

Sustainable and Future-Oriented Urban Development in Vienna & Barcelona

Stefan Lehrner

Geography and Economics, University of Vienna, Vienna, Austria

Email address:

A00453027@unet.univie.ac.at

To cite this article:

Stefan Lehrner. Sustainable and Future-Oriented Urban Development in Vienna & Barcelona. *International Journal of Sustainable Development Research*. Vol. 8, No. 2, 2022, pp. 25-32. doi: 10.11648/j.ijdsr.20220802.11

Received: February 11, 2022; **Accepted:** March 7, 2022; **Published:** April 14, 2022

Abstract: The current situation in urban areas and the increasing proportion of the world's population living in cities are leading to massive sustainability problems, which is why buzzwords such as sustainability, environmental protection, global warming, the Internet of Things and smart cities are omnipresent. Taking Vienna and Barcelona as examples, this paper tries to find out, how modern cities deal with these current challenges. The basis for this quantitative content analysis are the so-called "Urban Development Plans" (UDP), which record not only the current situation but also future developments. The UDP can thus be used as a basis for advising politicians by urban planners and serves the political leadership as an instrument or as a decision-making or orientation aid. It can ultimately be concluded that modern cities have a crucial role in sustainable development and thus play a central position in the application of advanced technologies to support sustainable urbanisation. In short, urban growth raises a variety of issues that threaten the sustainability of cities, as it places a huge burden on urban systems and ecosystem services. Clearly, major advances in urban design are needed to address these problems and specific issues. In this regard, modern cities are required to develop or implement more innovative solutions and sophisticated approaches, as this is necessary not only to monitor cities, but rather to understand, analyse and plan them. Ultimately, this work tries to find out whether there are differences in the smart city strategies of Vienna and Barcelona, or whether both cities - although spatially separated - have the same points on their agenda.

Keywords: Sustainability, Vienna, Barcelona, Smart City Strategy

1. Introduction

According to the United Nations, more than half of the world's population currently lives in urban areas, and by 2050, around 70% will be concentrated in urban areas [1]. This projected urbanisation of the world poses significant challenges in terms of environmental, economic and social sustainability [2-5], which can be met with the help of Urban Development Plans. [1]. If one follows Althoff [6] then, Urban Development Planning can be understood as comprehensive overall planning based on a thorough analysis of the existing conditions (economy, demography, transport...) and on the basis of which future perspectives ('Leitbilder') can be formulated that can be translated into short-, medium- and long-term objectives. The Urban Development Plan can thus be used as a basis for advising politicians by urban planners and serves as an instrument or decision-making or orientation aid for the political

leadership. [6]. Ultimately, it can be concluded that modern cities have a crucial role in sustainable development and thus play a central position in the application of advanced technologies to support sustainable urbanisation. This requires taking into account increased (future) energy consumption, pollution, toxic waste disposal, resource depletion, inefficient management of urban infrastructures, ineffective planning processes and decision-making systems, congested transport networks, endemic traffic congestion, and social inequality and socio-economic disparity. [7]. In short, urban growth raises a multitude of issues that threaten the sustainability of cities, as it puts enormous strain on urban systems and ecosystem services. Clearly, major advances in urban design are needed to address these problems and specific issues. In this regard, modern cities are required to develop or implement more innovative solutions and sophisticated approaches, as this is necessary not only to monitor cities, but rather to understand, analyse and plan

them. This can improve not only sustainability in modern cities but also efficiency, resilience, equity and ultimately quality of life. [8]. Ahmed et al. [9] have referred in this context to the "internet of things" and "big data technologies", which serve as the basis for so-called "smart cities" and thus have an influence on modern urban planning that should not be underestimated. If one follows Bibri [8, 10, 11] then the sustainable design of smart cities requires interdisciplinary and cross-institutional planning by means of urban expansion plans. But it is not only research that is concerned with smart cities, "IoT" (Internet of Things) or Big Data technologies: The multifaceted potential of the "IoT" was highlighted by the United Nations [12] in the study "Big-Data and the 2030 Agenda for sustainable development". This study concluded that the technology is still largely untapped for advancing sustainability and that concerted action is needed to unlock and harness this potential. It can therefore be concluded that modern urban development - no matter which city in the European Union - poses a plethora of challenges for the responsible institutions.

