What are the conditions to become smart?

A systematic analysis of the smart city strategy and smart city development activities of Budapest

Smart cities (SCs) became a key mission in the European Union's biggest research programme (Horizon Europe). The urban transition to smartness, making smart decisions and strengthening capabilities for resilience are appreciating today, with such external shocks as the COVID-19 pandemic. Finding the way to become smart is more important than ever. Since literature is mostly engaged with excellent cases, in this paper we analyse the SC strategy of a less-well-performing city: Budapest in Hungary, Central Eastern Europe, using a case-study methodology. We reveal that in the case of Budapest the SC strategy uses a top-down approach that overweighs the deployment of technological solutions to manage urban sustainability issues rather than using a bottom-up and holistic approach. The framework conditions for implementing the SC strategy are rather neglected. In the case of the model for cooperation, Budapest adopts a double-helix model rather than a triple- or quadruple-helix model.

Keywords: *Central Eastern Europe, ICT, smart city projects, sustainable urban planning, case study*

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1. Introduction

Despite words about the declining popularity and diminishing hype of smart cities (SCs) (Trapp 2018), having climate-neutral SCs became one of the five main mission areas of the European Union's large-scale research and development programme Horizon Europe (European Commission 2021). However, the widespread uptake of the concept is still far from its potential in Hungary and the Central Eastern European region, which is further challenged by the social and economic impact of the COVID-19 pandemic. Some particularities make it especially challenging for scientists and practitioners to engage with the vision of SCs.

Ever since fundamental controversies were reported by Hollands (2008) in the SC research, studies aiming to untangle the contradictory nature of the literature have been gaining ground in the scientific community. Mora and Bolici (2017), Mora, Deakin and Reid (2018) and Komninos and Mora (2018) unveiled the significant differences among SC research streams by capturing four distinct dichotomies that are present in scientific publications. Mora et al. (2019) introduced a rigorous case-study-based methodology to analyse SC developments. With their proposed research methodology, they tested the four dichotomies as divergent strategic principles of SC development, using leading cities as examples (Mora, Deakin and Reid 2019).

The implementation of SC developments ought to be realised with strategic methods (Komninos 2014; Angelidou 2015; Mora and Bolici 2016, 2017). The particularities of how these strategic principles should be considered are relatively well researched; however, there are only a few publications available on empirical research relating to Eastern European, especially Hungarian cases of SC development. In this paper, we replicate this validated scientific method and systematically analyse the SC strategy and development activities of one Hungarian example, the capital city, Budapest.

When researching SC developments, most of the available publications focus on either a specific technology solution or urban sub-systems, including components of SC models. The comparability and replicability of these researches are limited. On the other hand, papers analysing the overall city-wide context, or multiple cities, with comparable results are usually measuring the 'smart' performance of cities. These works primarily use existing or newly designed indicator systems, based on already available regional or urban data. As Z. Karvalics (2016) points out, a myriad of these indicator frameworks, with their city rankings, are available. However, they are more likely to create confusion and divergent understandings of the concept. Besides SC performance measurement and monitoring, Lukács and Csomós (2020) systematically analyse the presence of SC domains in the strategic documents of 21 Hungarian cities, based on the model of Giffinger et al. (2007). They point out that only three cities have a dedicated SC strategy, and the overall significance of the SC concept in the medium-term strategy of Hungarian cities is very low (15%). Lados (2016) analysed the SC attitudes of Hungarian cities and found various levels of maturity.

This paper aims to establish better linkages between the Hungarian and the international research into SC strategies and smart development activities. The differing definitions and numerous models cause inconvenience for both researchers and

practitioners in adopting the SC concept in a localised context. A standardised methodology and its application to an Eastern European example of SC development will hopefully be inspiring and create cohesion among the various research pathways. Furthermore, this paper will help practitioners in the least developed cities to create their own SC strategy and design meaningful development activity portfolios.

This paper may be useful to policymakers and urban managers as well as SC specialists involved in strategic planning processes, and mainly when they are designing portfolios of SC solutions for a city, undertaking benchmarking and peer learning activities. It could also be interesting to scientists who are engaged with systematic research into SC development activities, SC strategies and SC governance.

In the following, we give a detailed description of the divergent principles of strategic SC developments (dichotomies), identified by Komninos and Mora (2018), which will provide the research framework for the case-study analysis of Budapest. Then, in the methodology section, we give a transparent description of how we collected and analysed the data, followed by the results of the four dichotomies studied. In the discussion, we point out the similarities and the differences among cities that demonstrated SC excellence (especially Vienna). Afterwards, we make conclusions, define future research directions and draw attention to the limitations and validity of our research.

2. The Dichotomous Nature of Smart City Research

There are four different dichotomies identified by Komninos and Mora (2018) in the research of SCs. These strategic principles in each of the four cases not only differ from each other but are directly opposed. The existence of such phenomena makes it challenging for scientists to research strategies since there is no consensus on which way is best for the development of SCs. There is robust evidence available on the existence of such dichotomies in the literature (Mora et al. 2019).

