienna (IP1, IP 6). The first framework strategy from 2014 did not yet contain any concrete measures for implementation; these were in the individual sectoral strategies or were to be created (Magistrat der Stadt Wien - MA 18, 2016).

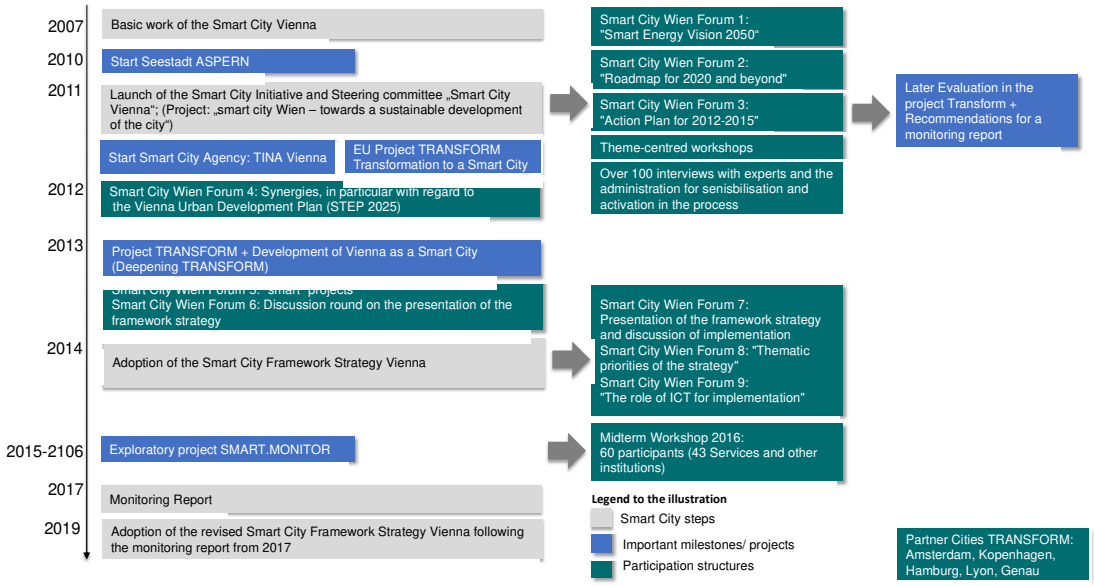

Figure 3: Biographical representation of Smart City Vienna. Source: Own Illustration, Sources: free available internet sources and 16 Interviews (IP1-IP16)

Analogous to the image of a funnel, the objectives of the Smart City Vienna framework strategy get more concrete, more narrowly defined and formulated in more detail in the 2019 revision process (IP12). According to the interviewees, almost the entire Viennese administrative system, across all hierarchical levels and driven from the very top by the municipal directorate, was integrated.

The aim was to bundle competences and to build up and consolidate capacities and cooperation structures. Cross-sectoral working groups emerge, particularly in the context of the revision of the second framework strategy in 2019 and in the 2017 monitoring report that preceded it. According to the interviews, these working groups were not conflict-free and still are not, but they are the only place to ask fundamental questions and form compromises (IP10, IP16). The respondents see the ability to cooperate within the process and the interdisciplinary cooperation as a decisive driver for the Smart City Vienna framework strategy. The initial breadth at the beginning of the process is now shown to be an advantage, because over 10 years, the departments of the administration have firmly committed themselves to the umbrella strategy, according to the respondents. The departments of the administration have learned that they can maintain their autonomy as long as they cooperate towards the common goals (IP1, IP10). Thus, it was possible to become much more concrete in the revision in 2019, also because work towards the first monitoring report in 2017 was again spread across all departments. The meetings of the steering group and other working goups are described by all as very enriching with cooperation constantly increasing. Furthermore, the interviewees describe that the exchange with other Smart Cities is very instructive (IP2, IP5). Here, some report on informative and enriching delegation trips and the resulting networking that often lasts for many years. The interviewees report that at the beginning, the disputes on certain topics were often tedious. Yet they see the interfaces between different areas of action as setting the course for success, even if they are not without conflict. According to the interviewees, the Smart City framework strategy is now, in 2021, a matter of course for all departments.

There is a strong continuity of people involved in the process from 2010 until today. Among the 16 interviewees, 9 persons are still involved in the ongoing process, 4 interviewees come from institutions that are still involved through different members. Only two of the respondents are no longer involved directly in the process themselves or through their organisations (Status April 2021).