In examining the urban strategies, this paper conducted a quantitative content analysis to investigate how smartness and sustainability aspects are addressed in the Urban Development Plans of the cities and to which areas these objectives refer. The content of the Urban Development Plans was classified into categories with which the analyses were carried out. Ultimately, this paper aims to answer the research question: How does sustainability manifest itself in strategic Urban Development Plans? - a comparison between Vienna and Barcelona.

This paper is divided into three parts: The first part presents the theories from which the hypotheses are derived. The second part - the evaluation - is dedicated to the case studies, which in our case consist of Vienna and Barcelona. The third part - the conclusion - will summarise the results and confirm or falsify the hypotheses.

2. Theories & Hypotheses

If one follows Butlin [13] but also Adams [14] then sustainability can be defined as a set of practices that take into account the social, economic and environmental needs of present and future generations [13, 14].

Several components are essential in this definition: Firstly, the balance between social, economic and environmental dimensions should be achieved. This is achieved through the development of a strong economy that eradicates poverty, improves the quality of life and restores the natural environment [13]. Second, the protection of the natural environment and ecosystems [15]. To create a balance, it is necessary to equate the economic and social dimension with the environmental dimension: However, since the environmental dimension is the framework within which the other dimensions operate, it is not possible to balance the dimensions against each other. Sustainability is thus inextricably linked to environmental protection. [14]. Thirdly, the commitment to sustainability inevitably aims at a longer-

term decision-making horizon. [13]. In the last decade, scholars have done a lot of research on sustainability at the local level and have been able to shift attention from simply describing sustainability practices (what is sustainability?) and motivations (why sustainability?) to formulating strategies for implementing change (what steps do we need to take?). [16].

If one follows Macke et al. [17] it is necessary to make the sustainability strategies of modern cities measurable in order to compare sustainability efforts. However, comparing cities is not without problems, as cities differ in terms of their culture, history, climate and wealth. This makes it difficult to develop uniform approaches to urban sustainability. [17]. Comparability, however, is key to the objectivity of the project, as it allows for an assessment of the real situation with regard to the goals and expectations of this work.

Comparability is established in two dimensions: First, the Urban Development Plans are used for comparison; second, cities whose similar characteristics allow for constructive comparison between them can be selected [18]. In our example, the comparison cities Barcelona and Vienna were selected based on three geographical levels: regional, national and European. The selection criteria that were set were:

1. similar population: between 1,500,000 and 2,000,000 inhabitants
2. urban typology - cities in a metropolitan area
3. Unemployment rate close to the country's structural unemployment rate
4. Gross domestic product per capita of the population.

Barcelona and Vienna are very similar (inhabitants, position in the region, unemployment rate, GDP) and therefore suitable to work out differences or similarities in the sustainability strategy. Portney [19] discusses two different strategies for initiating sustainability efforts: One focuses on gaining stakeholder support, the other emphasises a top-down approach where technical expertise is acquired from professionals. If Portney is followed, these different strategies also lead to different implementation results: The top-down approach is based on the idea that many sustainability issues are technical in nature and therefore can only be solved by experts and professionals and not by citizens and stakeholders. [19]. On the other hand, the stakeholder strategy emphasises the importance of involving stakeholders, especially civil society groups, in the planning and implementation of sustainability initiatives. The stakeholder strategy assumes that the success rate of the implementation of sustainability projects by politicians or public officials increases when civil society is involved in the implementation process. [20]. Furthermore, the stakeholder approach assumes that citizens can provide valuable input about local communities and their sustainable development needs. Gathering this information can ensure that sustainability plans are based on a comprehensive understanding of the interactive relationship between human behaviour and the natural environment. [21, 22]. Following this theory, the first hypothesis can be formed:

H1: The more top-down, the more technical solutions are found in the Urban Development Plan.

The second hypothesis is based on Portney's "stakeholder approach". [19] and therefore reads.

H2: The more external voice there is in the sustainable smart city strategy, the more categories there are.

