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EXTENDED FRAMEWORK FOR SMART CITY DEVELOPMENT: COMPLEMENTARY ELEMENTS OF A SUPPORTIVE ENVIRONMENT

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One of the most important focal points of the complex processes taking place in the world has been created by highly diverse urbanisation zones, which face the challenges of digital transition and smart development. At the same time, for historical, economic, cultural and geopolitical reasons, each settlement needs an approach that is tailored to its specific characteristics and needs. However, relatively little attention has been paid to developing the elements of a supportive environment, the process of planning and capacity-building needed to manage a smart city, and exploring concrete cases and best practices. This study examines initiatives supporting the conditions for smart city solutions within the framework of the Digital Success Programme launched in Hungary, with particular focus on the operation of smart city marketplace as an emerging info-communication platform for supporting the planning process.

Keywords:
business model, digital maturity, Digital Success Programme, knowledge sharing, smart city market place

1. INTRODUCTION

Today, around 55 per cent of the world's population, over 3.5 billion people, lives in cities and towns. This figure is expected to rise to 66 per cent by 2050, while the number and size of cities are also growing: while 83 cities had more than 1 million inhabitants in the 1950s, this number rose to 512 by 2016.[1] Obviously – for historical, economic, cultural and geopolitical reasons – each city needs an approach that is tailored to its specific characteristics and needs. It is for this reason that the concept of a 'smart city' has recently received special attention. Although there is no uniform definition, it is interpreted in the extremely rich international and ever-growing domestic literature as the development and local application of innovative solutions, the efficient and sustainable use of resources and cooperation with citizens.[2] So, the smart city phenomenon does not simply mean the introduction of digital technologies, but it also includes the development of a collaborative, digital ecosystem based on the active involvement of stakeholders and citizens. The leading role of large cities is obvious, but small and medium-sized towns have little or no resources, capacities and capabilities to address these challenges. Critical regional inequalities at both global and nation state levels can be further exacerbated by varying degrees of digital maturity which shows different levels influenced by the quality of governance, human capacities and the effectiveness of applied technology.

The level of maturity indicates the extent to which the institutional design and capacity-building of a given city are ready to develop and introduce smart solutions into its day-to-day operation.[3] However, a city does not work in an isolated way, so the environment and other – technological, human and institutional factors – have to be also taken into account. As a consequence, smart ecosystems show high complexity and interdependence as well as the requirement of co-creation and co-evolution. In order to translate these overarching goals into practical terms, the concept of a city business model can help city governments articulate how they will produce and deliver public value by integrating ICT into their current infrastructure and service provision. The smart city business model as a decision-making methodology and a planning tool reflects the status of key elements of digital maturity by identifying and mobilising human and financial resources as well as enabling collaboration through the use of ICT.[4] The business model logic also addresses how smart city solutions offer public value, to whom they offer it, and how they can operate

1 United Nations, 'World Urbanization Prospects: The 2014 Revision', 15 January 2021.

2 Albert Meijer and Manuel P R Bolívar, 'Governing the smart city: a review of the literature on smart urban governance', *International Review of Administrative Sciences* 82 (2016), 392–408; Viale G Pereira, Peter Prycek, Enzo Falco and Reinout Kleinhans, 'Smart Governance in the Context of Smart Cities: A Literature Review', *Information Polity* 23, no 2 (2018), 143–162.

3 Tetiana Fesenko and Galyna Fesenko, 'City-Governance: conceptualizing digital maturity model', *Socrates* 5, no 2 (2017), 106–122; Ayca Tarhan, Oktay Turetken and Hajo A Reijers, 'Business process maturity models: A systematic literature review', *Information and Software Technology* 75 (2016), 122–134.

4 Alexander Osterwalder and Yves Pigneur, *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challenges* (Hoboken, New Jersey: John Wiley and Sons, 2010).

it in a sustainable way. As cities differ from each other by having rather differing stages of smart development, there is no general theory and application for a smart city business model.

A growing body of literature on smart cities have addressed different aspects of digital maturity and business models so far.[5] However, relatively little attention has been paid to the conditions, elements and operations of the necessary supportive environment.

