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SMART CITY DEVELOPMENT MODELL METHODOLOGICAL BASIS

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INTRODUCTION

Around the globe, new technologies are gaining increasing significance in contemporary urban development. Whether it be in the management of administration and public utilities data, in local governments, in the business sector or social networks, innovations are generated in a variety of fields, independently of levels of urban development. They promise more efficient forms of operation, economical management, personal and open communication, as well as improved standards of living.

In and of themselves, however, new technological assets and the growing amount of available data cannot solve issues concerning the development and maintenance of cities. Creating economic and ecological balance, establishing an appealing urban environment with high standards of living, and achieving the active participation of citizens in the life of the city are all tasks that require a strategic approach and the lasting cooperation of various actors.

The spread of digital technologies could be a major factor in reaching appropriate solutions. Perceptible changes in areas such as tourism, business and political decision-making, and the personal environment present great economic opportunities in the collaboration of active urban operators and individual settlements.

The aim of this document is to provide an overview of urban development plans, methods and solutions that align with the concept of the 'smart city', thus assisting local governments, businesses, communities and other stakeholders in devising smart city strategies and project plans for Hungarian settlements.

The following chapters first describe the factors leading to and providing the background for contemporary smart city programmes. Afterwards, the concept, aims and assets of a smart city are defined, and the thematic organizing principles and methods applied to smart city developments are laid out. This material provides an overview of the pertinent European and Hungarian regulatory environment, including the organizations and programmes concerned. Last but not least, an introduction is presented to the Settlement Evaluation and Monitoring System and the Smart City Development Model devised by Lechner Knowledge Centre.

1. BACKGROUND PROCESSES – WHAT SHAPES TODAY'S CITIES?

Urbanisation

At the beginning of the 21st century, the number of people living in cities exceeded 50% of the total human population. By the end of the century, this figure is predicted to reach 70-75%. This process not only points towards the growing significance of cities, but also the responsibilities and challenges urbanisation entails worldwide.[1]

At present, the fastest-paced urban growth in the world can be observed in Southeast Asia and Africa – cities with tens of millions of inhabitants offer outstanding job opportunities, but at the same time, they can barely keep up with the housing, environmental and infrastructural needs generated by the population influx. The main tasks of these cities include the establishment and operation of basic public utilities, traffic management, and the mapping and reconstruction of informal neighbourhoods.

In Europe, just like in the rest of the developed world, more and more people live in large cities, but the role of small and medium-sized towns remains significant as well. 73% of citizens in the European Union live in cities, which provide 85% of the region's economic performance. Rather than the construction and operation of basic infrastructures, however, what raises problems here are *city regions' options for cooperation*, *the changing needs of an aging population*, and *the altering developmental funding structures* due to dwindling state resources. In Hungary, as well as in the rest of Europe, the sustainable management and re-cultivation of depopulated rural areas pose a particular challenge.

Ecology and energy sources

For developing countries, the appeal of an accelerating urbanisation process lies chiefly in industrial growth, while for developed countries, it is related to the knowledge economy and services. Both trends come with significant ecological consequences, however. Besides air, noise and light pollution, the environmental burdens of cities manifest themselves in solid waste and sewage, as well as in the hot and dry climatic effects of the built environment. Approximately half of the pollution causing climate change, and half of the heat emissions conducive to microclimatic variations, can be attributed to buildings.

The ecological footprint and resource needs of a primate city often exceeds even that of the rest of the country. It is a fundamental and urgent task to make the

[1] Burdett and Sudjic (2007)

operation of cities and built environments measurable and optimizable, be it transport systems, utilised resources, or special urban climates.

Therefore, the Smart Cities and Communities framework of the European Union's economic development strategy was established primarily in order to reach energy-related and ecological goals. The programme – based on sustainable resource management, the prioritisation of renewable energy, and the radical reduction of pollutant emissions – requires widespread collaborations reaching far beyond individual sectors.

Economic globalisation and the knowledge economy

Cities are the main actors of economic globalisation. The effective functioning of ever more closely interconnected commercial, industrial and financial operators requires complex services, supplies and professionals predominantly available in cities.[2] Local traditions also play an important role here, since they provide the foundations for the competences and ecosystems upon which contemporary companies thrive.

For this precise reason, globalisation may result in the strengthening of local resources, given that settlements get involved with a conscious strategy. The global economy has expanded not only horizontally, connecting more actors and cities than ever, but also vertically, by creating production chains and fostering collaborations in which local operators play a significant role.

Apart from services and the knowledge economy, what constitutes the basis of global competitiveness is innovation. Along with energy and health, a defining area of innovation for the forthcoming centuries is the development of smart systems, which typically work in urban environments. The incubator role of cities may thus result in economic advantages and a dynamically increasing quality of life, provided that they maintain collaborations beneficial to all parties. In order for *regional innovation* to be successful, the four main stakeholders – the government, businesses, academia and civil society actors; or urban residents more generally – should cooperate on equal grounds.[3]

[2] Sassen's (1991) late model of imperfect globalisation highlights the significance of traditional yet convertible local expertise in global competitiveness, e.g. commercial developments in New York, and industry in Chicago.

[3] The triple helix model of innovations in the knowledge economy (government – industry – academy, Etzkowitz and Leydesdorff (1995)) is expanded into a quadruple helix model in the case of cities (Carayannis and Campbell (2009)).

The advance of digital technologies

Since the 1990s, one of the major means and medium of globalisation have been the rapidly evolving Internet and mobile data communication technologies. This technological revolution reforms our everyday environment more and more, including communication, the operation and availability of services, data for decision-makers, social life, and the functioning of the private sector.

Big data companies apply these technologies for developing decision support systems that are capable of analysing enormous amounts of data, under the concept of the 'smart city'.

Other than public utility systems and traffic control, settlement-level data management has expanded to include various other, continuously growing areas (communication, services, public security, economic data, etc.). Furthermore, real-time data are available not only about the comprehensive work of systems, but also about nearly every endpoint. The complex and voluminous 'big data' thus generated are managed dynamically in extensive databases, which allow for the holistic and simultaneous optimisation of many different processes – for instance, the operation of energy systems depending on weather conditions, and traffic congestion.

Local governments are not the only actors interested in developing services based on such systems. Making data public in a careful and considered fashion may also facilitate development capacities that could significantly affect local innovations, society and the economy. This realisation, and the need for data to be interoperable and transparent, led to the birth of 'open data' opportunities, forming the basis of innovation labs, business and education programmes, and civil initiatives.

Data are no longer collected via central sources only, but increasingly from end users and through various other channels. Data on public utilities and traffic management are provided not only through central measuring devices, but also via end-point smart measurements, or even users' own smart devices. Recently, a number of smart systems were introduced at a European scale and collect environmental data for open databases with the help of free-access, inexpensive and easy-to-install sensors.

Systems of local sensors could become an important pillar for the future of public utilities and decentralized management models. Besides, increasingly refined digital spatial analysis systems are capable of collecting and managing spatial data ranging from the mechanical performance and energy use of buildings (Building Information Modelling or BIM), to the urban and regional level (Geographical Information Systems or GIS), which can be used to support applications, services and physical devices. BIM systems can measure and manage individual buildings or building complexes from planning to operation and follow-up. GIS, by contrast,

works at a larger geographical scale and can be used for various purposes from orientation to the spatial display of real-time data.

This transforms the operation of urban services, since maintenance, and even communication with users, may now occur at a distance (Software as a Service or SAAS).

With the evolution of information and communication technologies, interactions between humans and devices, as well as between devices themselves, are gaining significant traction alongside traditional inter-human relations. The physical internet – Internet of Things (IoT) – is the next major field of technological research and development,[4] including a system of services and devices in which individual environmental elements and their users are in a constantly coordinated interaction via data and service clouds (e.g. self-driving cars, buildings' automation systems).

The changing means of urban development

Partly as a result of the above-mentioned processes, the methods and solutions of urban development and planning are changing worldwide. Factors such as dwindling state resources, rapidly shifting economic trends, and market and community actors' ever-increasing participation in development and maintenance have contributed to a shift from comprehensive and fixed-framework settlement-level plans, predominant in the past few decades, towards process management and flexible tools that can be started at a small scale.