The third hypothesis follows the theory of Conroy et al. [20] and reads.

H3: The more stakeholders are involved in the Urban Development Plan, the more likely the projects in the Urban Development Plan will be implemented.

If one follows Exner et al. [23] there is a correlation between the intensity with which smart city technologies are advanced and political leadership. Exner et al. [23] examined the smart city strategy of Barcelona under the liberal mayor Xavier Trias (until 2015) and the socialist mayor Ada Colau and found that under Trias the goals were very precisely defined, while under Colau they were rather vaguely defined. Exner et al. paint a different picture for Vienna, as here they locate the participation of the Greens as a regulative for a binding smart city strategy. If we follow this theory, then the hypothesis is as follows.

H4: Liberal governments like those one currently find in Vienna tend to be more inclined towards a binding smart city strategy than socialist governments like those one currently find in Barcelona.

3. Case Studies

3.1. Vienna

If one analyses the Urban Development Plan of Vienna [24] then one can see that a closed co-administration system prevails in which the concept of "Smart City" is to be implemented in a broad sustainability strategy with a focus on resource conservation and resource protection. The Viennese "Smart City" strategy is dominated and steered by the administration, especially by urban planning, the city planning department and municipal utilities, while state actors are important in conflict situations and as a source of legitimacy. The implementation of the smart city concept is characterised by "non-hierarchical negotiation". [24] The implementation of the Smart City concept is characterised by "non-hierarchical negotiation" and is based on a high degree of self-organisation and a committed engagement with the topic on the part of the various administrative officials. Smart City thus signals an innovation in meta-governance in Vienna, which is partly becoming more project-based and operates flexibly across departmental boundaries. [24]. The decisive influence of a well-equipped and competent administration is reflected in the Urban Development Plan 2025, which is characterised by its coherence, completeness and complexity and takes up long-standing political goals with greater ambition. While - compared to smart city strategies in other modern cities (such as Barcelona [25]) - high technology plays a rather subordinate role, in Vienna housing is included in the strategy. General social aspects are also addressed in the Urban Development Plan.

Madreiter [26] has noted that the Viennese media

discourse on "smart city" is shaped by a sustainability narrative: In this discourse, technology is only one part among other elements of solutions to a variety of problems, which can, however, be understood as interrelated. The normative focus of this narrative is on quality of life and ecological compatibility [26].

The Vienna "Smart City" concept is thus conceived and understood both as a planning instrument as a planning framework and as a guiding principle for an integrated form of urban development.

3.2. Barcelona

In 2011, Barcelona City Council launched a new IT strategy that includes a global transformation plan aimed at introducing the use of new technologies in innovative ways to improve the overall operation and management of the city, promote economic growth and strengthen the well-being of its citizens.

This strategy was strongly aligned with the objectives of Horizon 2020, the European Union's strategy to improve its growth model for the next decade and create a more sustainable, smarter and inclusive development pathway [27]. Barcelona's strategy was also a response to the challenges the city faced in terms of its own organisation, the integration of citizens*, private companies and local government [28]. The project focused on replicable processes that bring the city closer to citizens through open data initiatives and provide valuable information to individuals and private companies. [29]. The City Operating System (City OS), for example, is a decoupling layer between data sources and smart cities solutions, within which various open source add-ons can be added and interconnected. [30]. The Smart Citizen open data platform is another example of a replicable process implemented in Barcelona that can bring the city closer to its citizens. It is an open data platform that aims to trigger participatory processes in the city. By linking data, people and knowledge, it serves as a hub for building productive, open and distributed indicators and tools that enable residents to collectively shape their own city. [31]. The aim of Barcelona's smart city strategy was also to generate sustainable urban growth through initiatives related to smart lighting, mobility (e.g. e-vehicles), and the development of new technologies. (e.g. e-vehicles) or residual energy (e.g. heating and cooling networks), but also in the context of social innovation. [32]. For example, with the Social Innovation for Communities project, Barcelona City Council catalysed the efforts of organisations, entrepreneurs and investors to implement proven and successful international solutions in Barcelona's local context. [33].