Dichotomies	Strategic principles	Definition
Dichotomy 1: Technology-led or holistic	**Hypothesis 1.1:** Technology-led strategy	SC development must be driven by information and communication technology (ICT) solutions.
	Hypothesis 1.2: Holistic strategy	SC development should rather consider all other conditions for urban environments, built for human habitats.
Dichotomy 2: Top-down or bottom-up approach	**Hypothesis 2.1:** Top-down approach	Local governments must take the leading (governance) role in SC developments and provide strategic directions for all stakeholders.
	Hypothesis 2.2: Bottom-up approach	The civil society and key stakeholders other than the local government must build up SC developments, unbound by central regulation.

Dichotomy 3: Double or quadruple-helix model of collaboration	**Hypothesis 3.1:** Double-helix model of collaboration	SC developments can be efficiently realised within the narrow margin of traditional public–private relationships (double-helix structure).
	Hypothesis 3.2: Quadruple-helix model of collaboration	SC developments can be realised only with a platform-based inclusive approach that generates the necessary intelligence (quadruple-helix structure).
Dichotomy 4: Mono-dimensional or integrated intervention logic	**Hypothesis 4.1:** Mono-dimensional intervention logic	The mono-dimensional version of the SC entails the implementation of environmentally friendly solutions.
	Hypothesis 4.2: Integrated intervention logic	SC development must cover most urban domains, in an integrated manner.

Table 1. The four dichotomies of SC research and the divergent strategic principles (own edition based on Mora et al. (2019))

3. Methodology

The present study applies a case-study methodology to analyse the SC strategy of one city. The purpose of the study is to analyse a Central Eastern European case that has not been researched yet and is not regarded as an example of excellence. Considering the purpose of this study, we used a non-probability sampling type, convenience sampling, where the sample was drawn from the part of the population that was closest to hand. As the study is a sort of pilot testing for this type of population, it is the most useful one. The aim was to select a case-study city in which the transition process has proven to be unsuccessful yet. The sampling process took into account the following criteria: (1) larger cities (at a European level), with between 500,000 and 2,000,000 inhabitants, that (2) have an existing SC strategy.

We did a comparative analysis of the SC rankings which showed whether each candidate was an example of an unsuccessful case. Budapest has a resident population of 1,750,216 and has had an SC strategy since 2019, which makes it a late adopter of the concept. However, SC developments were already underway there in the last decade. The city ranked lower (77th) than its region's average ; only Bucharest ranked worse in 2020 (Csécsei 2020). The collection of data was conducted in multiple phases, to find online sources where digital records are available for the city of Budapest and its SC development activities. The main sources identified were: (1) Budapest Portál, the official online information system of the local government (Budapest Főváros Önkormányzata 2021), and (2) the Lechner Knowledge Centre's SC project repository (Lechner Tudásközpont 2021). Using these main sources, we identified and collected digital records, including press releases, web pages, policy documents, local government acts and so on. All the identified activities were collected in an Excel spreadsheet, where duplications were removed and the data was described with a pre-defined template. The processing and analysis of

the qualitative data were carried out in the QCA Map website's service. Besides the digital records for each activity, the coding procedure produced quantitative data on the SC domain it belongs to, the year of the activity, the type of activity (A: Community Building, B: Strategic Framework, C: Services and Applications (the type of service or application), D: Digital Infrastructure), the spatial level (City, District, Building, Home) and the organisations participating in the implementation. In the case of organisations, their type and administrative level were also determined. With the coding process, 111 activities (Annex 1) and 337 organisations (Annex 2) were identified. The annexes are accessible in an external file due to their size (Csukás 2022).

4. Results

4.1. Dichotomy 1: Technology-Led or Holistic Strategies

Budapest's SC development strategy gives much more weight to (1) deploying technological solutions ('Services and Applications'; 'Digital Infrastructure') than to managing urban sustainability issues. The city's strategy implements activities that use ICT components. In contrast with the technology-led focus, the city's strategic activities have a lesser focus on (2) the development of activities aimed at community building and the necessary strategic framework that supports the roll-out of those technological solutions. This strategy is therefore based on the services and application-focussed vision of SCs, with a high emphasis on technology, particularly ICT. Therefore, we do not consider it a holistic type that is more engaged with the development of socio-technical systems in which technology is a means, not an end itself. Figure 1. illustrates the distribution of SC development activities among the four categories, which ultimately determines the type of strategy.