The participation of communities has been an evolving element of development programmes for decades. Going far beyond initial solutions such as promotion, education and opinion polls, there is now an increasing demand for the continuous and thorough involvement of stakeholders, from the initial planning phase to post-implementation maintenance. Successfully constructed participation programmes save significant amounts of resources, create long-term commitments, and improve the quality of locally available services.

The digitalization of planning environments and new development tools have had a major impact on planning practices, facilitating an action-oriented, multi-actor, and strategic approach.
Models known from ICT innovation such as validation, beta testing, and the parallels of platform models are easily identifiable in urban development – particularly in temporary interventions, in 1:1 scale modelling, in services developed together with communities, and in many other solutions.

[4] Current business predictions (Frost & Sullivan (2013)) estimate the global market of smart city and IoT products and applications to reach 1,500 billion USD (!) by 2020.

2. THE CURRENT SITUATION OF SMART CITIES

2.1. Smart cities in practice

The notion of the smart city first emerged in the mid-1990s with reference to *sustainable growth* and concepts related to reforming *urban management systems*. These two themes remained central to the subsequent spreading of the idea of the smart city.[5] In both cases, it was important that, beside traditional development tools (regulations, physical developments, collaborations, etc.), *creative city* strategies were beginning to gain ground, focusing on entrepreneurialism, experimentation, downtown density, and the active media presence and interactivity of urban policy.[6]

Another factor contributing to the strengthening of the knowledge economy has been the appearance of *information and communication technologies* (ICTs) at the beginning of the decade. They initially took the form of services offered to businesses, but by the end of the decade, they were already applied in a few cities in transport regulation and the monitoring of public utilities.

At present, there are three defining groups of smart city programmes.

From the 2000s onwards, the construction of a number of new 'blueprint' cities has begun, gaining a lot of publicity (Songdo, South Korea; Masdar, United Arab Emirates; PlanIT Valley, Portugal). These settlements started out as greenfield investments, aiming to demonstrate the integrated utilization of a full range of smart solutions, from ecological design principles to built-in technologies and operation. Progress in the construction of these cities varies, and their actual feasibility is subject to analysis and critique.[7] *Technology-driven* programmes may be considered *smart city generation 1.0*.

In existing cities, the impact of projects implemented as a comprehensive strategy, or as part of a programme, is even greater than that of demonstration projects.[8] Settlements with a long history and a diverse environment, society and economy have already established smart traffic and public utility systems, integrated urban management centres (e.g. Rio de Janeiro, Brazil, in collaboration with IBM), e-government and service infrastructures, as well as development programmes in which data and technological devices are prominent. *City-led, service-based* programmes aiming to meet actual demands constitute *smart city generation 2.0*.

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[5] Hollands (2008) elaborates on the publicity history and background of the concept.

[6] The notion of the creative city as a phenomenon and as a development strategy was first introduced by Charles Landry (Landry (2000)). The economic significance of creative classes is discussed in detail by Richard Florida (Florida (2012)).

[7] E.g. Greenfield (2013), Townsend (2014)

[8] Caragliu et al (2011), Shelton et al (2015)

Nowadays, an increasing number of settlements are establishing extensive collaborations instead of focusing solely on corporate products-based developments. They usually occur on platforms (organisations, framework programmes, or even IT systems) that allow a diverse set of actors to join and participate in urban management. Such strategies are based on the integration of different sectors and the achievement of holistic goals in multiple fields at various scales. *Smart city generation 3.0* is *organised around communities*.

In practice, the three generations are usually present simultaneously. However, when looking at the development of individual settlements, telling which approach constitutes the starting point remains a decisive question.

The main actors of smart city developments

In the context of smart city programmes, it is useful to subdivide the four key groups of actors in the urban innovation environment (i.e. government, businesses, academia and the civil sector). In the field of governance, this subdivision is necessitated by fundamental differences in the roles, responsibilities, and opportunities of the international environment, the European Union, and national and local governments. In the economy, small and medium-sized enterprises are gaining ground – and may play an even more important local role – alongside large corporations that contribute significantly to the development of smart city tools and programmes. Therefore, in the following sections we shall introduce six distinct roles.

The birth of integrated smart city products is mainly a result of developments conducted by *global ICT corporations*. Therefore, such products are often grounded in corporate data management and communication platforms which, in the past few decades, have allowed for the operation of business and service systems comparable with the scale and complexity of settlements.[9] These advances form the foundations of a self-governance approach combined with management and services, which can open up novel ways of looking at politics.

The activities of local *SMEs* are distinct and twofold. First, they work as developers or suppliers for large corporations. Second, they develop business (B2B, B2G) and commercial (B2C) goods that cater for the needs of individuals, communities, and institutions at the local level (e.g. applications, smart home devices, peer-to-peer

[9] Frost & Sullivan's 2013 market research sorts these into four main groups:
1. Integrators (service bundles fully covering sectors, e.g. IBM, Oracle, Accenture)
2. Network suppliers (developers of corporate communication systems, data analysis, cooperative platforms, e.g. Cisco, Verizon, Ericsson, AT&T)
3. Pure product distributors (suppliers of measuring devices, hardware, network units, e.g. Eaton, Honeywell, ABB, Schneider Electric, Siemens AG)
4. Management providers (monitoring, system and service maintenance, consulting, e.g. IBM, Serco, SAIC, Infosys)

or community sharing services). In this sector, immense ongoing innovation activities abound on the global market, resulting in incredibly successful products, but also regulatory conflicts and the toppling of historically established economic models (e.g. Uber vs. passenger transport, Airbnb vs. the rental housing market).

EU programmes target issues such as the balancing of market pressures, the advance of regional innovations, and the promotion of cooperation between cities and market actors. The latter also explicitly aims to create some of the world's highest-standard and most liveable urban spaces as part of urbanisation and the development of urban environments in Europe.
All this is guaranteed via targeted strategic programmes (Urban Agenda, EIP Smart Cities and Communities), research and collaboration resources (Horizon 2020, Interreg, SETIS on Smart Cities, Urban Innovative Actions, etc.), and platforms of collaboration (Urbact, EuroCities, JPI Urban Europe, and several smaller regional and thematic programmes).

Beyond the establishment of infrastructures and digital cohesion strategies, the tasks of *national governments* also include the management and consolidation of big databases, the formulation of data security frameworks, the allocation of resources, regulation, and the setting of development priorities. The outcomes of national-scale tasks such as e-government proceedings and the coordination of transport systems are directly related to the everyday lives of end-users. Depending on individual countries' level of development, these tasks may require fundamentally different strategies, but this field typically offers less developed or even developing countries the opportunity for rapid and significant progress. The introduction of digital services may cause major changes in attitudes, ways of life and the economy, and the costs of their establishment are also remarkably lower than in the case of hard infrastructures.

The importance of the role of *city governments* is often tantamount to that of higher administration levels, which is especially important in relationships between cities and the operation of city-regions in the European Union. Local governments manage several databases, sectoral policies, etc., and communicate with a considerable share of economic actors as well. For this reason, the prominent role of cities in the management and regulation of regional developments becomes increasingly apparent. Moreover, the presence of local government interfaces and institutions is conspicuous in the everyday lives of citizens. Therefore, the quality, messages and established frameworks of service provisions are some of the defining factors of people's quality of life and opportunities in a city.

Rethinking the data management policies of local governments, opening up certain innovation platforms, and proactively collaborating with the innovation sector (SMEs, creative industries, local communities, education, etc.) could be of great help at the local level. Such programmes increase competitiveness and earn

recognition at a regional, or even continental scale (see the smart city programmes of Vienna, Amsterdam, Copenhagen, Ghent, Barcelona, and other cities).[10]

The role of civil society – *local communities and non-governmental organizations* – in urban development is growing throughout Europe. Following the economic crisis, the majority of these organizations – which typically functioned as protest movements before – have by today established their roles as operators, maintainers, and developers. In cities like Rome, Berlin and Amsterdam, they are also actively involved in the maintenance of a surprisingly large proportion of cultural institutions and local social services.