The implementation and promotion of alliances between private and public partners is also part of Barcelona's smart city strategy and there are collaborations between companies such as CISCO, IBM, Philips, SAP, Schneider and GDF Suez/Engie, as well as research centres and universities such as i2CAT, CESCA, the Dublin Institute of Technology, business schools such as IESE and ESADE and international organisations such as the World Bank, the European Commission and the United Nations (UN Habitat). [34].

The strength of Barcelona's smart city strategy is based on

its cross-cutting approach. Barcelona City Council aims to engage and keep all stakeholders connected to ensure strong support from all and to continuously foster innovation [35]. In addition, the city started to work with a cyclical and cross-cutting innovation model with all departments of the municipality to provide citizens* with innovative and useful services that they have gradually integrated into their daily habits in a flexible, continuous and agile way [36].

4. Evaluation

In order to confirm or falsify the above hypotheses, we combined quantitative content analysis with qualitative aspects, i.e. we classified the topics and companies on the basis of the UDP (Urban Development Plans) of Barcelona and Vienna, which means that this work is a theory-based, hypothesis-driven literature research. To achieve this, we created a "codebook" for the topics of energy supply, buildings, mobility & transport, economy & work, water and waste management, environment, health, social inclusion, education, science & research, digitalisation, participation, district planning and infrastructure, and then expanded it to include the topic setting. This is to ensure that not only the pure case numbers appear in the evaluation, but also that the precision of the objective can be checked. We deliberately refrained from calculating a reliability coefficient (e.g. according to Holsti), as the topics were already defined by the respective city governments.

Our quantitative evaluation of the Urban Development Plans of Barcelona and Vienna showed that a total of 258 projects were planned on the topics of sustainability, inclusion, education and smart city strategy:

Projects of the UDP in Barcelona and Vienna

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Buildings	3	1,2	1,2	1,2
Mobility & Transportation	14	5,4	5,4	6,6
Environment	4	1,6	1,6	8,1
Health	12	4,7	4,7	12,8
Social Inclusion	14	5,4	5,4	18,2
Education	2	,8	,8	19,0
Science & Research	1	,4	,4	19,4
Digitalisation	136	52,7	52,7	72,1
Participation	9	3,5	3,5	75,6
District Planning	63	24,4	24,4	100,0
Total	258	100,0	100,0	

Figure 1. UDP projects in Vienna and Barcelona.

A total of 31 projects were in Barcelona and 227 in Vienna:

Number of projects in the Barcelona and Vienna UDPs

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Vienna	227	88,0	88,0	88,0
Barcelona	31	12,0	12,0	100,0
Total	258	100,0	100,0	

Figure 2. Number of projects in the UDP in Vienna and Barcelona.

4.1. Evaluation 1 - Hypothesis 1

H1: The more top-down, the more technical solutions are found in the Urban Development Plan.

We have made this evaluation based on the topic setting "digitalisation", as this fits best with the areas of "technical solutions".

In our evaluation we found a total of cases 136 that reflect the digitisation strategies of Barcelona and Vienna. Of these, 106 Vienna and Barcelona account for 3.0.

The quantitative evaluation of the objectives marked "digitalisation" shows that a total of 107 projects were planned in Vienna and 30 in Barcelona. This is remarkable in that there were "only" 31 planned in Barcelona, while there were 227 projects in Vienna. However, since it is important to look more closely at the topic setting in order to answer this hypothesis, it is necessary to switch to the qualitative area and take a closer look at the projects that were marked with "digitalisation":

Projects of the Barcelona and Vienna UDP - Digitisation

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Vienna	106	77,9	77,9	77,9
Barcelona	30	22,1	22,1	100,0
Total	136	100,0	100,0	

Figure 3. Smart city strategies in Vienna and Barcelona.

Projects of the Barcelona and Vienna UDP - Subcategory of "Digitisation"

Count		Where?		Total
		Vienna	Barcelona	
Untertopic	Mobility and Transportation	8	0	8
	Economy & Employment	23	6	29
	Health	9	0	9
	Social Inclusion	0	15	15
	Education	10	5	15
	Science & Research	9	0	9
	Digitalisation	2	0	2
	Participation	20	2	22
	District Planning	0	2	2
	Infrastructure	25	0	25
Total		106	30	136

Figure 4. Projects in the Urban Development Plan in the category "digitalisation" in Vienna and Barcelona.