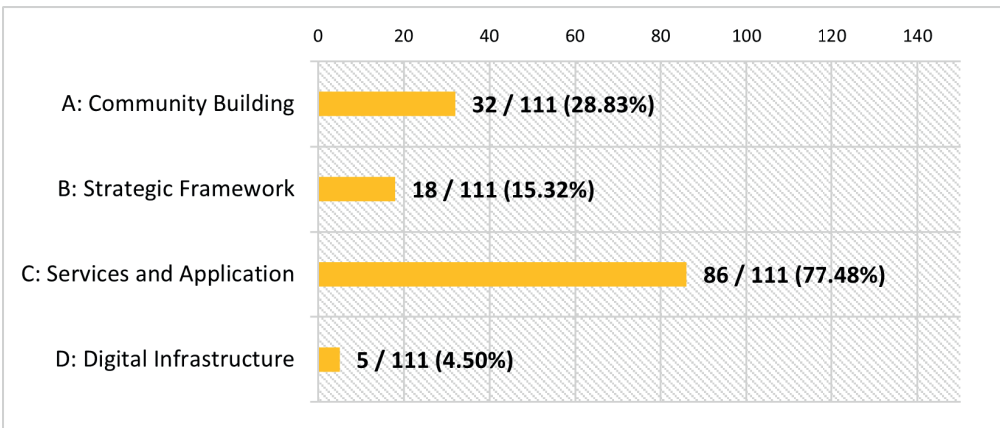

Figure 1. Budapest's SC development strategy: Number of activities by category (own edition)

The details of the statement above are further elaborated in Figure 2., which splits the categories according to their percentage and nominal share of activities. The first group includes those activities belonging to at least one of the first two categories – 'Community Building' and 'Strategic Framework' – both of which focus attention on the non-technological factors of SC development. In the comparison of the two groups, we identify that they are non-balanced – Group 2 has almost twice the number of activities of Group 1.

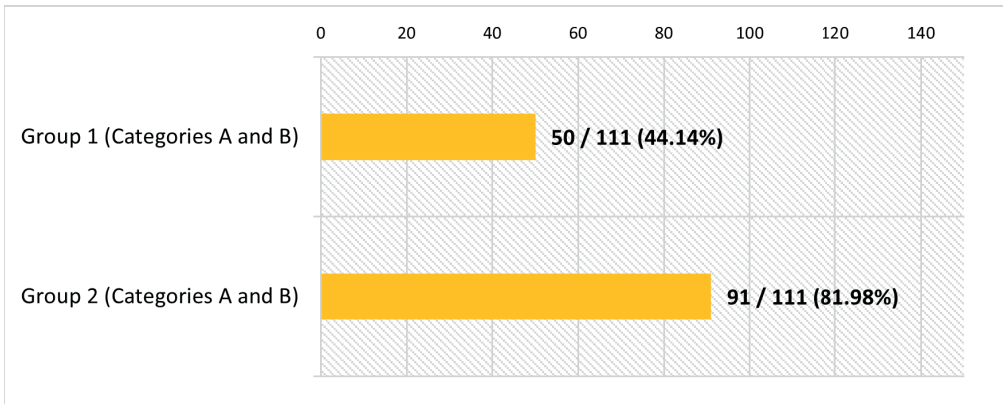

Figure 2. SC development activities of Budapest: Distribution of activities by groups of categories (own edition)

In Group 2, activities are concerned with technological developments. In the smart government domain, examples include integrations with electronic documentation systems, secondary data portals, connection to ASP application services or the Budapest GIS Portal. Many other activities are linked to the smart mobility domain, including the BKK Futár application, smart parking solutions, e-car charging infrastructure and sharing systems, and smart lampposts. There are also examples of electronic card systems in various districts and application-based solutions for tourists.

As an example of Group 1 activities, the CH4LLENGE project, co-funded by the Intelligent Energy Europe Programme of the European Union, with the participation of BKK Budapesti Közlekedési Központ Ltd, improved the capacities and knowledge of Budapest. The objective of the activity was to develop quality Sustainable Urban Mobility Plans, considering the most pressing challenges of participation, cooperation, measure selection, monitoring and evaluation. The final report of the project emphasised the role of institutional cooperation and strategic frameworks (CH4LLENGE Project 2021). The overall strategic framework for SC developments in Budapest is defined in the 'Smart Budapest Framework Strategy' approved by the Budapest City Council in 2019 (Budapest Főváros Önkormányzata 2019). On the other hand, there are various strategic frameworks aligned with it: the climate strategy of Budapest (2018), the Budapest 2030 urban development plan (2013), the Balázs Mór Plan for transport development strategy for the 2014–30 period. An example

of the [A] Community Building activities is the establishment of a climate-change platform in Budapest, with 33 member organisations. The objective of the platform is to expand the knowledge of the capital's decision-makers and the public about climate change, to ensure the long-term coordination of the activities related to this topic at the capital level and the conditions of professional communication related to climate change, as well as to define its framework effectively.

4. 2. Dichotomy 2: Top-Down or Bottom-Up Approach

This section provides an overview of the activities of the Budapest municipality in the governance of the SC as well as defining its objectives and characteristics. The municipality's strategy is defined in the document 'SMART BUDAPEST: The Smart City Vision of Budapest', which also details the dedicated role of each partner and the overall nature of the strategy. The strategy states that it is based on a new approach, which – in contrast with the traditional method of urban development documents – does not emphasise the necessary interventions in all the particular urban domains. It rather collects a criteria framework for 'smartness', which horizontally aligns with all urban domains and harmonises them. It eventually acts as a complex guide to achieving the long-term goals. It could be used in the preparation and decision phase of projects. On the other hand, it may also be used in embedding smartness into the integrated urban development strategies (Smart ITS). The final focus areas are (1) Initiator Urban Governance, (2) Smart People, (3) Smart Economy, (4) Sustainable Resources, (5) Smart Mobility and (6) Urban Quality of Life.