Besides focusing on the reconstruction of energy and transport, the widespread use of the concept of liveable cities brings the active involvement of the citizens to the foreground. This, along with new strategic elements of urban development programmes (e.g. 'soft' development elements, temporary programmes, transitory uses), is often provided by technological devices (e.g. problem reporting applications such as FixMyStreet; cooperation platforms between local governments and residents; data sharing, community-based environmental data collection and problem solving, etc.). Participatory planning has long been a part of urban development. The convergence of certain smart city sub-systems and tools expands the scope of participation significantly, thereby creating new opportunities and means for the inclusion of the most diverse communities.

Academia and universities traditionally provide the expertise and the analytical and scholarly background to urban development principles. Smart urbanism is a hotly debated theme that receives substantial research attention worldwide, since the advancement of technology transcends conventional disciplinary boundaries. Several universities have launched smart city labs and research centres, where analytical work and research is revolving around practical problems and innovations. Other universities have launched postgraduate trainings, typically along the intersections of disciplines such as IT, Engineering, Design, Urban Studies, Economics, and the social sciences. The EU's development framework programmes especially promote collaborations between cities and the academic and educational community, since this kind of activity may best be performed in a practical context with concrete projects.

Financiers and market models

The sustainability of smart city programmes is a fundamental criterion from a social, ecological and economic point of view.

[10] This also includes EU development framework programmes such as CitySDK, which targets the shared development of city services, and the open-source application development platform based on city databases, FiWare. The latter has a startup investment programme as well.

The phasing out of the EU's non-repayable funds and the dominance of repayable and market resources sets new conditions for settlements. Apart from maintaining their creditworthiness, local governments and development companies are increasingly acting as *market operators* by producing goods and services, and occasionally selling them to other business or local government clients. This behaviour requires a *proactive, goal-driven approach*, for which smart city strategies may provide a solid basis.

New formats emerging among financiers – such as *venture capital funds* focusing on urban development – could become veritable assets in smart city developments from the perspective of both services and infrastructure. The duration of investments is typically longer than average, and the degree of commitment may vary (e.g. jointly owned services or development companies). These models may pave the way for tapping into diversified resources, e.g. with the inclusion of local venture capital or even community funding.

Appropriate funding and financial models also help to manage the *utilization of* the ever-expanding *wealth of data* generated through digitalization. The integration of these data into business is crucial since, although they are mostly owned or managed by local governments, their strategic use for secondary, business or social purposes is usually lacking. Thus, cities miss out on income opportunities (transport, housing market, services, etc.), which are instead monetized by market enterprises, typically along with the production of data wealth.

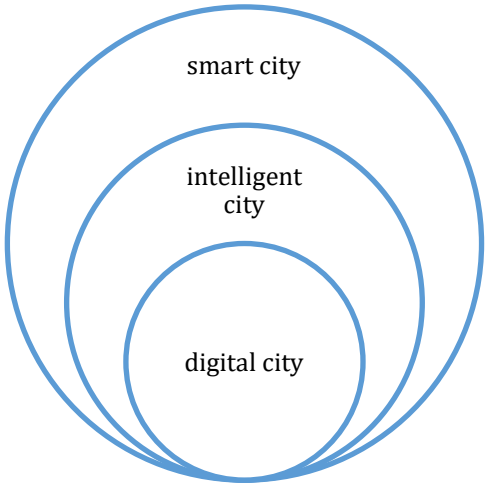
2.2. Smart City – the liveable and intelligent city

Definitions. What makes a city 'smart'?

There is no single universally accepted definition for the notion of the smart city, which is also reflected in its Hungarian equivalent (*okos város*). The three most widely used and related terms are the *digital city*, the *intelligent city,* and the *smart city*.

These three terms have emerged in the wake of sustainable urban development and decision support services offered by ICT industries, denoting primarily the widespread, inter-sectoral utilisation of *digital* technological solutions in urban development and the operation of urban systems (public utilities, transport, services, decision-making, regulation, etc.).

At present, the use of these terms is inconsistent, but they could be distinguished depending on how development approaches broaden from specific digital solutions (digital city) to tech-enabled institutional services (intelligent city), and a more comprehensive, strategic approach (smart city).



In agreement with the smart city definition provided by the British Standard Institution (BSI)[11], the official Hungarian governmental definition also considers the development of *smart cities* an important policy strategy. Accordingly, rather than establishing a label or a status to be achieved, it describes a methodology – that is, a path to be followed:

[11] Effective integration of physical, digital and human systems in the built environment to deliver a sustainable, prosperous and inclusive future for its citizens. (PAS 180:2014, 3.1.62)

Smart City Methodology:[12] a **settlement development methodology** for settlements or settlement groups, improving their natural and built environments, digital infrastructures, and the quality and efficiency of local services via the application of up-to-date and innovative information technologies in a sustainable manner, and with the increased inclusion of residents.

In this framework, technological and smart service solutions are *assets* for achieving complex goals concerning quality of life, efficiency, and ecological and economic sustainability. These assets could be utilised successfully when applied alongside *other assets*:

- ***Sustainable development of the natural and built environment***
  One of the key issues of global urbanisation is its fundamentally unsustainable resource needs. Besides optimising costs and expenditures, a more economical form of operation targets the reduction of cities' ecological footprints, which include not only the environmental burden and pollutant emissions, but also climatic issues of a city's built environment (e.g. urban heat islands), and the role of ecological networks surrounding and permeating cities (e.g. blue-green infrastructure).

- ***Development of the digital infrastructure***
  Alongside traditional settlement infrastructures, ICT systems are becoming even more prominent, not only via their physical elements (e.g. data transmission networks), but also with their systems and applications in the digital space. On the one hand, this new type of infrastructure requires a new legislation framework (e.g. national and local data policies), but unlike traditional infrastructures, it needs users (e.g. local government employees and local residents) to possess the adequate knowledge in order to be fully accessible. Citizens of diverse social backgrounds and ages, as well as businesses operating in different sectors, encounter and live with opportunities of the digital world to varying degrees. Digital developments are only successful and sustainable if the majority of local actors become active users, and therefore it is necessary to devise these developments in conjunction with that of the appropriate competences.

- ***Improving the quality of settlement services***
  The public administration's service-centred reform, open management and digital infrastructure (single-window system) may result in swifter and simpler administration processes, thus making official procedures more personalised and efficient. Data transparency makes the work of local governments and authorities easier to follow and understand. Integration also creates opportunities for sorting out competence issues between administrative branches. As per the government decree cited above, the

[12] Government Decree 314/2012. (XI. 8.) on the concepts of settlement development, integrated settlement development tools and strategies, and their special legal institutions

same approach should be applied to the improvement and running of all local services, which in the long run would enable suppliers from a variety of backgrounds and interests to create a more sustainable local services portfolio in collaboration with local governments and residents.

- ***Citizen inclusion***
  Beyond well-functioning services, quality of life in cities depends on a number of other complex factors, among which citizens' individual and community activities are key. Constructive and value-creating involvement, and a growing sense of personal responsibility and attachment are not only important in terms of public life and well-being, but they also directly affect competitiveness and the economy. In future cities, an increasing number of business, community or individual actors are expected to appear in the fields of development, decision-making and even management, and smart solutions may be effective in facilitating their collaborations.

- ***Economic efficiency***
  Along with ecological and social sustainability, it is fundamental that the established systems constitute an economically viable and flexible model. Therefore, it is necessary to choose and plan organizational solutions and methodological, technological tools appropriately, so that they do not rely on one-off, mainly externally subsidized resources. Instead, their operation and maintenance should produce added resources, or even generate direct profit for settlements. It is important for local economic development that, rather than concentrating on the economy per se, each settlement should focus on establishing a set of frameworks, tools, collaborations and corresponding infrastructures which are flexible, capable of effectively adapting to changes driven by external circumstances, and are based on local resources.

It is clear from the above that technological solutions alone are insufficient for the fulfilment of the objectives described. Therefore, the toolbox of smart cities has expanded to include methods generally serving the improvement of citizens' quality of life, awareness and decision-making autonomy. 'Smart city' has thus become an umbrella term, regrouping often interconnected concepts such as the liveable city, green city, creative city, open city, sustainable city, and the 'city-as-a-service' model, under the banner of technology.