Based on this, the first argument of this article is that smart city developments can benefit from applying business model logic based on ecosystemic thinking, but projects and other smart initiatives have to be embedded into a broader framework of enabling a supportive environment. The establishment of a supportive environment is of key importance, including the necessary institutional, legal and human capacities. However, these main pillars form only a macro-level architecture of supportive environment which needs to be broken down into specific, smaller elements in order to avoid the 'one-size-fits-all' approach. These micro-elements have distinctive features depending on the context and requirements of a given smart city context. Thus, our second argument is that both the creation of a 'tailor-made' supportive environment and a proper business model are crucial for establishing an enabling framework which includes pilot projects, platforms for knowledge sharing, as well as smart city market places for bringing together stakeholders and successful smart solutions.

On the basis of exploring the enabling conditions of smart city developments this paper seeks to test them within the framework of the Digital Success Programme (DSP) in Hungary. Analysing the initial phase of the DSP, we assume that the potential of a supportive environment depends on the degree of complementarity among the identified three elements of it. From a viewpoint of smart city development, complementarity between pilot projects, knowledge sharing and market place can be treated as a key determinant in developing smart solutions and creating the conditions for scaling up successful smart solutions. The main aim of the paper is to outline the basis and directions for a forthcoming comprehensive research project. In this initial phase, the methods used include, in addition to an overview of the relevant literature, an analysis of DSP's regulatory environment, its strategic documents and pilot projects. As a consequence, the approach of the paper tends to be basically theoretical, but there are practical motivations behind the statements and remarks.

The paper is divided into three main parts. Following this introduction, we identify the key business models by examining their applicability to smart city solutions. In the next

[5] Krista Timeus, Jordi Vinaixa and Francesc Pardo-Bosch, 'Creating business models for smart cities: a practical framework', *Public Management Review* 22, no 5 (2020), 726–745; Oliver Gassmann, Karolin Frankenberger and Michaela Csík, *The Business Model Navigator: 55 Models that Will Revolutionise Your Business* (Harlow: Pearson, 2014); Nils Walravens, 'Qualitative indicators for smart city business models: The case of mobile service and applications', *Telecommunication Policy* 39, nos 3–4 (2015), 218–240.

part, we explore some specific elements of a supportive environment with special regard to the role of smart city market-place. In the third part, we address the practical applicability of the theoretical model thus developed in one of the pilot programmes, and the creation of a marketplace implemented under the DSP.

2. SMART CITY BUSINESS MODEL: MODEL, METHODOLOGY AND PLANNING TOOL

Over the past few years, business models (BM) have become integral for any organisation as an important concept in terms of development of new technology, social innovation and sustainability. Despite being a relatively new phenomenon, increasing attention has only recently been devoted to the emerging smart city business models both in academic literature as well as among local decision-makers and solution providers. Although there is still no common definition on smart city business model, within academic discourse the relationship between the adaptability of BMs to smart city development frameworks and related topics such as scaling up innovative solutions or projects is ongoing.[6] From a practical point of view, BM as a new unit of analysis helps to understand how firms 'do business', which are the preferred activities, not just how it is captured.[7]

BMs provide a tool for simulation and testing innovative ideas. The main factor we should focus on is the maturity of the smart city ecosystem which forms a value chain that enables stakeholders to develop different BMs which open up new demands and possibilities. From an innovation perspective, new markets are created due to new technologies and co-creation activities of the ecosystem actors. Accordingly, it is broadly accepted that BM is about how an organisation creates and captures value in terms of development of new technology, social innovation or sustainability in organisation.[8]

However, as the overall context and the level of digital maturity are different, there is no ready-made theory for smart city business models. A particular business model consists of the architecture or design of value creation delivery and capture mechanisms it puts in practice. Within this overarching framework, three stages of development can be identified for understanding the nature of business models. Closed business models relate

6 Timeus et al., 'Creating Business Models', 727; Raimundo Díaz-Díaz, Luis Muñoz and Daniel Pérez-González, 'The Business Model Evaluation Tool for Smart Cities: Application to SmartSantander Use Cases', *Energies* 10, no 3 (2017); Daniel van den Buuse, Willem van Winden and Wieke Schrama, 'Balancing Exploration and Exploitation in Sustainable Urban Innovation: An Ambidexterity Perspective toward Smart Cities', *Journal of Urban Technology* 28, nos 1–2 (2020).