Looking at this table, one can see that the topic of "digitalisation" is implemented in a very diverse way in Vienna's Urban Development Plan: In total, there are technical solutions in eight subcategories, while there are only five subcategories in Barcelona. If we look at the projects on the qualitative level, we see that the projects in Vienna are not only more diverse in quantitative terms, but also in qualitative terms: While in Vienna there are mandatory projects such as Technology in Youth Work, Telemedicine - Digital Health Services or Environmental

Sensors at Traffic Lights, in the Barcelona Urban Development Plan there are topics such as Balancing the Digital Divide in Urban Benchmarks or Increasing Economic Development based on Neighbourhood Trade, Circular Economy, Social and/or Technological Economy and Self Containment. If one follows the theories of Sisto et al. [18] then it can be assumed that comparable cities can also be expected to achieve comparable results in smart city strategy. However, our research has shown that in the field of technical solutions, it is also relevant which approach is chosen in planning and implementation: The participatory or the top-down approach. Our study showed that the top-down approach (as practised in Vienna) is clearly different from the participatory approach in Barcelona, because Vienna has enough potential to be technically innovative with its "in-house" experts.

4.2. Evaluation 2 - Hypothesis 2

H2: The more external voice there is in the sustainable smart city strategy, the more categories there are.

To answer this hypothesis, we have examined the "subcategories" of Barcelona's and Vienna's strategy efforts in more detail:

Diversity of strategies in the Barcelona and Vienna UDPs

Count

		Wo		
		Vienna	Barcelona	Total
Untertopic	Energy supply	1	0	1
	Buildings	1	0	1
	Mobility & Transportation	9	0	9
	Economy & Employment	24	6	30
	Environment	2	0	2
	Health	9	0	9
	Social Inclusion	11	16	27
	Education	12	5	17
	Science & Research	13	0	13
	Digitisation	3	0	3
	Participation	109	2	111
	District Planning	0	2	2
	Infrastructure	33	0	33
	Total	227	31	258

Figure 5. Diversity strategies - Barcelona & Vienna.

Looking at the strategies of Barcelona and Vienna, one can see that Vienna's strategies are more variant on the "second" level (i.e. not the main category). Although Vienna - if one follows the official UDP report [24] - does not rely on external stakeholders, the inclusion of internal stakeholders as well as the establishment of MA01 has a non-negligible impact on the diversity of measures. For our case studies we have to falsify Leuenberger's theory [22] For our case studies, we have to falsify Leberger's theory and state that it is not enough to use only the external stakeholders for multifaceted sustainability strategies. Although Barcelona relies heavily on external stakeholders and Vienna not at all, Vienna's UDP is much more diverse than that of Barcelona.

4.3. Evaluation 3- Hypothesis 3

H3: The more stakeholders are involved in the Urban Development Plan, the more likely the projects in the Urban Development Plan will be implemented.

To answer this hypothesis, we looked at which projects were marked as "Completed" in the Urban Development Plans of Barcelona and Vienna. Our research showed that a total of 112 projects were marked as "Completed" by the respective project leaders, with the largest share in the area of neighbourhood planning already implemented.

Completed projects in Barcelona and Vienna

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Buildings	3	2,7	2,7	2,7
	Mobility & Transportation	3	2,7	2,7	5,4
	Environment	4	3,6	3,6	8,9
	Social Inclusion	14	12,5	12,5	21,4
	Education	2	1,8	1,8	23,2
	Science & Research	1	,9	,9	24,1
	Digitisation	16	14,3	14,3	38,4
	Participation	6	5,4	5,4	43,8
	District Planning	63	56,3	56,3	100,0
	Total	112	100,0	100,0	

Figure 6. Completed projects in the Urban Development Plan in Vienna and Barcelona.

Of the 112 completed projects, 109 were in Vienna and 3 in Barcelona.

Frequencies - completed projects in Vienna and Barcelona

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Vienna	109	97,3	97,3	97,3
	Barcelona	3	2,7	2,7	100,0
	Total	112	100,0	100,0	

Figure 7. Frequencies - completed projects in Vienna and Barcelona.