Overall, the review of the persons and participating institutions, organisations and research facilities reveals a very heterogeneous and very stable network over the period 2014-2019 (see figure 1). The interviews also show that there is a stable core of participants in the process, both throughout the entire process and currently. The core team consists of the steering group around the Department of Urban Development and Urban Planning of the City of Vienna. They are the central drivers of the Smart City process. The Smart City steering group consists of, among others, senior officials of the City of Vienna, the management and senior staff of the Vienna Business Agency, Municipal utilities of Vienna, “Wiener Wohnen” and “Wien Energy”. It is complemented by the “Wiener Wissenschafts-, Forschungs- und Technologiefonds” with the role of external consultant and Urban Innovation Vienna, the Smart City agency which emerged from the process towards the Smart City. Working groups have been set up for the individual thematic goals and are responsible for their implementation (Magistrat der Stadt Wien, 2019). For this, the interviewees emphasise the relevance of strong networking so that people at the interfaces exchange information (IP14). In addition, parallel processes converge at some crucial points, e.g. in the planning department. From the interviews, it appears that these interfaces are extremely important for the integration of the different processes and strategies, as they expose possible contradictions and create coherence. In the interviews with the stakeholders, the importance of good and functioning cooperation based on mutual respect and working across levels is emphasised again and again (see figure 1) (IP1, IP10, IP14).

It emerges unanimously from the interviews that the framework strategy does not follow any digitalisation ideology. On the contrary, some of the interviewees even distanced themselves from the term. Social inclusion, on the other hand, plays an important role and is emphasised again and again (both in the documents and in the interviews): A good life for all Viennese. Some formulate the basic ideas of Smart City Vienna as: thinking together, networking and integrating (IP1, IP3, IP14). All interview participants show the same understanding of the Smart City, in which sustainable urban design is a central component. One interview states: "Smart City Vienna is the coalition of the city's future-minded and innovative people" (IP2). Furthermore, the stakeholders emphasise the relevance of the different partners and players within the City of Vienna and their influence on the design of the Smart City Vienna. In particular, the interviewees describe the cooperation on joint externally funded projects between administration and science as very fruitful and as an important learning process towards interdisciplinary cooperation (IP15).

The dialogue and process effort behind Smart City Vienna should not be underestimated, as all interviewees agree. It requires incentive systems, win-win situations, motivation and attractiveness. Financing issues are also often an important and contentious factor (IP2, IP3). Moreover, the interviewees describe these cooperation partnerships as learning processes. They report that the beginnings of cooperation were much more difficult (IP15). Many staff members first had to get used to acting and cooperating beyond departmental logic in particular.

5.3 Procedural results – “Governing Smart City” based on “Governing Sustainability” – Vienna as best practise

The process description drawn from the interviews on Vienna’s Smart City largely matches that from the anlysed documents. The interviews offer insights into essential details, which are clustered along the model for steering sustainability below (Steurer & Trattnigg, p. 149) (see figure 4). The identified good governance criteria will be presented biographically in the following whenever possible, including dates where applicable. The Smart City Vienna is centered on its framework strategy. This is in line with Roland Berger's studies from 2020 and 2019 (Roland Berger, 2020).

All respondents agree that Vienna started to develop Vienna`s Smart City on a solid existing basis. This means that the process towards a Smart City did not start in 2010, but with many good steps, some of which had already begun decades earlier (IP2). The triad of resource conservation, innovation and quality of life for all Viennese has remained constant over the years, according to the interviewees. However, in the first years, the city was looking for a new narrative that offered more possibilities for development than the concept of sustainability. According to the interviews, at the time around 2010, the concept of sustainability was too inflationary in use and too vague to be able to adequately meet Vienna's urban challenges, above all the strong growth. According to one of the interviewees, it was no longer sufficient and it can be seen as a paradigm for preserving systems rather than developing them. Attributes such as dynamics, innovation and growth had to be included, and they worked better under the term Smart City (IP10). With the development

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of the SDGs in 2015, these have been incorporated into the revision of the framework strategy 2019: "With the Smart City Vienna framework strategy, Vienna emphatically commits to the international and national targets and makes its contribution to achieving them. Conversely, in order to realise the Smart City goals, Vienna needs suitable framework conditions, which the federal government and the EU must create." (Magistrat der Stadt Wien, 2019, p. 19, own translation)