7 Christoph Zott, Raphael Amit and Lorenzo Massa, 'The Business Model: Recent Developments and Future Research', *Journal of Management* 37, no 4 (2011), 1020.

8 Marko Peric, Jelena Durkin and Vanja Vitezic, 'The Constructs of a Business Model Redefined: A Half-Century Journey', *Sage Open* 7, no 3 (2017).

to the existing value chains, mixed business models are very close to the network approach, while open business model follows the principles of sharing economy.[9]

Drawing on insights from relevant academic literature, we suggest adopting a combination of the basic patterns of BMs. The starting point is the four-dimension business model based on the 'Magic Triangle', which aims to obtain a deeper understanding of the customer segments of values proposition, value chain and profit mechanism.[10] The four dimensions identify what is offered to potential customers, how the offerings are produced and why the business model is profitable (these aspects form the peaks of the triangle) as well as who the customers are (this is the focal point inside the triangle). The components are also utilised to address the potential impact of the external environment. It highlights the role both of the enabling and hindering factors which make it necessary to put the usefulness of business models in a wider context.

As a first step, we suggest to broaden the scope of the above mentioned four-dimension model that Gassmann et al. proposed by filling it with the elements of the 'Business Model Canvas' (BMC). The canvas is composed of nine different building blocks, namely customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships and cost structure.[11] It adds a practical framework to the four-dimension model by introducing the core value for development, identifying the target groups of them, listing key activities, exploring potential partners and financial opportunities. As a result, an adaptive business model framework could be established by combining the dimensions (what, how, who, why) of the general BM with the nine components of the BMC.

As a second step, the combined business model framework should be extended by the elements of an enabling supportive environment which are based on interrelated 'twin pillars'. We argue that each of these pillars match the dimensions of the 'Magic Triangle' and its components (See Table 1).

Nonetheless, the aim of this paper is not restricted to introduce the above proposed EBM in detail. On the contrary, we focus on some of the components of a supportive environment. Before analysing them, it has to be premised that there are many factors that can be part of any emerging supportive environment in a given context. According to van Winden and van den Buuse, the following drivers can be identified: regulatory and policy frameworks, knowledge transfer mechanisms and incentives, prospects for economies of scale, the management of ambidexterity, data exchange and system interoperability and standards to measure return of investment.[12] The first three components have been inserted

[9] Sari Perätalo and Petri Ahokangas, 'Toward Smart City Business Models', *Journal of Business Models* 6, no 2 (2018), 67.

[10] Oliver Gassmann, Karolin Frankenberger and Michaela Csík, 'The St. Gallen Business Model Navigator', *Working Paper, University of St. Gallen,* 2013, 2.

[11] Osterwalder and Pigneur, *Business Model.*

[12] Willem van Winden and Daniel van den Buuse, 'Smart City Pilot Projects: Exploring the Dimensions and Conditions of Scaling Up', *Journal of Urban Technology* 24, no 4 (2017), 5. 55.

into the EBM, while economies of scale have been interpreted as an enabling condition of the market place. In addition, we argue that interoperability and standards to measure return of investment are integral parts of pilot projects and their scaling up process indeed. The management of ambidexterity (being exploration and exploitation) are also presumed to have significance in the context of upscaling smart solutions from pilot projects, but at the same time inherently embedded in the establishment and operation of smart city market places. In the next chapter we seek to introduce the role, functions and elements of a supportive environment following an integrative approach to smart city development.