We have already established in answering hypothesis H3 that Vienna does not rely on external stakeholders, but has installed its own department, MA01, which is responsible for IT projects and sustainability. If one follows Vienna's Urban Development Plan. [24] Then these internal stakeholders are the reason why the number of implemented projects in Vienna is higher than in Barcelona - also in percentage terms: A total of 109 projects were marked as "completed" in Vienna. This is 48.02% of the total number of 227 projects. In Barcelona, on the other hand, only 9.68% of projects were completed (31 projects in total, of which 3 have already been completed).

4.4. Evaluation 4 - Hypothesis 4

H4: Liberal governments like those one currently find in Vienna tend to be more inclined towards a binding smart city strategy than socialist governments like those one currently find in Barcelona.

In order to be able to answer this hypothesis, it is necessary to qualitatively examine the themes set by the two

city governments: The UDPs of Barcelona and Vienna are ideally suited for this purpose, as they contain all the objectives and their binding nature can be examined.

4.4.1. Barcelona

The Barcelona city government has formulated the goals relatively openly. There are goals such as "E-Government - Smart City Strategy to modernise e-government", "E-Inclusion - Closing the digital technology gap by meeting the basic needs of the different groups at risk of social exclusion", "Promoting the necessary actions to classify cities as Smart Cities, taking into account the gender perspective", "Reducing the digital technology gap through training for companies and citizens* covering the basic needs of companies with technological knowledge deficits that affect their competitiveness and the different groups at risk of social exclusion (loneliness among the elderly; improving the employability of the unemployed; e-literacy of immigrants, etc.), but also "increasing the efficiency of public service delivery in smart cities". These measures or strategies clearly show that the city government under Colau defines the goals broadly rather than narrowly. Social projects such as inclusion are of course very welcome, but as these goals only exist as "headlines", their implementation is rather to be judged as "vague". The focus on "headlines" makes it difficult for residents to follow the individual projects, as they do not actually exist for those who are not involved.

4.4.2. Vienna

The city government of Vienna has formulated the goals relatively narrowly. The measures defined in the UDP include, for example, "IBot - the digital civil servant", the "digital building submission", "digital counter - official channels via video", the introduction of a "digital noticeboard", "telemedicine - digital health services", the introduction of a "fully automated underground", as well as "digital education" to name but a few. The goals of the Vienna city government are very narrowly defined and are not based on "headlines" but on projects that are tangible and therefore comprehensible for the residents. If one follows Exner et al. [23] liberal city governments tend to define the measures or strategies for a sustainable smart city strategy more precisely than socialist governments. Our evaluation showed that this hypothesis is also valid in our case study. The more liberal city government of Vienna has shown that the measures are much more precise and detailed compared to Barcelona.

5. Conclusion

With the help of a quantitative content analysis (combined with qualitative elements), this study investigated how sustainability manifests itself in strategic UDP: 258 projects were planned in Vienna and Barcelona in the categories of buildings, mobility and transport, environment, health, social inclusion, education, science & research, digitalisation, participation, district planning.

It was particularly noticeable that - especially in Vienna -

there was a large share of projects in the areas of participation and urban district planning. It was remarkable in this context that district planning was often not in the area of construction measures, but that it was primarily about district development in relation to citizen participation:

For example, the City of Vienna has created projects in the field of urban greening like Community gardens, green roofs, but also the establishment of a children's and youth parliament or the promotion of "do-it-yourself" workshops.

Both cities have a "social media strategy" that is not only intended to encourage residents to participate, but also serves as an information platform for future projects. But the digital future is also taken into account to a large extent in the urban development plans of Vienna and Barcelona - Digital building submissions, digital payment, digital official channels, telemedicine, digital health services, digital assisted living,... - to name just a few that are implemented or planned in both Vienna and Barcelona.

A high priority in the urban development plans of Barcelona and Vienna is also the digitalisation of education - and remarkably so - even before the outbreak of the COVID-19 pandemic: In Vienna, for example, there are projects on the topics of "digital teaching", "digitalisation of libraries", "establishing universities as competence centres for the digital sector". Barcelona focuses on "Digital workshops to increase digital competence and education" or on "Digital competences in all forms of education".