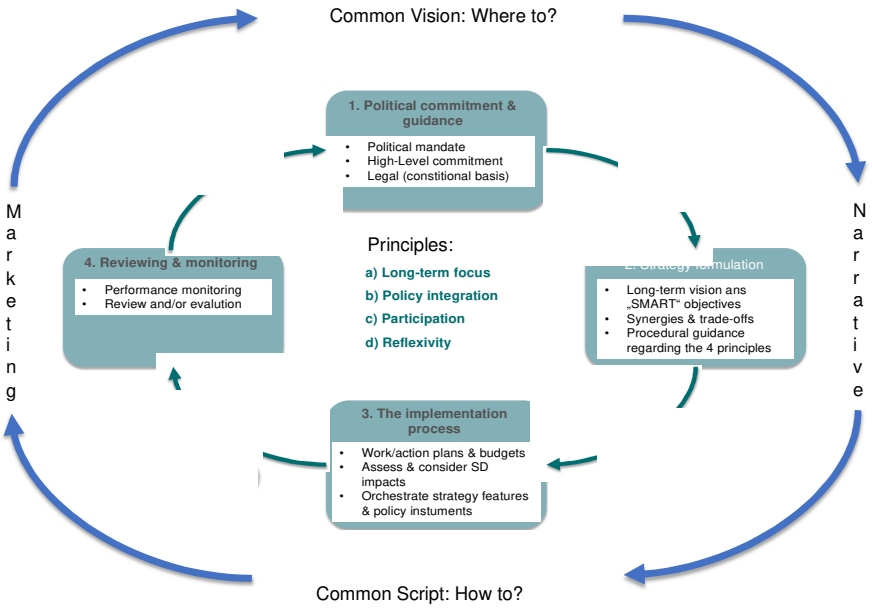

Figure 4: Policy Cycle of Sustainability Strategies. Source: Own extended illustration according to Steurer & Trattnigg, 2010, p. 149

All interviewees agree: The Smart City Vienna is about a sustainable design of the city. All 16 interviewees from administration, municipal departments, research or municipal organisations said this. The same is stated in the 2014 framework report as well as in the further development in 2019, in the workshop report from 2015 and in the monitoring report from 2017. Vienna chose a new narrative under whose flag it could better formulate a future-orientated urban design than under the mere term of sustainability (IP10). According to a long-term companion of the process, this was not accepted uncritically without reservation, especially at the beginning of the process. For many, the term smart contained a strong technological aspect, which the Viennese had to frame differently in their process - towards quality of life, conservation of resources and social as well as technical innovations.

The document analysis and the results of the narrative interviews revealed components and governance principles that can also be found in sustainability research and research on sustainability strategies (see figure 4). They involve the essential actors of a city, have (worked out) a common vision of the future of Vienna, developed a strategy and are currently working on a roadmap for implementation (IP12). For implementation, they have numerous partners and links that mediate between urban demand and businesses.

The initial impetus for the process towards a Smart City in Vienna was the political mandate of the Mayor to develop and formulate a strategy that has such a long timeframe (2050), integrates all policies, has a participatory character and develops iteratively. The implementation of the strategy in Vienna takes place through thematic projects with a holistic reference to the development goals of the framework strategy. From the joint development processes and the projects, knowledge transfer and joint learning take place in Vienna, both in terms of cooperation across departments and in terms of content. In 2016, preliminary work on monitoring was carried out as part of a research project, which then resulted in a report in 2017. This was distributed across the supplying departments and shows internally and externally where there is room for improvement. And the results showed learning experiences that were incorporated into the revision of the strategy. Here, not only internal development processes were taken into account, but also the new requirements of the EU and the UN, e.g. the integration of SGDs in the further development of the Smart City Vienna framework strategy in 2019 (see figure 3).

5.4 Detailed success factors within the governance structures in Vienna

The narrative around the Vienna Smart City has been relevant from the very beginning, and the same applies to its Smart City Vienna framework strategy (IP11). The communication is consistently positive, and there was a strong marketing campaign for the Smart City before it had even been fully defined. The narrative, i.e. how to communicate about the Smart City, and the marketing, i.e. how to promote the Smart City product, are important drivers for progress, connected to but also sometimes independent from the actual content (IP11).

(1) Political commitment (in Vienna from 2011- today)

With the normative governance principles of horizontal and vertical political integration (Steurer & Trattnigg 2010, p. 37)

All interview partners agree that the strong political will on the part of the mayor in 2010/2011 gave the initial impulse for Vienna`s Smart City. Thus it is a top-down initiative (IP3).