Table 1 • *The extended business model (EBM) (Source: Compiled by the author based on Gassmann et al., 'The St. Gallen Business Model Navigator' and Osterwalder and Pigneur, Business Model)*

	Value target	**Value proposition**	**Value creation**	**Value capture**
Design parameters	Customers	Key activities	Key resources	Budget costs
	Customer relationship	Key partnership	Distribution channels	Revenue streams
Supportive environment parameters	Regulatory and legal framework	Marketplace	Knowledge creation	Pilot projects
	Policy framework	Economies of scale	Knowledge transition mechanisms	Upscaling

3. PREREQUISITES FOR SMART SOLUTIONS: DEVELOPING A SUPPORTIVE ENVIRONMENT

The starting point for a supportive environment is the need to create contact points between the needs and intentions of technology ('smart solutions') and key actors (urban governance, citizens and businesses). It is basically the responsibility of the city management to ensure that all stakeholders are addressed, and that messages to be sent to target groups are properly formulated and delivered. The prerequisite and essential element of this is the creation of an enabling, dynamic supportive culture with stable regulatory, legal and policy frameworks that open up the possibility for everyone, from entrepreneurs through the working age population to the elderly and young people in order to develop differentiated digital skills and to have access to advanced technological tools. As a consequence, a smart city is based on the network of actors involved and the cooperation among stakeholders based on mutual benefits via info-communication platforms, which are an essential element of moving forward. The platforms rely on the basic infrastructure available, but constantly upgrades it with state-of-the-art technology to match demand and supply, such as the quick and easy collection and delivery of publicly available data from the area of tourism to urban transport and mobility.

Info-communication platforms often perform a role of knowledge platforms which enable the necessary knowledge sharing mechanisms between stakeholders. It consists of both the various forms of formal trainings providing explicit knowledge and the transfer of tacit knowledge which is key in the replication process. In practical terms, efforts to

be made in order to replicate any smart city solution – be it a complex business model or a concrete project – strongly interrelate with the forms and channels of knowledge sharing. The replication process includes two phases, namely exploration (acquiring knowledge) and exploitation (putting this knowledge to use).[13] Addressing them simultaneously, the two phases are called 'ambidexterity', which expresses the ability of firms and cities to pursue exploration and exploitation at the same time as two distinct modes of learning and activities.

Ambidexterity is of key importance in practice to manage the transition from the pilot or testing (experimentation) phase of a project to the upscaling (exploitation) phase. City governments often face the challenge of balancing between the two elements of organisational ambidexterity as the two phases need different competencies and capacities.[14] In order to tackle the problem, it is useful to divide the organisational ambidexterity into structural and contextual approaches.[15] The former suggests that an organisation should structurally separate organisational units dealing with exploration and exploitation in avoiding inherent tensions between them. The latter create a context that allows employees to simultaneously explore and exploit within the same unit. Previous experiences suggest that the focus on the two modes of ambidexterity strongly depends on the conditional factors (economic, regulatory and technological) which have an impact on the environment of smart developments. We suggest that city governments may have a choice to combine both in the form of hybrid ambidexterity. In practice, the establishment of a resilient management structure should be influenced by the relevant BMs. Accordingly, tailor-made facilitating programmes and knowledge transfer mechanisms are required because many small cities and towns lack the competencies and financial incentives to create the necessary institutional and administrative capacities. In such cases, knowledge transfer should be provided in the form of training programmes and advocacy networks initiated by national and regional governments or the EU, as a big founder of smart city projects.

However, the proper management of ambidexterity is a necessary but not sufficient condition of scaling up projects which have been tested and validated as successful. Many successful pilots are not continued, so their impact remains very limited. Decision-makers are often unwilling to continue successful pilots because of the potential risks and unforeseen costs that may arise in the long run – triggering negative feedbacks from the citizens, or in a case when regulatory, legal and policy frameworks are not supportive. Scaling up also becomes difficult if the innovation team is too far removed from the day-to-day operation, causing problems between city managers and operational departments.

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13 Sidney Winter and Gabriel Szulanski, 'Replication as Strategy', *Organization Science* 12, no 6 (2001), 730–743; James G March, 'Exploration and Exploitation in Organizational Learning', *Organization Science* 2, no 1 (1991), 71–87.

14 Oded Berger-Tal, Jonathan Nathan, Ehud Meron and David Saltz, 'Exploration-Exploitation Dilemma: A Multidisciplinary Framework', *Plos One* 9, no 4 (2014).