Another influence is the emergence of a growing number of small-scale developments and community initiatives alongside big ICT companies, attempting to reach similar aims. Besides top-down smart city visions, bottom-up initiatives are gaining increasing economic, political and cultural significance. The coordination of these two main directions is a recurring theme of smart city agendas, where various actors cooperate with each other while taking part in the operation of individual policy areas.

How does a smart city manifest itself in the physical environment?

In all probability, the physical fabric of future cities will not look much different from their present form. However, the *functioning* of their internal systems and services will change considerably, and so will urban dwellers' relationship to their cities. Presently, cities around the globe are at an early stage in this process, both in developed and developing countries.

An ordinary streetscape of our time does not differ substantially from a century-old one; nevertheless, its meaning to passers-by, customers of shops and cafés, local residents and businesses has changed completely. Locally installed appliances and users' own devices now record and transmit nearly every occurrence to local, national and global databases. The number of vehicles waiting at the traffic light, their own navigation systems and inventory of transported goods; the photographs taken and messages sent by passers-by; purchase transactions, household appliances, etc. all have a real-time effect on the operation and availability of various services.[13]

All this constitutes a paradigm shift – the city becomes an increasingly *dynamic system*, where services are personalised and change over time. The great centralised infrastructural systems of the 20th century (public street lighting, power supply, drainage and water supply, communication) are becoming decentralised and complemented by local and parallel elements. This approach also extends from digital and service-providing platforms to *physical solutions*. For instance, rainwater drainage and management occurs locally with the building of green roofs or curbside mini-gardens; street pavements filter and drain sewage, and building envelopes filter air pollutants. Rather than using air conditioning systems, heat islands between buildings are eliminated by shades, special envelopes and greenery. Solar energy produced by buildings can be used to charge electric vehicles or to power streetlights and other local appliances,. and public transport changes routes flexibly depending on traffic congestion and demand.

This kind of operation requires regulations, specialised policy decisions and technological solutions. Community involvement is also changing, since community maintenance and, occasionally, financing are emerging alongside community use. Technology – whether in the form of horizontal platforms for local businesses to develop applications and for students to use in learning, or detection systems providing environmental data – is present in developments as an integrating and interpretative tool.

Therefore, the availability, openness or exclusivity of technological devices and data can generate or counterweigh significant differences in the character of cities. For example, instead of physical fences, digital or data-level restrictions may be

[13] For a detailed description and potential visions of the phenomenon, see Hill (2008).

sufficient to keep people away from certain areas of the city, or to prevent them from using certain services (geofencing). Conversely, as demonstrated by global protests and weather events over the past years, technological and data devices are no longer exclusively state-owned. Indeed, an ever-expanding range of tools and applications is available from mass movements and local communities, allowing for a bottom-up coordination of city-level activities, e.g. in the case of disasters.

Forms of collaboration

Smart city programmes consider urban governance and management a multi-actor model. The already mentioned quadruple helix model, as well as the *Public-Private-People Partnership* (PPPP) models of EU strategies take concrete shape in smart city programmes.

Centralized smart city programmes can only be realised in a completely monopolized technological and data environment, where control over the management and supervision of platforms is in the hands of a single entity, be it the state or a company. Apart from the greenfield model urban programmes discussed previously, such experiments are being carried out in the so-called *charter city* model, in which the role of local governments is temporarily or permanently taken over by companies, enterprises, or consortia. Such examples, like the city-level operational centre established in Rio de Janeiro with the help of IBM, are questioning the system of modern political institutions and the models of representative democracy. These points should be kept in mind when implementing similar programmes.

Developments commonly referred to as 'brownfield smart cities' take up the majority of practical programmes, and operate under different principles. Initiatives implemented in existing cities are usually hybrid state–market models, where a number of cooperating partners and a variety of incentives guarantee long-term functionality.

Here, the significance of *local governments* lies in coordination, goal-setting, the maintenance of social guarantees and the building of an ecosystem of cooperative actors. These are also the fundamental conditions of liveability for future cities.[14]

As providers of market solutions, *businesses* take interest in development and services, i.e. in creating user-friendly and efficient solutions that are competitive and commercially sustainable. However, it is important to highlight the fundamental difference between users and citizens – cities are both social and political environments, where it is impossible to get purely business-based considerations accepted in development projects. That is why the regulating,

[14] More on the European Union's regional innovation models in Regional Innovation Ecosystems. Learning from the EU's Cities and Regions. CoR guide (2016).

standardizing and service-providing role of the *state* is important, which may encompass both centrally and locally operated systems (e.g. transport, e-government, electronic billing, etc.).

The *academic sector* may support local programmes with resources coming from research, professional integration, education and training, which could pass on the concepts incubated in universities to the market.

The role of *civil society* depends on how it is defined – depending on whether we are talking about residents, citizens, communities or civilians, a number of different frameworks can be established. How can one determine what city users may be interested in or responsible for? People living and working in the city, entrepreneurs and even visitors form distinct groups do not correspond to categories such as citizens, registered residents or employees, etc. Therefore, smart city strategies should pay special attention to reaching out to citizens and establishing dialogue, since genuine commitments are not going to be formed along legal categories.

Smart cities or smart citizens?

Debates and critiques on smart city concepts in the past years can be summarized with the dichotomy of cities vs. citizens. There is a pronounced difference between development strategies that prioritize the services, technologies and data of *cities* and make decisions correspondingly; and strategies that are concerned with improving the standards of living, expanding the knowledge and opportunities of *citizens*, and allocate resources accordingly.

In technology-driven urban strategies (smart city 1.0, partly 2.0), it is easier to overlook issues of individual sovereignty, the private sphere, and community considerations, since compromises are compensated by the promise of efficiency, based on measurable data and applied technology, and the appeal of a personalised urban environment.

On the other hand, strategies built upon the concept of *smart citizens* (smart city 3.0) promote the importance of autonomous, often non-synchronisable decisions and the retaining force of communities, assuming that expanding opportunities and responsibilities would result in more powerful and successful cities in the long run. Here, the role of data, services and technologies is not to support the decision-making of the central city administration, but rather to increase information flow towards civil stakeholders, while at the same time sharing decisions and supporting initiatives. Cities following this latter strategy (e.g. Ghent, Amsterdam, Barcelona, Brno) consider establishing and maintaining cooperation frameworks and programmes their most important tasks, both online and in the physical environment.

Both models necessarily imply continuous optimisation. In the case of the city-centred approach, data-determined services and performance make up the criteria of efficiency. In the citizen-centred model, large-scale, top-down planning and development solutions of the 20th century are rivalled by temporary, small-scale, experimental solutions which, if successful, can become permanent. Should they fail, their correction still costs significantly less than before.

Optimal solutions may be reached with a *combination of the two strategies*, in each case taking into consideration the local, settlement-level characteristics, resources and needs.

2.3. Major issues of smart city developments

Centralisation and community initiatives

The most important issues facing smart cities are the changes brought about by emerging technological and data management systems in urban governance. The integration and supervision of services developed for and marketed to municipalities and e-governance often overstep the sovereign and legal boundaries of modern democracies. This mostly becomes palpable in relation to civil sovereignty and independence, but raises similar dilemmas in local governmental data management, the availability of public utility services, and even the sovereignty of modern nation states. Since the majority of services is marketed and managed by big corporations, they are gaining access to previously unimaginable kinds of data, similarly to the way local governments and states are finding out more and more about their citizens, thanks to data collecting systems repeatedly infringing on the private sphere.[15]

On the other hand, there are of course personal data collection and management systems, the most spectacular element of which are the hybrid digital–physical ecosystem of mobile IT devices and their corresponding cloud-based services. Through these platforms, individual citizens are continuously supplying their own personal data, which, in the absence of adequate knowledge, could even escalate to total vulnerability. The importance and popularity of data on consumption, traffic, etc. also indicates that authorities no longer have exclusive authority over the management of urban and public utility services data. The success of contemporary bottom-up initiatives and their practical and constructive nature is

[15] Frost & Sullivan's market research also points out the frequent lack of resources in local governments to claim full ownership of corporate service packages. In light of this, four types of dominant market models are to be expected in this sector: Build Own Operate (BOO), Build Operate Transfer (BOT), Build Operate Manage (BOM) and Open Business Model (OBM). All of these models reallocate significant competences and knowledge from the state administration into the hands of the market.

often a result of access to information no longer being dependent on the attitudes of local governments.