The initial phase is formative for such large projects, so it is crucial who you involve from the beginning (IP3). The project management is based in the Municipal Department of Urban Development and Urban Planning. This office is part of the steering committee, as are some top officials of the City of Vienna and various stakeholders (see above). The Smart City Forums are open to interested persons, but are mainly attended by experts from different fields (see figure 3). “Smart City requires especially horizontal integration.” (IP3, own translation).

Coherence of policy fields was a frequently raised point in the interviews and the relevance of good cooperation across disciplines. Here, the cooperation of governmental and administrative levels was addressed (vertical integration) as well as the coherence of different policies and the underlying issues (economic issues, environmental issues and social and cultural concerns).

Clear areas of responsibility, regular exchange formats (both same hierarchy levels and across hierarchies, both topical and again across hierarchies) are mentioned as another important point.

Vienna shows a strong orientation towards the climate goals of the EU and the federal government and thus follows the principle of vertical linkage.

(2) Development and formulation of the strategy (in Vienna from 2013-today)

With the normative governance principles of participation and reflexivity

The first step was to take stock of the situation in order to build on existing strengths (and already existing strategies) and to bundle the measures. In addition, this first step served to activate the stakeholders (IP1, IP6, IP15).

At the beginning, a measured amount of digitalisation was included in the framework strategy, as it was not intended to become a digitalisation strategy. In the first version of the strategy in 2004, digitalisation was only mentioned in connection with information and communication technologies, and here specifically the topic of open government, with a commitment to the principles of participation, transparency and data security. In the further development, this topic was readjusted once again and was given its own theme (IP12).

In particular, the linking of innovation with sustainability is a groundbreaking topic for all interview partners.

The multidisciplinary approach is an important factor for the success of the Vienna Smart City strategy for the interviewed persons from all sectors. The integration of many municipal departments and sectoral strategies into the process led to acceptance and openness towards the process.

The research institutions are often named as important partners. In the interviews, they are motioned as important partners by the administration, but they also refer to themselves and other research institutions as such. The long time horizon of the strategy as an umbrella strategy is an important point that provides both, the necessary framework for the sectoral strategies and leaves freedom for their own, shorter objectives.

Many of the interviewees perceive the sharing of knowledge between the departments as a driving force in the process (IP1, IP2, IP 9, IP10, IP15). It is also accompanied by headwinds and contrary opinions and discussions, but the interviewees see this also as constructive for the process and thus desirable.

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The Smart City Vienna consists of small iterative steps in different teams and frequent cross-sectoral and cross-departmental meetings at different hierarchical levels, according to the interviewees. They thus follow the governance principles of participation and reflexivity.

(3) Implementation Process (in Vienna from 2014 – today)

Especially in implementation, the actors look to other cities. The learning aspect is emphasised by the interviewees, in terms of learning and practical experiences from the individual departments in which they were confronted with implementation. Here, many report on the good trips to other smart cities and the exchange with other cities.

As early as 2011, the Vienna City Council aimed at peer learning among the cities themselves (Gemeinderat Stadt Wien, 2011b, p. 45).

At the operational level, the framework strategy is supported by many individual projects. These are often accompanied scientifically. This is where Vienna's municipal enterprises see themselves as enablers. They actively drive projects in these areas (especially in the fields of energy and mobility).

The inclusion of research institutions enabled transdisciplinary consortia to acquire funding and test Smart City projects.

Access to digital solutions is always demand-driven. Once the city's needs are defined, innovative solutions are sought (IP2).

(4) Evalaution, Monitoring and Further development (in Vienna from 2016 – today)

According to the interviewees, a monitoring system at the process level is a prerequisite for identifying and resolving conflicting goals. It should also serve the learning of the organisation, according to one of the process staff members.

The impact monitoring process from 2017 was itself internally evaluated. This shows a strong will to improve also at the process level.

The further development in 2019 was expanded with experiences from practice and lessons learnt from the departments. These had time to test themselves on the topics or grow into them over the years following the decision by the Council in 2014.

Further awareness was created through monitoring

The learning and developing aspect is not only emphasised by the interview partners. They can also be found in the documents, for example in the form of learning from cities such as Copenhagen, Berlin, Paris, Amsterdam or Stockholm, as contained in the revised framework report (Magistrat der Stadt Wien, 2019, S. 45).