15 Jan Ossenbrink, Joern Hoppmann and Volker H Hoffmann, 'Hybrid Ambidexterity: How the environment shapes incumbents' use of structural and contextual approaches', *Organization Science* 30, no 6 (2019), 1127; Susan A Hill and Julien Birkinshaw, 'Ambidexterity and Survival in Corporate Venture Units', *Journal of Management* 40, no 7 (2014), 1904.

Sometimes collaborating partners have very different interests and capacities in upscaling and implementation. Finally, funders and financers are often reluctant to finance smart city developments, finding them too risky by introducing new, unknown and expensive technologies and often where revenue streams are unclear.[16]

All in all, behind the key pillars of a supportive environment, a couple of hindering factors exist. One of the main problems is that despite many projects and pilots, smart solutions are often isolated and customised. Fragmented initiatives lack business models and financing opportunities and need – among others – overarching knowledge sharing, improved communication of project results to the public and interested stakeholders as well as 'tailor-made' capacity building. In order to avoid or alleviate such bottlenecks, the emerging smart city marketplaces offer practical solutions.

The general function of the marketplace is to facilitate integrated planning and management. It is a long-lasting process which includes enabling actions from problem identification and definition, through development and analysis of options, consultation and engagement to evaluation and review. In practice, the marketplace is an open, info-communication platform that connects government actors and investors with vendors of new technologies. The platform will help cities find comparable information on products, validated results of previous investments and peer reviews. As for vendors, they can offer their products and related smart solutions, bankable smart city proposals as well as showcase their previously successful innovations, focusing on types of towns and technologies. It helps to mobilise capital from different sources to finance projects at an early stage. The key function of the marketplace is therefore to facilitate, as well as simplify and accelerate the process of matching supply and demand, and to confirm and validate new technologies and the conditions for their application. An important element of the viability and sustainability of the marketplace is the spill-over effect, as a result of which new cities, data, information and feedback are constantly added.

The most obvious model is the Smart Cities Marketplace (SCM), lead and supported by the European Commission and bringing together cities, industries, SMEs, investors, banks, researchers and other smart city actors.[17] The SCM aims also at being a platform for cities, industries, SMEs, investors, researchers and other interested organisations who want to demonstrated and deploy smart city solutions in the sectors of energy, transport and ICT.[18] By acting as an interactive forum for discussion, SCM provides meeting opportunities (virtual and matchmaking sessions), databases of business models and potential partners. As the SCM does not have its own budget and it cannot itself fund or finance specific

[16] Van Winden and van den Buuse, 'Smart City Pilot Projects', 52.

[17] For details visit https://eu-smartcities.eu

[18] The EU's Smart Cities and Communities Innovation Partnership (EIP SCC) was developed to promote the rollout of smart city solutions in the EU. Launched in July 2012, it was set up by three Directorates of the European Commission (DG MOVE, DG ENERGY, DG CONNECT), in partnership with many cities and other stakeholders in Europe. From 1 October 2020, the Marketplace of the European Innovation Partnership on Smart Cities and Communities is called Smart Cities Marketplace.

projects, all participants take part in their own capacity and on a voluntary basis. The current structure of the SCM consists of 6 Action Clusters (as an assembly of partners committing to work on specific issues related to smart cities) and 19 Initiatives (pool the work of the various partners around a particular objective).[19]

All in all, the SCM serves as an information and communication hub, which is used to communicate the latest news, events, documents, partnerships and development results. The platform makes it possible to find partners, investors and funding opportunities with appropriate expertise and experience in joint development projects, provides insight into completed or ongoing projects, evaluates the obstacles and opportunities arising during implementation and benefits from inspirational results.

Marketplace-type planning instruments are already available in several countries, allowing for flexible adaptation to local needs and opportunities and taking into account the particular level and spatial distribution of digital maturity. In the next section, we will present a marketplace toolkit within the Digital Success Programme (DSP) launched by the Hungarian Government in 2017 that focuses on the needs and opportunities of small and medium-sized towns.