Budapest's SC development strategy shows a mixed picture of top-down and bottom-up approaches, mainly due to its special view on the strategic framework, as explained above. The local government of the capital of Budapest is a key driver and participant in SC development activities. Public companies and district municipalities related to the capital were involved in 62% of all activities. Those activities that happened without the participation of local public administration took up a rather lower share of 38%, which means that the bottom-up approach of the city's strategy is less significant. The framework strategy describes the role of different stakeholders in the implementation process. The actors are explicitly called (1) local governments and central government administration, (2) inhabitants and civil society and (3) market-oriented enterprises. Local government tasks are described as adopting SC principles into existing operations and executing new projects, with special emphasis on incentives and legislation. Civil society is encouraged to take on responsibilities and enforce smart principles in individual decisions. Members of the civil society are also expected to monitor, validate and provide feedback on planning and implementation of smart projects. The market-oriented enterprises' task is to engage with urban challenges by developing products and services.

The document defines its role as a guiding mechanism for all the stakeholders to support their cooperation and harmonise project activities. On the other hand, the strategy emphasises the special structure of Budapest's public administration, the two-tier system of local governments. This makes the city services more com-

plex; additionally, the Hungarian government implements several projects, within its jurisdiction, while key government services – where SC developments are common in excellent cases – are nationally centralised, leaving little space for the city to plan and implement actions. Taking into consideration the relatively high level of engagement of the city, one may expect strong leadership and a straightforward vision. However, the fragmentation of authority, the diverse interests of the various public bodies, the centralised service provision and the horizontal nature of the framework strategy make it challenging to classify it as a purely top-down approach. Figure 3. shows that, while the Budapest municipalities take the lead, the central government's role is relatively high in the SC development activities of Budapest.

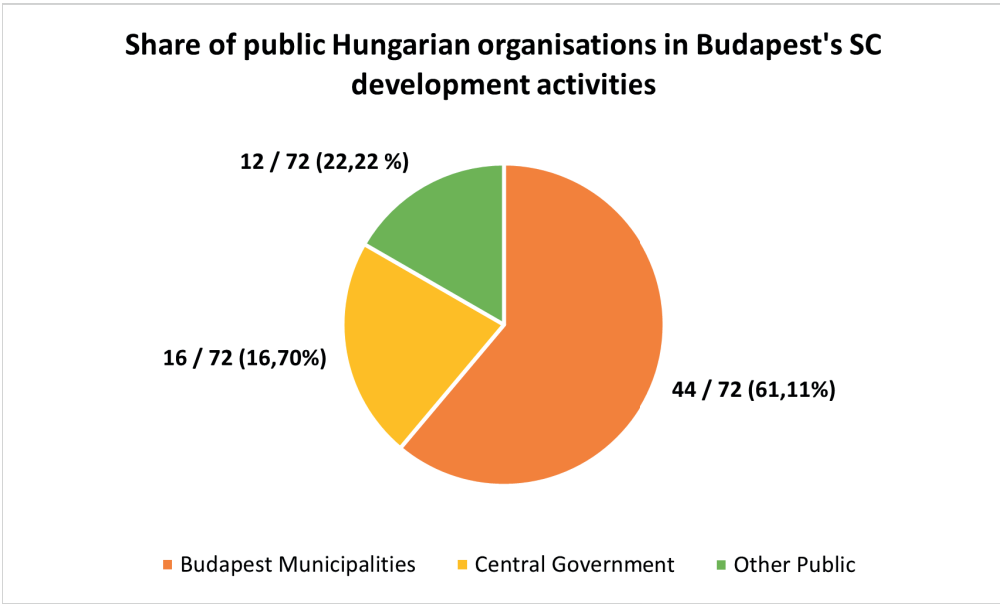

Figure 3. Share of public Hungarian organisations, based on their spatial level (own edition)

Budapest's SC framework strategy outlines a four-step planning process that begins with the (1) definition of SC, its focus areas and principles, based on the city's vision, and a review of international practices; continues with (2) assessment of the situation in each focus area, covering already implemented and ongoing SC projects, local and national sectoral plans, and identification of key stakeholders; is followed by (3) determination of objectives and intervention areas in the focus areas; and concludes with (4) preparation of mechanisms to enforce smart principles in the development areas.