It is in everyone's best interest to avoid competition and conflict between the two sides, and instead form a system in which they are cooperative and compatible with one another, and which would push parties into taking up new and even unusual roles. This is a shared learning process, demonstrated by successful smart city programmes (e.g. Amsterdam, Vienna), whereby cities and citizens improve simultaneously.

Data security and personal security

Managing, storing and analysing data in previously unimaginable quantities and resolutions raises obvious security issues.

In an era when information is a fundamental economic asset, such concerns are to an extent predictable, since everyone is affected and thus interested in the transparency of the management, ownership, security of data produced by or about them.

This is primarily a matter of education and raising awareness. However, there is much less clarity around the kinds of opportunities large corporations are going to provide for exercising civic, local governmental, sectoral and national sovereignty, given that they have divided the Internet into monopolistic and walled garden-style markets over the course of a few years. What happens, for instance, if a company goes bankrupt, and with its termination data are lost that would have otherwise been preserved for centuries by modern state archives?

Furthermore, the effects of malicious attacks, terrorism, and grey and black market activities could present even more pressing problems. A hacker attack against an e-mail server poses a different threat from an attack against a water company or the control units of a power supplier. These concern is not only becoming relevant at the level of large urban systems, but for the private sector as well, with the widespread use of networked home appliances (IoT).

Complementing already existing European initiatives on these issues, practical experiments and lab programmes may also yield invaluable results.

Participation and cooperation

Political passivity and the need for instant and personalised services in modern consumer societies also leave their mark on people's participation in urban life.

Mobile and digital technology-based services generally promise to reorganize our environment (transport, shopping, entertainment, etc.) in real time, and according to users' prevailing preferences. Our map recommends restaurants based on our actual location, notifies us of friends nearby, and suggests routes according to our interests and security settings. This approach moves cities from being a field of encounters, coincidences and shared experiences – in other words, of social experience, cooperation and learning – towards personal and more or less closed worlds. This creates demands on the built environment and community services that are difficult or impossible to meet.

A priority of smart city projects is to move on from the 'me-here-now' dimensions of technology and instead help build successful and functional communities working together or in parallel. Most of all, there is a need to encourage individuals' progress from being consumers to becoming responsible citizens.

For this reason, it is essential that feedback is immediate and consistent on both services and development, since this is how to boost motivation for further participation; and this is how a city could become a recognized and appreciated background for its personalised services.

Heritage protection, local resources and development

In the case of natural and built values, and especially the preservation of characteristic and protected traits of local community identities, focus is shifting from individual elements towards *systems.* Instead of facades, we are protecting *townscapes*; instead of buildings, we are concerned with the *urban fabric* and its *spatial structure*; and rather than dot-like green areas, we are seeking to preserve *ecological networks*. Complex systems are always more than just the sum of their parts, and thus the dynamic relationships of elements, their roles in the system, and their resulting characteristics are values that need to be protected. Due to this integrated approach, a much wider space for development opens up, and emphasis is given not only to the protection of values, but also to their usefulness and their present and future functions.

Settlements – not counting megalopolises – may be considered small and open economies. Their locally available values and resources consist not only of the built and natural environment, but also of local human capital, the collaborations of local enterprises and institutions, and local city services. The role of local values and resources has become more pronounced due to the recurring crises of the global economy, helping individual cities to emerge and stand out from their

surroundings. These resources are the factors influencing enterprises' choices of the location of their sites, and residents' decisions to stay or move.[16] By identifying local specialties as values, and recognizing their potential to be preserved and improved, individual settlements may establish the human, institutional and physical frameworks that can guarantee their long-term development.

[16] Balás (2015)

2.4. Scales of smart city programmes

Although the effects of smart city programmes mainly manifest themselves locally in the life and operation of settlements, their implementation requires the coordinated and continuous cooperation of fundamentally different systems and solutions at various scales.

The role of data and ICTs are key to the workings of smart systems, since they provide the means of assessing and improving settlement operations and the relations between public utilities, services and users. There are already a number of such technologies present in everyday life from social networks to map data provided by global IT companies and other services. Users – or, from a different perspective, city residents – typically access them via their own personal devices, and use them to organize their lives in the city. Since local government and state services emerge in this environment as well, it is fundamental that they should be useful, available, and flexible enough to keep up with market solutions.

The success of market and community solutions frequently depends on their *interoperability* and *scalability*. In other words, it is about the confidence that a particular service works the same way in each city, and is equally applicable to big cities, small villages, districts and neighbourhoods.[17] Moreover, it is essential for smart city projects to be interoperable and scalable so that they are compatible with each other at the national, but preferably the international, European level as well; and provide relevant and differentiated solutions from a larger and broader scale down to the level of local communities.

European and international interoperability has primary significance for the use of data and technologies in cities through the relevant tools and services developed. Innovative ideas originating from enterprises, communities, universities and the knowledge economy need to become economically sustainable. To this end, it is necessary that solutions devised and tested in a particular settlement can be spread and implemented elsewhere. This can only be ensured with an appropriately synchronized technical and IT background, and the coordination of certain organizational and communication procedures of local governments and public service providers. All this is necessary so that development processes follow similar courses instead of having to face completely different decision-making procedures, administrative structures and organisational competences each time.

[17] A good example of this success and the conflict with state-regulated services is Uber, which offers user-friendlier solutions than taxi services. The economic success of the company is based on the recognition that the scalability and quality of strongly regulated transport services fall behind market standards, and that settlements and other actors do not utilise the opportunities of ICTs. The operation of the company, however, is seriously conflict-ridden, which stems from a conscious violation of law, a monopolistic attitude, discrimination against passengers, phishing, as well as a disregard for employee rights.

Although it is primarily the role of local governments to unite smart city developments, their established strategies should take a variety of scales into consideration, from the international and national levels down to smaller units within a city.

City level – centrally provided elements

In Hungary, local governments and market suppliers can reach a number of services via central state-maintained systems. As with public administration, the aim of centralized development is to make certain solutions available for everyone on the same conditions, and to make the data and IT solutions they are built upon identical in every settlement. This ensures the comparability of settlement-level solutions with incoming data, and in the case of certain critical elements, it guarantees the application of solutions compatible with European standards and directives.

Central solutions are mainly connected to public administration services.

One of the pillars of nationwide smart systems includes *city cards* based on e-ID cards, as well as other cards developed by the National Mobile Payment Plc. as part of the National Unified Card System. Depending on a given settlement, city cards may grant access to entirely different, locally determined sets of services, although it is important that their IT background should be identical on the level of platforms, and that users could use the same cards in other settlements as well.

The other pillar of national developments is related to *electronic administration services*, establishing an invoicing and payment platform connected to numerous fields of public administration. Thus, it enables various services – provided locally or at other scales by local governments or market actors – to connect to the same system. This makes services even more easily accessible for users, and also allows for the introduction of competitive models in city administration services, thereby significantly increasing quality and efficiency.

The already existing national GIS platforms are currently managing mostly statistical or sectoral data. Setting up a *national geographic information data warehouse* would create a platform upon which a number of further development applications and other solutions could build, while remaining scalable and interoperable.

Settlement level – smart city enabler platforms

Frameworks providing the basis of city-level integrated smart developments are termed *enablers* in practice. An *enabler* can be anything that serves as a foundation for the operation of procedures, processes, applications, tools, etc. capable of functioning beyond their designated purposes when connected to one another.[18]

Although the literature tends to use the term to denote IT solutions, we shall distinguish between two major categories here: *human* and *technological* enablers. With a different set of tools, these two kinds of enablers can collaboratively lay the foundations for establishing integrated settlement-level strategies.[19]

Human frameworks comprise organizations, trainings, institutions and programmes that can provide city-level resources, and join the implementation of smart city strategic aims with their operation and user environment. They can educate directly or indirectly by communicating and performing tasks, or embracing external initiatives and making their workings transparent. With regard to participation goals, people's active contributions to city maintenance, and the reform of city management, these frameworks play a decisive role.