4. INFO-COMMUNICATION PLATFORM FOR MARKET DIALOGUE: AN EMERGING HUB FOR SMALL AND MEDIUM-SIZED TOWNS IN HUNGARY[20]

In 2015, the Hungarian Government began a comprehensive digital development strategy with DSP 1.0. In the first phase, measures were introduced into the public administration system (for example free Wi-Fi in town centres and creation of a public data cadastre).[21] The second phase, which began in 2017 (DSP 2.0), defined the areas of development by chapter and coordinated implementation within the governmental organisation.[22] Currently, the implementation of the strategy has been managed by the Ministry of Innovation and Technology – with interdepartmental competence.[23] 'DSP Points' (1,500 in place at the end of 2019) assist smart city projects throughout the country, though mainly in smaller settlements. They are designed to provide scope for digital literacy development

[19] To date, SCM has 982 active members, 16 investor network members, 124 bankable project proposals have been received, 81 projects have been finished. For details visit https://eu-smartcities.eu

[20] In this sub-chapter, I heavily relied on one of my previous papers: Tamás Kaiser, 'Smart City Governance from below: How Hungarian Towns Respond to the Need for Institutional Design and Digital Capacity Building', in *CEE e|Dem and e|Gov Days 2020 Social Networks and Social Media. Proceedings of the Central and Eastern European e|Dem and e|Gov Days 2020, Budapest,* ed. by Thomas Hemker, Robert Müller-Török, Alexander Posser, Dona Scola, Tamás Szádeczky, Nicolae Urs (Austrian Computer Society, 2020), 467–477.

[21] See Government Decree 2012/2015 (XII. 19.) DWP 1.0.

[22] See Government Decree 1456/2017 (VII. 19.) DWP 2.0.

[23] See Government Decree 94/2018 (V. 22.).

and electronic administration. These specific tasks are aided by a 100-person mentoring network.

The four pillars of the DSP are digital infrastructure, digital competencies, the digital state and the creation of a digital economy. The pillars are supported by horizontal themes which fall into three interrelated subfields. The three subfields are as follows: professional training in digital regional development, smart city pilot programmes and a smart city marketplace. According to Article 3 of Government Decree 56/2017 (III. 20.), cited above, a 'smart city means a city (or town) that develops and implements its integrated urban development strategy on the basis of a smart city methodology, a town or group of towns that develops its natural and built environment, its digital infrastructure and the quality and economic efficiency of its services using modern and innovative information technologies in a sustainable manner, with the increased involvement of the population'. The horizontal nature of smart city development is also reflected in the fact that its implementation is supported by the main pillars. The digital state in and of itself entails the digital renovation of public administration, including the support of the online presence of local governments and the creation of a level playing field for the Hungarian digital industry. The digital competencies pillar encompasses Hungary's digital education strategy and digital competency development. Among other things, the digital economy pillar contains Hungary's digital start-up strategy.

In order to reach the scale and scope of the emerging supportive environment, Government Decree 252/2018 (XII. 17.) on the Establishment and Operation of Smart City Central Platform Services, appointed the Lechner Knowledge Centre as the provider of the centralised public service of the Geographic Information System Platform for Settlements and designated the city of Monor as the local government that is currently connected to the smart city central platform service; subsequently, other cities will follow suit. The essence of the platform is that a central 'standard package' will be developed, open for other settlements to join, where they will need to deal only with those developments that serve specific local needs. In addition, the Lechner Knowledge Centre develops Smart City Methodologies. Based on the requirements of Hungarian cities and the guidance of the European Union, the methodologies contain proposals that may ensure the systemic implementation of certain smart city development models. The Inventory of the Smart City Methodologies already contains 234 projects in Hungary, and 900 in the world in total. In Hungary, it monitors projects implementing smart city developments in roughly 66 settlements.[24]

From 2017 onwards, the marketplace element of the smart city component of the DSP strategy has been constantly evolving as a complex software solution – in a form of an info-communication platform – for developers and suppliers to present their smart city products and buyers to learn about the detailed features of the products. The platform established contains legally, technically and economically validated and quality-assured suppliers and products and makes them available primarily to local governments, state

[24] See in detail 'Smart City Methodologies' http://okosvaros.lechnerkozpont.hu/hu

and municipal institutions and business associations. One of the most important aspects of the marketplace is that the services provide financing options and return calculations, which greatly facilitate the work of municipal decision-makers considering smart urban developments. The goal is to make it easier for customers involved in the development (city leaders, company representatives) to find the right tools to meet their needs.