Different target groups were engaged, using various methods. The working group responsible for developing the strategy consisted of personnel from the Mayor's Office and external experts, which determined it as a centralised development process. Urban challenges and good practices were identified by conducting workshops with

the participation of district local governments, where they also disseminated the methodology of the planning process. Another key stakeholder group, where similar workshops were conducted, was public service provider organisations (e.g., utility companies). In these cases, the working group also used the interview technique with representatives of the organisations, to enquire in depth about their opinions and recommendations. Despite these efforts to make the strategy creation process an open and inclusive one, there is no publicly available evidence found on these workshops and interviews; furthermore, activities related to gathering the opinions of the wider population are also missing.

Despite the thorough description of monitoring systems, measurement and indicators to evaluate the interventions in each focus areas, there are no responsibilities assigned to any organisations. Being a horizontal methodology to enforce smart principles in urban development, the strategy has no central organisations, where the necessary capacities and competencies are assigned. The strategy refers to the role and central role of Lechner Non-profit Ltd, which is a professional organisation that supports architectural and construction work and performs other professional information technology (IT) tasks. It created a Smart City Development Model – Methodological Guide TÉMOR, a City Evaluation and Monitoring System for Hungarian cities. However, this organisation has national jurisdiction and is directly linked with the Prime Minister's Office and therefore the Hungarian government. Another key organisation mentioned is related to the Digital Welfare Program 2.0 (the Hungarian government's digitalisation strategy), which is similarly linked to the central government. There is no specific local government organisation with the role of coordination, internal and external stakeholder management, project initiation, communication, etc. Nevertheless, the framework dedicates a central, leadership role to district local governments. There are also mentions of the pivotal role of knowledge generation and knowledge sharing (know-how) among members of communities, and institutional experience sharing. However, the strategy does not describe the mechanisms, sources or any particulars about such activities, for instance, organising cooperation events, stimulating the ecosystem and involving new stakeholders. The legislated environment and the regulations are also not sufficiently developed.

4. 3. Dichotomy 3: Double or Quadruple-Helix Model of Collaboration

Budapest's SC ecosystem for collaboration in development activities is analysed and visualised using the freeware Gephi software. The participating organisations are classified based on their affiliation in the quadruple-helix model. As Figure 4. shows, the most active organisations are within the 'Government' category, with 133 organisations (39.47%), while the second most active sphere is 'Industry', with only two fewer participants, 131 organisations (38.86%). The third one is 'Research', which comprises the higher-education institutions, with 41 organisations (12.17%). The fourth most active sphere is 'Civil Society', with 32 organisations (9.50%). This data suggests that Budapest uses a double-helix collaborative model, with the main

participation coming from government and industry, as an engine behind the city's strategy for SC development activities.

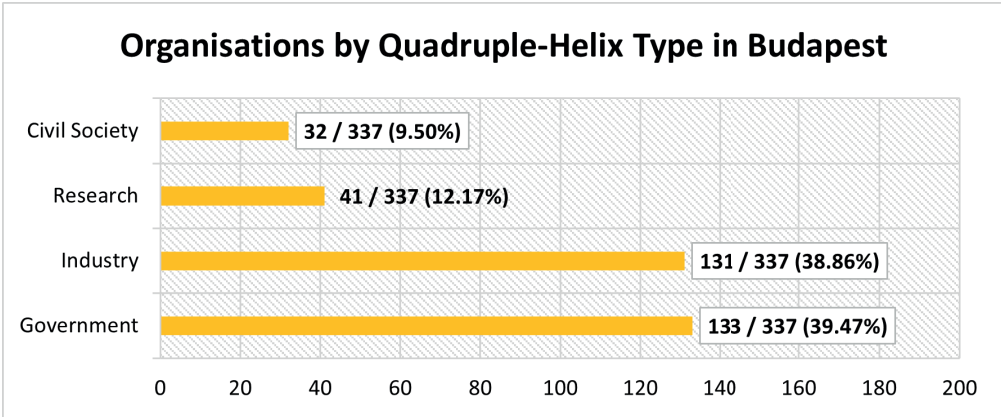

Figure 4. Organisations by quadruple-helix type in Budapest's SC development activities (own edition)

Figure 5. shows the network graph of the participating organisations in the ecosystem. The organisations mapped during the coding process are represented as nodes with a diameter that is directly proportional to the number of activities they participated in. Every edge connects the organisations that have collaborated in implementing at least one activity. Some organisations carried out activities on their own, and these cases are defined as self-loops in the software. The stronger the degree of collaboration between two organisations, the thicker the edge connecting them. The graph uses the Fruchterman Reingold layout, which is a classical one, developed in 1984 (used in Gephi software). For the sake of managing duplicate collaborations between two organisations, we used the simple 'sum' method for weighting. The edges are all 'undirected' ones. Colours are assigned according to the organisation types, as the legend on the right side illustrates.