However, sustainability is not only expressed in digitalisation or district development: Vienna and Barcelona also focus on the inclusion of migrants, senior citizens and young people in the participation process. This is mainly realised by teaching residents how to use the resources developed by the city administration. This mainly concerns the reduction of the digital technology gap through training for businesses and citizens, covering the basic needs of businesses with technological knowledge deficits that affect their competitiveness and of the various groups at risk of social exclusion (loneliness among the elderly; improving the employability of the unemployed; e-literacy of immigrants, etc.).

The research has shown that Firstly, cities with similar orientation and infrastructure also have similar sustainability and smart city strategy projects. Secondly, we found out that not only external stakeholders are important for the variance or bindingness in the implementation of projects, but that - depending on the setting - it is above all internal stakeholders who ensure that the strategy of the city government is versatile and binding: Vienna has installed its own department, MA01, which is responsible for IT projects and sustainability. If one follows the Urban Development Plan of Vienna [1], then these internal stakeholders are the reason why the number of implemented projects in Vienna is higher than in Barcelona - also in percentage terms: A total of 109 projects were marked as "Completed" in Vienna. This is 48.02% of the total number of 227 projects. In Barcelona, on the other hand, only 9.68% of the projects were completed (31 projects in total, 3 of which have already been completed).

Furthermore, we have been able to prove that liberal city governments are more precise about their strategy than socialist governments.