The process of entering the platform begins after registration with the creation of a profile. This is important in order for the platform to categorise settlements based on size and economic, social, geographical characteristics and issue maps. Registration and access to information is free for municipalities, while businesses have to pay a minimal fee. They will then have access to the marketplace, including the product catalogue. The most important element of the latter is a datasheet of available products, which contains legal and warranty information, technical and compatibility data, investment costs and social impact figures. A similar process takes place on the vendor side of the marketplace. After registration, candidates enter into a contract with the marketplace, followed by legal, technical and economic validation, then a social return calculation. This process results in a product data sheet which is made available to customers. The marketplace offers other services in the existing product catalogue, including trademarks, the registration of consultants, newsletters and blog information on financing options, and, in this context, runs a return calculator.[25]

The functioning of the marketplace is closely linked to the other two elements of the horizontal theme of the DSP smart city. Specialist training in digital spatial development, the first comprehensive smart graduate training course in Hungary, is provided by the Edutus University, the University of Public Service and the Moholy-Nagy University of Art and Design. The target group is made up of professionals who have the appropriate knowledge and influence concerning the decision-making processes of their cities or towns. The aim is to train professionals who have thorough knowledge of the relationship between digitisation and towns and cities and smart city considerations and practices. Graduates will be aware of smart city solutions and will have enough knowledge to launch and implement a related project.

The second component, the first phase of pilot projects at nine sites, is undergoing feasibility studies.[26] The methodology applied during the studies can serve as an example for municipal (smart city) developments: it plans data-based developments, takes into account the size and needs of the user community, the aspects of financing and sustainability, and the characteristics of the settlement. It is significant that the methodology also utilises the results of other digital strategies (for example education strategy, agricultural strategy, health strategy, Carpathian Basin digital ecosystem) applied to the situation assessment

[25] 'Civitas Sapiens 2020, Smart City Conference, Hungary' (Budapest: Digitális Jólét Nonprofit Kft., 2020), 9–10.

[26] The pilot project locations: three districts in Budapest (the 8th, 11th and 17th), Tata and Tata County districts, Balatonfüred and Balatonfüred County districts, Tamás, Nyíradony and Nyíradony County districts, and two non-urban development areas: Tokaj, the mountain range, which covers the area of the Tokaj wine region, and the heart of Pannonia, which covers part of Lake Velence and the Vértes Mountains.

of smaller settlements. Finally, the studies present the cost structure (investment and maintenance) of the proposed developments based on the identified capabilities and opportunities, as well as the calculation of the return on the improvements.

The tools of this methodology are opinion polls and secondary data collection (examination of the administrative, economic, IT and social characteristics of the settlement/region based on the data of the Hungarian Central Statistical Office), the enumeration of existing developments, their analysis, the processing of accepted site development plans, and interviews with decision makers, the civil sector and institutional leaders, that is, all stakeholders in the area. The main purpose of surveys is to assess the digital status of a given area. The main elements of these surveys is to explore socio-demographic and statistical issues, use of internet and social media, use of e-government (customer gateway, e-administration), commerce and use of electronic payment methods and smart tools.[27]

It is too early to assess the effectiveness of the DSP marketplace. Nevertheless, by the end of 2020, the DSP Smart City Marketplace company list consisted of 19 registered companies which included a short description of each of them, as well as detailed information on their offered products. Taking the profiles and intended goals of the products, we have clustered them into different groups with an aim of specifying areas for development. However, in this early stage, neither the boundary conditions nor the expected outputs have been specified. The second aim was to match the identified clusters to the EU SCM Action Clusters. As the work of each Action Cluster is collected under thematic initiatives, it can be treated as an appropriate point of reference for marketplaces organised at national or local levels (see Table 2).