Technological enablers include horizontal, physically extensive and accessible infrastructures, upon which useful devices, applications, services or programmes can be built in line with local demands. Apart from traditional public utility systems, infrastructures delivering broadband internet connection, as well as such networked systems such as public street lighting are also extremely important.[20] The data collected by horizontal infrastructures and their connected devices could form a valuable foundation for numerous innovations and developments if opened up and made accessible carefully. The platform approach also integrates systems traditionally separated along sectoral lines, and can link sectoral data and decisions accordingly.

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[18] For instance, continuously powered public lighting networks can be considered enablers, on which a variety of sensors, communication devices, charging stations, etc. can be installed. A similar physical system or a community transport database are potential platforms, for which a variety of applications may be developed.

[19] More on the demarcation of the two fields: http://smartcitiescouncil.com/smart-cities-information-center/the-enablers

[20] Humble Lamppost, a working group of EIP SCC's Integrated Infrastructures, aims to establish a transferable basic infrastructure based on the 60–90 million lampposts within the EU. The plan aims for the development of 10 million lampposts which, taken together, present a great market opportunity, and would create a huge new market at the same time. (http://beta.eu-smartcities.com/initiatives/78/description)

Uniform platforms provided by national and international standardising endeavours make enablers interoperable, and thus ensure the critical mass of resources and users necessary for sustainable operation. Locally utilised solutions, which also enable international expansion, could bring an outstanding profit for all local operators.[21]

The development of individual enablers comes with considerable costs and resource requirements. It is therefore important that the development of platforms should be realised through partnerships and collaborations between professionals, institutions, financiers and communities.

The implementation of a complete horizontal platform or human institutional system requires serious planning and a number of steps. Urban case studies and good practice examples indicate that such large-scale developments should be introduced step by step, flexibly and first accommodated to the local level.[22] The tools of contemporary urban planning offer many useful solutions, from temporary programmes that model and test the effects of developments and subsequently scale good practices, to cost-efficient resource-allocating developments.

Local level – city labs

Whether they be about total settlement-level platform developments or small-scale projects, *laboratories* are some of the most significant settings of contemporary research, development and innovation. However, they are not closed-off institutions of purely scientific work conducted in isolation from the external world in the conventional sense. On the contrary, city laboratories are working most successfully in the context of everyday environments as tools of testing and experience-based development.

As indicated by the term 'living lab', the testing of developments occurs in a real environment, with the involvement of actual users, and occasionally lasting for extended periods. This practice is becoming predominant in a number of industries, and it is significantly more efficient in facilitating the production of truly successful and functional goods and models. Thus, the perceived risks associated with the experimental approach of labs would bring greater economic profit and general satisfaction in the long run.
Urban laboratories are specialised versions of the living lab, established for testing various urban development solutions, services and innovations. Depending on

[21] The previously mentioned FiWare platform development aims to create such an open-source horizontal enabler. The platform database contains numerous service and data management units, and both developers and settlements may join. For more information, see: https://www.fiware.org/2015/03/25/fiware-a-standard-open-platform-for-smart-cities/
[22] okosvaros.lechnerkozpont.hu

their initiative and maintenance partners, they can work in a variety of ways, but local governments generally have a key role in raising questions and applying solutions first on the local, and later on a systemic level. Thus, urban labs are typically based on the collaboration of local governmental, market-based, academic, and community partners, conforming to the quadruple helix model of innovation ecosystems.[23]

Urban laboratories can be specific city neighbourhoods, blocks of buildings, streets or other sites, but also organizations and spatially fluid collaborations. Their main aim is to create experimental and testing environments for real-life users and developers, who are working together on solving individual problems of specific products or services. The European Commission defines it as the PPPP (Public-Private-People Partnership) model, and supports the collaboration and knowledge exchange of laboratories as part of the European Network of Open Living Labs.[24]

The JPI Urban Europe programme is also an active advocate of the establishment, connection and research of urban labs. It has published an overview brochure of its projects[25] and a detailed practical guide[26] based on the experience of programmes running in the past years. Moreover, their calls for tenders incentivise the launch of new projects.

Around the globe, labs are playing an increasingly important role in urban development. A practical guide published jointly by the European Network of Living Labs (ENoLL) and the World Bank helps mayors and city officials to establish experimental programmes and fit them into their urban development strategies.[27]

Incubation and testing labs are working along four main strategic aims:

- Co-creation – the collaboration of developers and users in the planning process
- Exploration – discovering newly emerging forms of use, behaviours and market opportunities
- Experimentation – involving users and communities in the testing of single processes and applications, including the whole scenario of their introduction

[23] For an overview of types, financial models, etc., see Keith & Headlam (2017).

[24] www.openlivinglabs.eu

[25] McCormick, K. & Hartmann, K. (2017). The publication is a result of GUST (Governance of Urban Sustainability Transitions), a project compiling an online curriculum for establishing and operating living labs. http://www.urbanlivinglabs.net/

[26] Scholl, Ablasser et al. (2017). The handbook is a product of the Urb@exp research programme and follows the operation of labs in five cities from 2014 onwards. http://www.urbanexp.eu/

[27] Marsh, J. et al. (2015)

- Evaluation – assessing concepts, products and services along socio-economic, social cognitive and social ergonomic indicators

Urban laboratories offer excellent real-life circumstances for testing the feasibility of individual ideas that apper to be innovative and promise substantial practical benefits during the planning process. Feedback is a part of testing, and it is about measuring how useful, accepted or marketable an idea is within an examined environment. Sustainable development and a liveable city may only be achieved through carefully introduced solutions that take users' needs into consideration and react appropriately to changing socio-economic processes.

An even finer-scale, but at least as effective method as labs is the inclusion of carefully chosen communities, individuals and families into testing and development. This method, also known as 'the Futurists', seeks to gain a deeper insight into the functioning of particular systems through a detailed analysis of personal uses and the collection of extensive feedback. The acceptance and popularisation of successful projects can thus be achieved through users themselves.

3. REGULATIONS AND PROGRAMMES

When looking at a regulatory environment, it is necessary to consider the unique characteristics of smart city programmes. The *smart city* entails a complex strategy, and the coordination and mutually supportive planning of objectives, existing assets, and developments in the name of sustainability and efficiency. These strategies and objectives may vary depending on countries, cities, and projects, even if they consist of various combinations of familiar project elements. Therefore, when examining regulatory environments and preparing projects for smart cities, it is important to start by identifying the appropriate tools, elements, and corresponding regulations for a given project.

Consequently, a unified, all-encompassing and binding EU-level or national 'smart city' regulation does not, and cannot exist, and therefore the only possible option is to collect and organise rules, guides and recommendations concerning particular fields and sub-fields.

3.1. The European Union

Although the European Union lacks a comprehensive smart city regulation, it pays special attention to the topic nevertheless. Large framework programmes have typically been established along the principles of energy efficiency, resource management, economic competitiveness, innovation, community inclusion, and governance reforms.[28] Consequently, tendering and development resources are likewise connected to these themes.

The following documents can be considered major steps in the EU's regulatory and policy environment:

- March 2010 – Europe 2020 growth strategy for a smart, sustainable and inclusive economy[29]
- March 2011 – The European Commission's 2050 energy strategy[30] (roadmap to a competitive, renewable energy-based economy, aiming to reduce greenhouse gas emissions by 80%)
- March 2011– EU White Paper on transport[31] (phasing out conventionally fuelled cars by 2050)

[28] See the EU strategic documents on urban future, Hermant-de Callatay & Svanfeldt (2011).