The data suggests that Budapest's SC strategy holds onto the belief that SC developments can be efficiently realised within the narrow margin of traditional public–private relationships. Therefore, the collaboration's model is a double-helix structure. In this specific case, this means that the roles of the research organisations and universities are underappreciated; there are great opportunities for municipalities to engage with research actors on the topic of SC development activities. The potential for various instances of mutually beneficial cooperation is currently underexploited. The city's framework strategy declares that the road to smartness could be achieved through validation of 11 horizontal principles, which might be interpreted in any level of planning. The 'cooperative' principle describes that one of the most important indicators for measuring the smartness of Budapest is the degree of interconnectedness of its urban actors. With regards to the status of a central institution, the strategy states that the municipalities play a pivotal role in urban governance. It is the public sphere's (e.g., local governments') re-

sponsibility to build partnerships, be proactive and coordinate urban actors. A key practical challenge is the management of activities that affect several administrative boundaries.

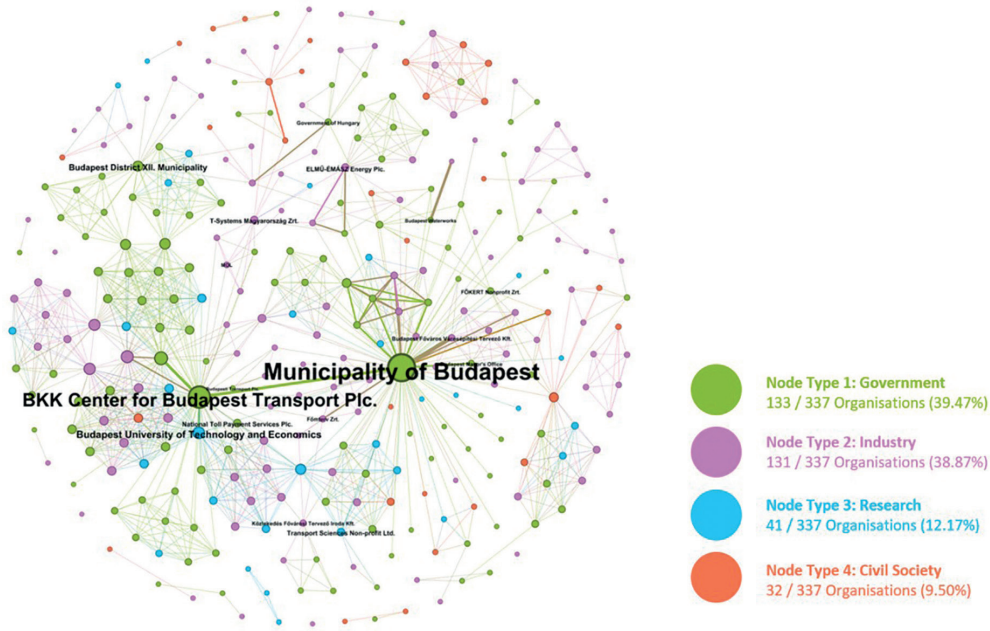

Figure 5. The SC development ecosystem of Budapest's strategy[1] (own edition)

Civil society, being the least represented organisation type, holds a rather high share, compared to the international examples of excellent cases. As an example, Budapest's local government and several local district governments introduced the institution of participatory budgeting, which had dedicated to it an important role in empowering citizens and incentivising their engagement with local urban development activities. However, this significant participation is to be interpreted not only as a consequence of the city's intention to strengthen the role of the civil society but as proof of the existence of notable grassroots activities.

4. 4. Dichotomy 4: Mono-dimensional or Integrated Intervention Logic

The available data in the analysis shows in Figure 6. that in the activity category of 'Services and Applications' Budapest's SC strategy has an integrated approach,

[1] In labelling the nodes of the visualisation, the official English names of the organisations were used. When they were not available, we used the original Hungarian names, to help with searching for them via search engines.

which means that SC development activities cover most urban domains, in an integrated manner. It focusses on various domains of applications, not solely on the implementation of environmentally friendly solutions. Most of the activities are connected to 'E-Government' (25/86, 29.07%), 'Mobility and Transport' (23/86, 26,74%), 'Health and Social Inclusion' (20/86, 23,26%), 'Education' (18/86, 20.93%) and 'Air' (17/86, 19.77%).