Table 2 • *Matching DSP Initiatives to EU Action Clusters (Source: Compiled by the author based on the EU Smart Cities Marketplace Charter and DSP Marketplace Company List 2021.)*

	Action Cluster	**Registered Products Cluster**	
EU SCM	*Sustainable Urban Mobility*	Geospatial Mapping System	**DSP SCM**
		Safe and Sustainable Transport	
	Sustainable Districts and Built Environment	Environmental Protection and Monitoring	
		Sustainable Installations	
		Energy Management and Monitoring	
		Smart Solar Power Energy Production	
	Integrated Planning Policy and Regulations	Smart Dashboard	
		Data Warehouse	
	Integrated Infrastructures and Processes	Integrated Communication System	
		Knowledge and Info Sharing	
	Business Model and Finance		
	Citizen Focus	Social Care System	
		Smart Recreation	

[27] 'Civitas Sapiens 2020', 11.

As a result of a comparison, the products cluster of DSP SCM proved to be fundamentally compatible with the EU Action Clusters. However, so far DSP initiatives do not intend to make their own or common business models. Also, detailed financial proposals are absent. In addition, relatively few initiatives focus on developing projects based on wide-ranging citizen engagement. As business models and various forms of citizen engagement have key importance from the viewpoint of digital maturity, these components need to be developed. At the same time, it can be seen that in the realisation of smart city development, the goals and tools of a supportive environment based on common logic, and a multi-level, layered institutional structure are beginning to emerge.

5. CONCLUSIONS

Currently, all forms of settlement experience the need to respond to rapid changes by adaptive and innovative solutions which are an integral part of long-term strategies. However, any developments must take into account the geographical location, level of development, human resources, and basically the size of the given settlement, as in many respects the problems of small and medium-sized towns are different from those of developed, large cities.

The success of the responses depends to a great extent on the level of their digital maturity which expresses both the introduction of digital technologies, smart solutions, as well as the creation of a collaborative, digital ecosystem based on the active involvement of local authorities, enablers, technical solution providers, knowledge institutes, banks, financial institutions, co-initiators and so on. Accordingly, the level of maturity indicates the progress to be made in the field of institutional and administrative capacity-building. In other words, becoming a smart city could be understood as an inevitable process. Here, a lack of financial resources, difficulties in public procurement, and restrictions on the use of ICT tools are serious obstacles. In order to tackle the barriers and bottlenecks, there is a strong need for ecosystemic thinking in general, and for a 'tailor-made' supportive environment and adaptive business models in particular. An extended business model which includes design parameters and complementary elements of a supporting environment is crucial in order to become a real smart city.

However, the introduction of ICT tools, platforms, various channels of knowledge sharing, creating and operating a smart city marketplace, initiating knowledge transaction platforms are necessary but not sufficient conditions for building a smart city. The marketplace as an open info-communication platform is not enough to build a smart city. The lack of horizontal coordination, complementarity, collaboration, or acceptance between line ministries, departments, public agencies, local authorities, local businesses, solution providers and universities proved to be a well-known issue in organisations and projects, in addition a common problem in the implementation of smart city projects. In this paper we argued that instead of operating 'siloed' organisational structures and projects, holistically designed programmes with interrelated and complementary elements

are needed for triggering synergies. In practical terms, an extended business model based on a supportive environment fulfils the role of an enabling framework for integrated planning and management of smart city developments.

The experiences of the initial phase of the implementation of the DSP programme in Hungary clearly indicates that there is a strong need to create a supportive environment which requires the full involvement and cooperation of the municipal government and the citizens, as well as the development of effective management structures, business models, platforms and a sustainable marketplace. Having examined the initial phase of the DSP, it is obvious that the basic pillars of future developments are in place. However, in entering into the second, implementation or 'take-off' phase of the programme, many steps are still needed for mapping and mobilising the necessary resources, mostly in the field of financial opportunities and citizen engagement. These factors form the basis of an integrative framework capable of exploring the processes that determine the future of a smart city. Within this overall framework, our future research must pay particular attention to the different dimensions of smart city governance, where city leadership and partnership will play an important role not only in producing smart city content, but also in understanding and managing the smart city operation.

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