References

- [1] Fallmann, J., S. Emeis, and P. Suppan, *Mitigation of urban heat stress—a modelling case study for the area of Stuttgart*. DIE ERDE—Journal of the Geographical Society of Berlin, 2013. 144 (3-4): p. 202-216.
- [2] Bibri, S. E., *Smart sustainable cities of the future: the untapped potential of big data analytics and context-aware computing for advancing sustainability*. 2018: Springer.
- [3] David, D., *Environment and urbanization. The International Encyclopedia of Geography*, 24 (1), 31–46. 2017.
- [4] Han, J., et al., *A long-term analysis of urbanization process, landscape change, and carbon sources and sinks: A case study in China's Yangtze River Delta region*. Journal of Cleaner Production, 2017. 141: p. 1040-1050.
- [5] Estevez, E., N. Lopes, and T. Janowski, *Smart sustainable cities: Reconnaissance study*. 2016.
- [6] Althoff, C., *Stadtentwicklungsplanung in Wien am Beispiel STEP 84. Die historische Einordnung und kritische Analyse einer Planungsmethode und ihre Umsetzung im Rahmen der Verwaltung der Stadt Wien*. Wien: Diplomarbeit Universität Wien, 1996.
- [7] Bibri, S. E., J. Krogstie, and M. Kärrholm, *Compact city planning and development: Emerging practices and strategies for achieving the goals of sustainability*. Developments in the built environment, 2020. 4: p. 100021.
- [8] Bibri, S. E., *The IoT for smart sustainable cities of the future: An analytical framework for sensor-based big data applications for environmental sustainability*. Sustainable cities and society, 2018. 38: p. 230-253.
- [9] Ahmed, E., et al., *The role of big data analytics in Internet of Things*. Computer Networks, 2017. 129: p. 459-471.
- [10] Bibri, S. E., *Advances in the leading paradigms of urbanism and their amalgamation: compact cities, eco-cities, and data-driven smart cities*. 2020: Springer.
- [11] Bibri, S. E., *On the sustainability of smart and smarter cities in the era of big data: an interdisciplinary and transdisciplinary literature review*. Journal of Big Data, 2019. 6 (1): p. 1-64.
- [12] Maaroo, A., *Big data and the 2030 agenda for sustainable development*. Report for UN-ESCAP, 2015.
- [13] Butlin, J., *Our common future. By World commission on environment and development*. (London, Oxford University Press, 1987, pp. 383£ 5.95.). 1989, John Wiley & Sons, Ltd West Sussex.
- [14] Adams, W. M. *The future of sustainability: Re-thinking environment and development in the twenty-first century*. in *Report of the IUCN renowned thinkers meeting*. 2006.
- [15] Fiorino, D. J., *Sustainability as a conceptual focus for public administration*. Public administration review, 2010. 70: p. s78-s88.
- [16] Johnson, K., et al., *Building capacity and sustainable prevention innovations: a sustainability planning model*. Evaluation and program planning, 2004. 27 (2): p. 135-149.
- [17] Macke, J., et al., *Smart city and quality of life: Citizens' perception in a Brazilian case study*. Journal of Cleaner Production, 2018. 182: p. 717-726.
- [18] Sisto, R., et al. *City Assessment Tool to Measure the Impact of Public Policies on Smart and Sustainable Cities*. 2021. Cham: Springer International Publishing.
- [19] Portney, K., *Civic engagement and sustainable cities in the United States*. Public Administration Review, 2005. 65 (5): p. 579-591.
- [20] Conroy, M. M. and P. R. Berke, *What makes a good sustainable development plan? An analysis of factors that influence principles of sustainable development*. Environment and planning A, 2004. 36 (8): p. 1381-1396.
- [21] Leuenberger, D. Z., J. R. Bartle, and C. Chen, *Sustainability and transportation*. Public Works Management & Policy, 2014. 19 (4): p. 316-321.
- [22] Leuenberger, D. Z., *Sustainable development for public administration*. 2015: ME Sharpe.
- [23] Exner, A., et al. *Performing Smartness Differently - Strategic Enactments of a Global Imaginary in Three European Cities*. WU Vienna University of Economics and Business 2018.
- [24] Stadt Wien. *Stadtentwicklungsplan Wien - Publikationen - STEP 2025*. 2010 [cited 2010 2010-01-01]; Available from: <https://www.wien.gv.at/stadtentwicklung/strategien/step/step2025/publikationen.html>.
- [25] Capdevila, I. and M. I. Zarlenga, *Smart city or smart citizens? The Barcelona case*. Journal of Strategy and Management, 2015.
- [26] Madreiter, T., *Smart City Wien—kluge Lösungen für die lebenswerte Stadt*. Wien Wächst—Smart City. Planungsdirektor der Stadt Wien. AK Wien. AK Bildungszentrum, 17.02, 2016.
- [27] Veugelers, R., et al., *The impact of horizon 2020 on innovation in Europe*. Intereconomics, 2015. 50 (1): p. 4-30.
- [28] Angelidou, M., *Four European smart city strategies*. Int'l J. Soc. Sci. Stud., 2016. 4: p. 18.
- [29] Jaekel, M., *Smart City wird Realität: Wegweiser für neue Urbanitäten in der Digitalmoderne*. 2015: Springer-Verlag.
- [30] Ferrer, J.-R., *Barcelona's Smart City vision: an opportunity for transformation*. Field Actions Science Reports. The journal of field actions, 2017 (Special Issue 16): p. 70-75.
- [31] Aragón, P., et al. *Deliberative platform design: The case study of the online discussions in Decidim Barcelona*. in *International conference on social informatics*. 2017. Springer.
- [32] Blanco, I. and M. León, *Social innovation, reciprocity and contentious politics: Facing the socio-urban crisis in Ciutat Meridiana, Barcelona*. Urban Studies, 2017. 54 (9): p. 2172-2188.

- [33] Eizaguirre, S. and M. Parés, *Communities making social change from below. Social innovation and democratic leadership in two disenfranchised neighbourhoods in Barcelona*. Urban Research & Practice, 2019. 12 (2): p. 173-191.
- [34] Gonnord, J., et al. *HPCS 2012 keynotes: Tuesday keynote: Europe back in the HPC race: Building a European ecosystem to recover and maintain the capacity of designing and building large computers*. in *2012 International Conference on High Performance Computing & Simulation (HPCS)*. 2012. IEEE.
- [35] Rose, G., *Actually-existing sociality in a smart city: The social as sociological, neoliberal and cybernetic*. City, 2020. 24 (3-4): p. 512-529.
- [36] de Hoop, E., et al., *Smart urbanism in Barcelona: A knowledge-politics perspective*. 2018.