[29] https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/framework/europe-2020-strategy_en

[30] https://ec.europa.eu/energy/en/topics/energy-strategy/2050-energy-strategy

[31] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0144:FIN:EN:PDF

- May 2014 – European Energy Security Strategy[32] (reducing the import of energy resources)
- October 2014 – European Council Conclusion on the 2030 Climate and Energy Policy Framework (SN 79/14)[33] (cutting greenhouse gas emissions, increasing the share of renewable energy, improving energy efficiency with binding targets)
- May 2016 – EU Urban Agenda[34] for the improvement of the regulatory, funding and partnership environment of urban planning

At the EU level, the most important regulatory issue is the compatibility of developments, i.e. the interoperability of data and technological platforms. This is the only way to guarantee that multi-actor processes do not break up into opaque and incompatible elements.

Major European framework programmes and developments

A key component of the EU regional development strategy is urban development,[35] the goals of which align with the three priorities of the 2020 growth strategy (1. smart, 2. sustainable, 3. inclusive development).[36]

Several cooperation platforms exist between the various regions, urban areas, and settlements of different sizes in the European Union.[37]

Directly related to smart growth is the European Innovation Partnership (EIP) on Smart Cities and Communities[38]. As a programme supporting research, development and innovation, it has thus far initiated collaborations between cities and industries in six categories.[39] These are sustainable urban mobility; sustainable districts and the built environment; integrated infrastructures and processes (in energy, ICT, and transport); citizen focus; integrated planning, policy and regulations; and business models, procurement and funding.

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[32] https://ec.europa.eu/energy/en/topics/energy-strategy/energy-security-strategy

[33] http://ec.europa.eu/clima/policies/strategies/2030/index_en.htm

[34] https://ec.europa.eu/futurium/en/urban-agenda

[35] http://ec.europa.eu/regional_policy/en/policy/themes/urban-development/

[36] http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/priorities/index_en.htm

[37] For a list of all urban-themed programmes and collaborations supported by the European Committee, see: http://ec.europa.eu/regional_policy/index.cfm/en/policy/themes/urban-development/portal/

[38] http://ec.europa.eu/eip/smartcities/

[39] http://beta.eu-smartcities.eu/clusters Hungarian settlements take part in a number of EIP programmes, but the SCC programme has no Hungarian participants so far, neither as settlements, nor as experts.

Environmental, economic, governmental and inclusive urban solutions are integrated by the URBACT framework, a practice- and results-oriented cooperation platform.[40]

City-level public administration in the EU's political processes is represented by Eurocities,[41] a collaborative founded by six big continental cities that counts more than 130 members today. In seven priority areas (culture, economy, environment, knowledge society, mobility, social affairs and cooperation), they are concerned with strategy establishment, knowledge exchange, and active research and development. The main aims of its strategy for 2020 are creating quality workplaces, diverse and inclusive cities, a green and healthy environment, smarter cities, and reforming urban governance.[42] In Hungary, Budapest is the only member of Eurocities right now.

The European Network of Living Labs (ENoLL) was created in 2006 with the aim to establish connections between programmes providing development and testing environments for various innovation initiatives.[43] These laboratories usually operate with the participation of cities and districts, often in public spaces and public institutions; creating appropriate conditions for ideas and developments to be tested and assessed in a real environment with the involvement of users.

The Urban Europe research and development collaboration was launched as part of the European Commission's Joint Programming Initiative (JPI).[44] The programme encompasses five themes: urban economies, welfare and finances, resilient environment, accessibility and connectivity, and governance and participation.

3.2. Hungary

In Hungary, specialised policy material concerning smart city programmes first appeared in digitalisation strategies. Developments described as smart city services (and as corresponding transport, ICT, energy, etc. developments) in these documents touch upon ICTs and the public administration institutions of urban development. As a pioneering step even at the international level, a professional actor has been appointed in Hungary for coordinating tasks in this field.

[40] http://www.urbact.eu/

[41] http://www.eurocities.eu/

[42] Eurocities Strategic Framework 2014-2020 Towards an EU Urban Agenda for Cities

[43] http://www.openlivinglabs.eu/

[44] http://jpi-urbaneurope.eu/

The strategic aims of the 2010–2014 Digital Renewal Action Plan[45] are characterised by a people-centred approach, support for enterprises, the service-providing state, and the development of infrastructure, including actions for digital community spaces, smart transport systems and other related plans.

Aimed at establishing the regulatory environment for the Hungarian ICT ecosystem, the National Info-communication Strategy (NIS)[46] was adopted in 2014. The aim of its action plan, the Digital Nation Development Program (DNDP), is to make electronic services accessible, improve economic competitiveness and community activity, and increase the efficiency of government operations. The four pillars of the programme are super-fast internet, digital community and economy, e-services, and digital skills. The introduction of smart city services and the setting of frameworks and monitoring principles belong to the digital community and economy pillar. Local public administration developments, however, are typically part of e-services.

In 2015, a government decree established the state's regulatory and supervisory roles concerning smart city developments.[47] Beyond physical infrastructural development programmes, Lechner Knowledge Centre was commissioned to set out a state regulation framework and establish an institutional platform supporting the introduction of smart city services. Technological developments related to the National Unified Card System and to regulated electronic administration services are carried out by the National Mobile Payment Plc.

A 2017 government decision reinforced the above decree,[48] projecting the possible future integration of settlement development tools and smart city strategies, as well as determining the responsibilities of further state actors concerned.

Launched in 2015, the Digital Success Programme (DSP)[49] set ICT-related goals for settlements. From the five pillars of DSP 1.0, the Digital Startup Strategy proposed the establishment of a framework for settlement-level data policies. The actions of DSP 2.0 study then designated smart city programmes as general areas of priority, and suggested concrete educational and pilot projects.

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[45] http://www.etudasportal.gov.hu/pages/viewpage.action?pageId=17367065

[46] http://digitalismagyarorszag.kormany.hu/digitalis-magyarorszag

[47] Government Decree 1486/2015. (VII. 21.) on the current tasks concerning the implementation of the Digital Nation Development Program, and on the amendment of certain corresponding government decrees

[48] Government Decree 1024/2017. (I. 24.) on the establishment and operation of an organisational and knowledge platform supporting the coordinated introduction and functioning of 'smart city' services, and on the monitoring of the entire system's operation

[49] http://www.kormany.hu/en/cabinet-office-of-the-prime-minister/hu/digital-success-programme/strategies

4. TOOLS OF SETTLEMENT EVALUATION AND MONITORING

4.1. Smart city monitoring in international practice

The comprehensiveness of smart city programmes, the required scalability of implemented solutions, and the need for national and international coordination in certain areas makes it necessary that the status and results of settlements be comparable. For this purpose, an increasing number of more or less different criteria and monitoring systems, and several standards have been introduced in the past decade.

This, however, does not mean that settlements of different scales, historical backgrounds, geographical locations or development levels are generally comparable. Nevertheless, some areas can be identified where it is necessary for every settlement to formulate goals and establish strategies.

Comprehensively applicable evaluation systems make it possible to create development strategies, specialised policies and support programmes, which contain solutions and recommendations that other cities in the European Union can share and reproduce.

Although the strategic elements of the EIP SCC programme include setting settlement-level performance indicators and standardisation, common EU-level documents do not exist yet.[50]

State and market actors, academic/scientific institutions and municipalities are also developing smart city auditing and programme evaluation systems, between which numerous overlaps and correspondences can be identified. Typically, these systems measure 60-100 indicators grouped into bigger, cross-sectoral topics based on statistical data, status data, and to a lesser extent survey data. These indicators can be divided into two main groups: essential core data, and additional data that help conduct more in-depth analyses, and make comparability and the evaluation of regional characteristics possible.[51]

Industry studies, white papers

The ICT sector's corporate white paper studies commonly define 6–8 sub-systems (these tend to be the economy, mobility, energy, environment, water, governance,

[50] See the initiative at: http://beta.eu-smartcities.eu/initiatives/73/description The H2020 programme CITYkeys coordinated the measurement and standardisation of urban data, and was finished in 2017. The results are utilised by a working group. http://www.citykeys-project.eu/

[51] CITYkeys D1.2 and its annexes provide a detailed overview of the most prevalent evaluation systems and indicators currently in use, see Neumann et al. (2015, 2015a, 2015b).

people, communication, services, and security), and group their services accordingly.[52]

Unique city evaluations

The most commonly applied evaluation system in the European Union is a monitoring method developed by TU Wien in 2007, which has been continuously updated ever since and can be used for the comparison of mid-sized and big cities. This method groups 74 indicators evaluating smart city programmes into six sub-categories.[53] Besides its simple and manageable thematic structure, the system is working exclusively with internationally available local, national and European statistical measures. Since its inception, it has been evaluating 70 European cities on a regular basis.