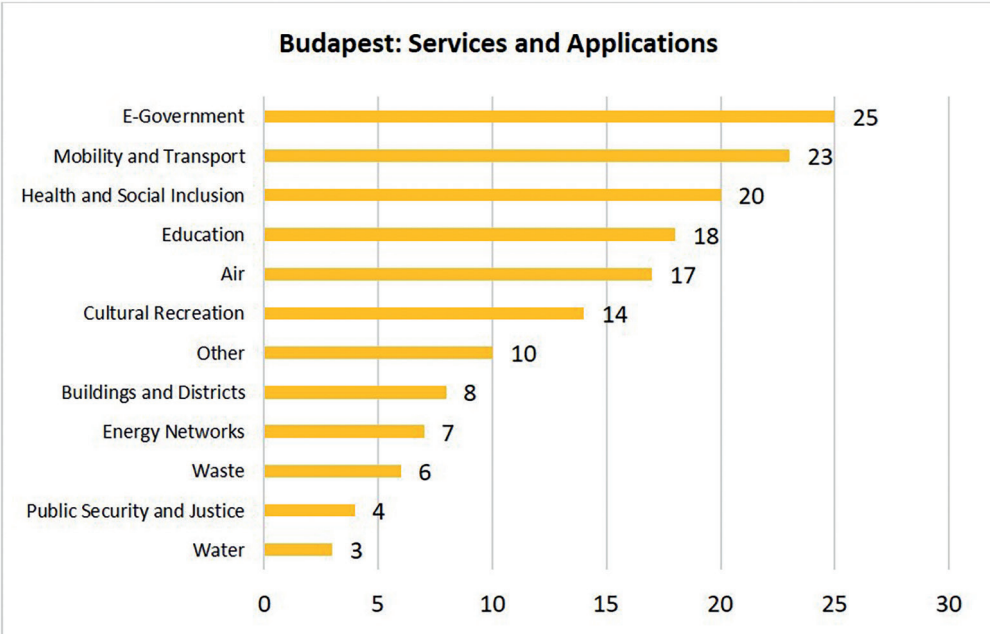

Figure 6. Budapest's SC development strategy: Activities by application domain (own edition)

Considering this data, the activity portfolio of the city fits well with the European understanding of SCs. This aligns with the current city management's policy focus of a climate strategy that aims to address the environmental sustainability issues that are pressuring the needs of the citizens. Among the services and applications, we find a variety of solutions – e.g., dynamic simulation models to optimise the operational and maintenance conditions of the city's waterworks, development of geographical information systems (GIS), e-mobility and micro-mobility solutions, open data utilisation portals to share public data assets with the general public and make use of them, community food sharing platforms, an online platform for the management of citizen reports about public space problems and sharing these items with the competent authorities, deployment of UV-B radiation sensors, providing citizens with real-time information on public transport, and a smart grid pilot project with the extensive engagement of households with smart metering solutions.

5. Discussion

For researchers and the general public, it would seem inappropriate, or at least irrelevant in contrast to other pressing issues, to discuss the current situation of SCs in Hungary or the Central Eastern European region. In many cases, the COVID-19 pandemic further marginalised the SC development activities of less-well-performing cities since some of them reported having challenges with operating even the very basic urban services such as public transportation. Nevertheless, we should remind ourselves that SCs are fundamentally not only all about fancy multi-million-dollar ICT projects. The concept emerged as a comprehensive framework to minimise the contemporary inefficiencies of urban systems, and maximise the quality of life for citizens. Amid the challenges of this new pandemic, the resilience of urban systems is being tested, and the need for smartness is becoming even more urgent than before.

As mentioned in the introduction, to embrace smartness, local governments are provided with directives, and financial incentives in the European Union, to plan smart activities. However, the unpreparedness of municipalities prevents them from accessing additional resources to develop urban services, and they decline even further in competitiveness. Lukács and Csomós (2020) reported that 15% of Hungarian cities with at least 10,000 inhabitants (140 cities) barely mention 'smartness' in their most important medium-term development programme. Are these results generalisable among Eastern European peers and the EU-15 countries, or is it only a Hungarian phenomenon? Cities need more support in tools and capacities to embed the concept into their mid-term plans.

Showing the characteristics of Budapest, the supposedly most advanced case in the country, we find the findings of the analysis to be more informative if we compare them with the case of Vienna, which is already reported in the international literature as an example of excellence. The comparison between the neighbouring countries is otherwise an often-used benchmark in public media. In contrast to Budapest, Vienna uses a holistic SC strategy approach, which means that technological development is aligned with human, social, cultural, economic and environmental factors. Furthermore, Vienna keeps a balance between top-down and bottom-up approaches, and the city government promotes a bottom-up development process. There is another sharp difference between the two cities. Regarding the models of cooperation, Budapest uses a double-helix approach, while Vienna uses a triple-helix one. The share of academia in Budapest's SC development activities is lower (12.17%) compared to its peer (19.61/%). Another key difference is the share of government organisations: 39.47% in the case of Budapest and 19.61% in the case of Vienna. The dominance of government organisations also means a lower share of industry organisations in Budapest (38.87%, in contrast to Vienna's 56.47%). Yet another interesting finding is that the share of the civil society is almost double in Budapest what it is in the other city. The composition of services and applications (C) is quite similar in the two cases. All this data suggests that, compared to an excellent case, Budapest's SC development activity uses different strategic principles in Dichotomies 1, 2 and 3. This suggests that the differences in performance might

be originating from the adaptation of these different principles, because the activity portfolio of the two cities is much alike in terms of the applied domain. The question arises, then, do cities like Budapest want to compare themselves to Vienna, if such fundamentally different approaches are present in the SC strategy? Or, rather, is the performance in smartness correlated with the type of strategic principles that cities adopt? This is a future direction for research.