6 DISCUSSION – TRANSFER AND FURTHER DEVELOPMENT

The innovation biography proved to be a good descriptive method to depict and analyse networks and cooperation relationships and connections, as well as knowledge relationships within the innovation process towards the Smart City.

The biographical retrospective method also shows interesting insights with regard to the derivation of successful governance. Similar to a process analysis, it reveals process components and thus serves to address them. The use of the open interview method also allows for a high level of detail. In this way, we were able to link the Smart City Vienna process with a model for governing sustainability. It is therefore possible to manage sustainability through the Smart City concept. In the initially top-down process of strategy development in Vienna, participation is very much in evidence, but less by a broad public than by selected representatives. Participation processes of rather abstract strategies are more difficult to implement than concrete implementation plans in which local citizens can be involved (Steurer & Trattnigg, 2010, p. 167). In the 2019 revision process, the stakeholders of the Vienna Smart City framework strategy have now set out to establish participation as an important action programme (Magistrat der Stadt Wien, 2019, p. 126). After all, participation processes are an important principle of good governance in Europe (Steurer & Trattnigg, 2010, p. 125).

With the interviews and some of the documents, their intentions must of course be taken into account. As the interviewees have been involved in the Vienna Smart City process for at least ten years, it can be assumed

that they are experts in this field. You could tell how experienced they are at telling the story of Vienna`s Smart City. The statements from the 16 interviews did not contradict each other in any point. This is astonishing and speaks for the validity of the statements.

The documents are part of the marketing of Vienna. They do not reveal the underlying difficulties or hurdles in the process, but describe the success story of Smart City Vienna. Cross-checking the transcripts of the interviews reveals important procedural factors and the importance of continuity and coherence. The teams have been working together in almost the same constellation for years, and unanimously enjoy doing so. These factors have played an important role in Vienna's process, but are also strongly anchored in Viennese culture. In addition, there are personality traits of the driving actors that were repeatedly mentioned in the interviews and are not transferable (cf. Schumpeter's pioneer).

However, procedural factors are very much transferable, such as the knowledge that in complex processes the selection of the actors involved is decisive and that people are more inclined to drop out of processes when complexity is too high. Also a high political committment in Vienna has been one of the most decisive criteria in the creation of a Smart City, as well as the integration into the individual departments. The same applies to the creation of a strategy and learning from other good examples. In the interviews, it was repeatedly emphasised that Vienna also looks at good projects and programmes in other cities, not to transfer them one-to-one, but to translate them into their city, to modify them or to generate new ideas with them. The relevance of creating a strategy has also been visible in Vienna and, according to other studies, is a decisive factor for the success or non-success of a Smart City. Thus, short-term ad hoc solutions or quickly manufactured compromises are not in the spirit of a strategic, i.e. long-term plan. Furthermore, the continuity of the actors (not only in the steering group) proved to be very successful. The same applies to the high level of political commitment. The interviewees all agreed that without this it would simply have been impossible to set up such a process in Vienna. The support of the municipal administration as a whole was equally instrumental. The process in Vienna has been a successful top-down model, which might not work for other cities. It may make sense to consider and compare an innovation biography of a bottum-up process alongside it. This "urban development from below", with sustainable design approaches in the context of urban gardening initiatives and repair cafes, i.e. interactionist urban development, also has its place in Vienna. The top-down approach of a framework strategy seems to offer enough space for this. As long as the Smart City is not (only) technology-centred, there is enough room for people to shape the city - by the administration for the big picture and by civil society for active action on the ground. Nevertheless, the question of who took the initiative for the respective Smart City is very relevant, given that companies can also design a Smart City (see Toyota Woven City in Japan).

What can certainly also be considered a success factor is the open learning culture that the process has shown. The interviewees talked about wanting to learn more about how Smart City works but also to share their knowledge. Although this is a normative aspect, it has been mentioned repeatedly: interdisciplinary cooperation. What is taken for granted in the management of successful companies, cities still have to conquer for themselves: "Innovation teams are always interdisciplinary" (Jaworski & Zurlino 2009, p. 61, own translation). Within the interviews it became clear that in Vienna this is still challenging but also crucial in the Smart City process. Especially in the initial phases of an (innovation) process, it is important to have different disciplines involved. According to the interviews, this was also very enriching in the Vienna Smart City process. The diverse disciplines generate different perspectives and ensure that the users and customers can also use the products and services (ibid., pp. 61-64). These products and services have been developed as a part of, or are related to, the Smart City framework strategy of Vienna.

Innovation is one of the foundations of Smart City Vienna, as evidenced by numerous projects, reallabs and the innovation interest of the stakeholders involved. "Innovation culture means "[...] norms, values and attitudes [...] that shape the behaviour of the people involved in innovation" (Jaworski & Zurlino 2009, p. 24, own translation). However, this innovation culture cannot be copied (ibid., p. 7). The same applies to local conditions, which influence the innovation capabilities of cities. The respondents are well aware of this. Vienna, for example, has good geopolitical and economic conditions for interdisciplinary and transdisciplinary cooperation as well as for the social dimensions of urban development.

The Smart City process in Vienna also shows that becoming a Smart City takes time (10 years in Vienna so far) and that the processes for joint cooperation are long and often laborious. In the interviews it became

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clear that it takes not only competence but also passion on the part of the participating actors to shape a Smart City. The actors of the Smart City Vienna need more interfaces in governance in order to further integrate the silo logic of the individual departments. However, this function requires a high degree of social competence as well as content-related and technical qualifications.

7 CONCLUSION AND NEED FOR FURTHER RESEARCH

Our document analysis was tasked with contextualising what was described in the interviews. It was therefore a matter of comparing the content. What this study could not do, since it is not part of the research design, is to evaluate the texts and documents on a linguistic basis. Also with regard to the narrative interviews, this supplementary method could certainly generate exciting further results, especially with regard to the scripts and narrative being so important for urban planning (van Hulst, 2012). Without going deeper into the research, it is immediately noticeable that Vienna has a good communication strategy - in general and in particular with regard to its Smart City as a way of sustainable urban design. Here we recommend further research at the interface of urban planning, urban research and linguistics. In this way, more profound statements could be made on the question of what role positive narratives have in urban planning and for urban planning (see e.g. van Hulst, 2012). "[…] [P]lanners should tell future-orientated stories, that help people imagine and create sustainable places." (Throgmorton, 2003, p. 125). There are already interesting approaches to this, e.g. "From the garden City to the Smart City" (Gurr, 2021).

This study is a case analysis. It helps to reveal the process towards a Smart City, to get a look behind the scenes and to derive success factors. It shows very clearly the complexity of this single case, the interrelationships and the background. By extending the method to other cities, such an ideal case can be placed in a larger context and compared. Also, the comparison of identified process factors from the Vienna Smart City to a Smart City that has not (so far) delivered the desired success would possibly validate these governance criteria again. Possibly, greater resistance, more conflicts or lack of cooperation within the cities towards a Smart City would also complicate the procedure of the analysis with the method of innovation biography. And of course, the structuring of the Viennese process on the basis of Steurer's governance model is an ideal-typical one and always falls short of a simple transfer. For a city to turn around and become the city it wants to be is a long, iterative and, above all, learning process. Nevertheless, the ideal-typical process from Steurer's model and the biography of the Smart City Vienna give confidence for a possible governance of sustainability via a Smart City. Vienna shows that the Smart City is more than a purely technical innovation. It is a concept, an idea, a political control model and contains more than technical prerequisites. "There is no blueprint for the perfect Smart City, so cities should not be afraid to encourage entrepreneurs to try new solutions. Innovation labs as well as technical and financial support will help." (Roland Berger, 2020, p. 16). We need sustainability strategies for the cities, that show the way to a CO2-neutral, resilient and climate-adapted city and see digitalisation as one part of the solution, not as a panacea. Vienna`s Smart City framework strategy shows that such an understanding of sustainable Smart City is possible.

The connection to a sustainability governance model (Steurer in this case) is only a beginning in the governance framework of Smart City. Further research is needed to explore these processes further. Knowing that a strategy is an important success factor for a Smart City is helpful, but knowing how to develop and implement such a strategy needs to be further investigated. The investigation of procedural factors in Vienna has shown that sustainable development can very much be advanced politically and administratively, also through the Smart City. Which form of governance is the right one for this can be another exciting field of investigation. Vienna shows strong tendencies towards mutual learning across disciplines as well as integrated knowledge production and interactive negotiations, i.e. the concept of collaboration, which correspond to the strategies of reflexive governance (Steurer & Trattnigg, 2010, pp. 250-251). "Sustainability is perhaps the quintessential terrain of reflexive governance." (Meadowcroft & Steurer, 2018, p. 7). Here, further research on links to the Smart City as a governance model of sustainable development can certainly be very informative.

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