Looking at the SC development activities of Budapest, we can state that the current European partnerships created benefits and challenges as well. One special example of failure originates from an international cooperation project, funded by the European Commission, called Cities4People (Cities4People 2021). Within the project, the local government and the BKK (competence centre for transport) worked together with several shared mobility solution companies, such as the Lime Lime Network B.V. which operates shared electric scooters. The service provider proved to be inadequate in terms of taxation, generated huge tension in urban mobility, and, parallelly, mainly served the needs of tourists, instead of the residents. The service has even been banned in various districts by the local governments.

Considering the very low engagement of the medium-term strategies of Hungarian cities with the SC concept, it is vital to provide easy-to-understand and standardised methodologies for researchers and practitioners. Besides the fundamental differences we found in the different strategic approaches of an excellent and less successful city, there are other key issues to be considered that are not at all technological or ICT related in their nature but, rather, involve strategic management, institutional challenges and planning problems, which are hindering the transition to smartness. A key difference is that the Urban Innovation Labs is missing. Every city is unique, and adaptation of novel technological solutions requires special skill and knowledge; otherwise, the 'boxed' products of the industry create tension and lead to further unsuccessful cases. The observation of excellence cases suggests that specialised competence centres are established, separately – e.g., Forum Virium Helsinki speeds up innovation in Helsinki, with pioneer work in the field of open data and SC development (Forum Virium Helsinki 2021). It uses the 'agile smart city development' concept (which originate from business and management science) to make Helsinki the most functional SC in the world. As another example, Urban Innovation Vienna was established as a competence centre for future urban issues in Vienna. It contributes the knowledge gained there to open discourse with local experts so that proactive and creative strategies can be drawn up for Vienna.

Therefore, this paper proposes, the key enabling factors to support the transition to smartness are not only technological ones but, in most cases, management, organisational and planning issues. If we accept that the local governments take the leading role in the transition, they must acquire the necessary organisational mechanisms to absorb and diffuse innovation. Unless a dedicated organisation with the necessary skills, expertise, competence and authority exists, the transition to smartness will be more likely to create problems than to solve existing urban challenges. As a new initiative, the Budapest Public Foundation for Enterprise Development's'Smart Budapest Idea Competition' has the potential to fill in such a gap in the future in Budapest.

As mentioned before, in the COVID-19 pandemic cities have been struggling to operate basic services; however, their resilience is being tested in these times, and the capacity of the city management is evaluated in terms of success or failure to recover quickly from difficulties, saving as many lives as possible. The capabilities of local governments to improve their efficiency and make more use of existing resources embodies smartness. Installation of fancy gadgets, and participation in low impact and unjustified, purely monetarily attractive international projects are not the way forward. However, the capability of making smart decisions is not a commodity that can be bought from industry; rather, the transition to an SC fundamentally carries within itself radical change, which might trigger resistance from those it affects.

Another key issue raised by this paper is connected to SC rankings and their indicator systems. It is important to measure the performance of cities in the framework of the SC concept. However, researchers should not be solely engaged with the development of such indicator systems unless they are directly linked with SC development activities, and those activities are clearly with the change of status range of certain performance areas (Bukovszki et al. 2019). In most cases, these rankings are indistinguishable from other competitiveness rankings. Attention needs to be focussed on what cities actually do within the SC context.

6. Conclusions and Future Research Directions

In this paper, we analysed the SC strategy of the Hungarian capital Budapest, which is considered to be an example of a less-well-performing city. Budapest's SC development strategy focusses on technological solutions. This means that the framework conditions for implementing the strategy – organisational background, authority, management, platforms for cooperation and so on – are rather neglected. The strategy uses a top-down approach; however, the two-tier administrative system and the key role of the central government make it a special case where the two approaches are mixed. In the case of the model for cooperation, Budapest adopts early on a double-helix model of collaboration: the most active organisations are government and industry ones, while the share of research is rather low. The presence of the civil society is relatively high compared to Vienna; however, in absolute terms, it is still low. Additionally, SC development activities cover most urban domains in an integrated manner; the city fits well with the European understanding of SCs, focussing on environmentally friendly solutions. The strategic principles used in Budapest's approach to SC transition are significantly different from a number of excellent cases such as Vienna, which might be the reason for the difference in performance. However, the correlation between a set of strategic principles used in cities and their performance is a future direction for research. Budapest lacks a specialised organisation, with the necessary skills, authority and capacities to engage with urban innovation, which on the other hand is present in various excellent cases. This might be another explanatory factor in the search for the different performance, which needs further investigation, too.

7. Limitation and Validity

It is important to note that the multiple-case-study selection process and the number of replications always determine the external validity of the study and the extent to which the results are generalisable. The extent of iteration is highly dependent on the confidence the researcher wants to achieve; 'the greater certainty lies with the larger number of cases' (Yin 2012, 58). Besides, analytical generalisation is also affected by two contextual conditions: the geographical distribution of the selected cases and their size. A more heterogeneous sample would determine a broader generalisation of the results. Budapest, as one case in the Central Eastern European region, is good for a pilot to assess the capability of the methodology that has proved to be working well for excellent cases. For further generalisation, other cases need to be tested in the region. Data availability also has a limitation on the research. Furthermore, the weight of each activity is not considered.

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