Another widely used index system is the so-called Smart City Wheel created by American urban planner Boyd Cohen.[54] It is frequently plotted as a pie chart, the main themes of which are identical to TU Wien's sub-systems, but its subcategories are partially different. Working with 62 indicators, the long-term aim of this system is to become useful for civil organizations and other interested parties besides municipalities' own data services. Cohen also points out the relations of this method with indicators of the ISO standards presented below.

Standards

Indicators for measuring cities currently exist in two standards systems. Applying them is not mandatory, and taking part in either is also partially voluntary and usually involves fees. Settlements joining the ISO standards gain access to a shared knowledge platform and to each other's data. The BSI standards formulate a unified pattern primarily for British settlements, but without foreclosing international applicability.

Concerned with smart city monitoring, ISO 37120:2014 defines a total of 100 core and additional indicators in 17 sub-categories for measuring cities' performance and setting strategic aims.[55] Further ISO standards have standardised the development of smart community service infrastructures (37150, 37151, 37152), and are establishing a framework for developing smart city strategies (37106, in progress).

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[52] E.g. Barsi, Lados (2011), a study conducted for IBM; or T-Systems Hungary's Smart City programme (http://www.t-systems.hu/smartcity)

[53] Giffinger et al. (2007), http://www.smart-cities.eu/

[54] Cohen (2014), http://www.fastcoexist.com/3038818/the-smartest-cities-in-the-world-2015-methodology

[55] http://www.iso.org/iso/catalogue_detail?csnumber=62436
The ISO has a corresponding database site that processes the data of member cities, making them available and comparable. http://www.dataforcities.org/

The other standards package in use is that of the British Standards Institution. It includes a set of documents building upon one another, which help local governments and state organizations create well-functioning, sustainable smart city strategies and operate their programmes.[56]

These two documents would most likely constitute the foundation for a possible European standards framework, and therefore, it is advisable to base domestic endeavours on the localisation of these materials as well.

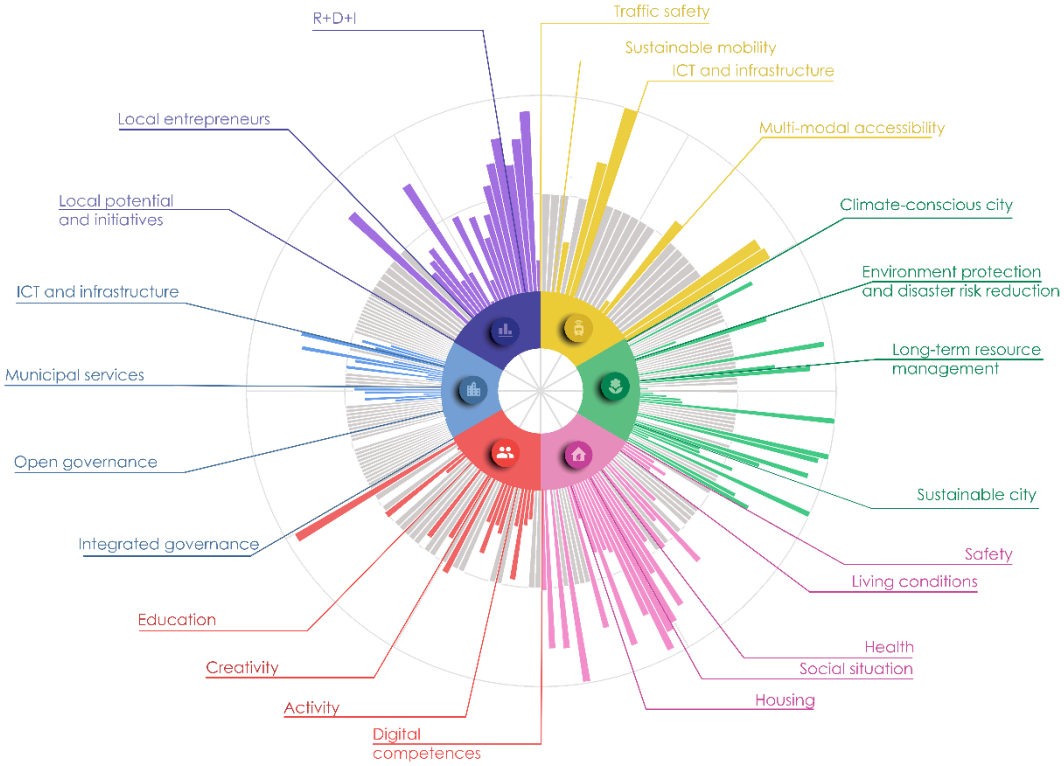
4.2. Settlement Evaluation and Monitoring System in Hungary

In Hungary, the evaluation system supporting settlements' smart strategies defines complex theme-based indicators in six sub-systems, including core and additional indicators, for auditing the initial state of settlements, evaluating their strategies and monitoring their development. The system indicates the situation of settlements in the country and compares them across various scales.

Datasets required for evaluation are filled up from internal (TeIR), external and other data sources, e.g. vector map and image processing. From this data, the system calculates indicators by applying statistical methods. The aim of the planned system is to create an interactive interface that grants a variety of users access to settlement evaluations and analyses, making their communication easier.

Building upon these evaluations through statistical calculations, the analysis of ever-increasing quantities of data, and interactive map applications, the optimisation of services and settlement-level developments may become possible in the long run.

[56] https://www.bsigroup.com/en-GB/smart-cities/Smart-Cities-Standards-and-Publication/



The Settlement Evaluation and Monitoring System of Lechner Knowledge Centre

Smart Mobility

Monitoring themes:

- Multi-modal accessibility
- ICT integration of infrastructure and services
- Sustainable transport
- Transport safety

Apart from reducing environmental burden, smart city mobility programmes typically focus on supporting *non-motorised transportation*, as well as *community transport*. The principles of pedestrian and bicycle-friendly traffic planning can be extended from route planning to other means of transport (e.g. bike transport services[57] and interoperability). The main aims of smart mobility include *multi-modal accessibility*, system-level and actual spatial connections between individual transport sectors, and *ICT integration* in each service area. Integration may result in national or international *compatibility*, meaning that users could access the transport infrastructure of multiple settlements via a single system.[58]

[57] In Copenhagen, every taxi has to be equipped with a rack capable of holding two bicycles by law.

[58] This contributed significantly to the market success of applications like Uber, Lyft, Rekola, etc.: their services work the same way in every city. Nationally integrated systems are in effect in the Netherlands, where a single transport card provides access, tickets, etc. to all services.

Besides transport cards, ICT system integration enables the collection of complex usage data not only on devices and routes, but also on corresponding services. This way, the district-level specialization of citywide systems and services, their dynamic traffic-based control and interconnection with local services can be implemented (e.g. car sharing services with electric cars and smart parking[59], directing local power surplus towards charging vehicles, and the dynamic synchronisation of the systems, routes and schedules of state, city and market service providers).

In the built environment, mobility primarily manifests itself in the form of road pavements and signalling systems. At a broader scale, it also involves public space developments, the architectural detailing and lighting of certain streets, etc., which may support new regional relationships and related services (institutions, recreation and social services).

Smart Environment

Monitoring themes:

- Sustainable city
- Long-term resource management
- Environmental management and disaster risk reduction
- Climate-conscious city

For a long time, environmental sustainability had no significant role in the development of cities. However, accelerating urbanisation and climate change pose inevitable challenges that urge not only large-scale, industrial and international policies, but also new local solutions.

Environmental management is necessary at the scale of urban systems, individual buildings and small interventions alike. Technology has a pronounced role in the integration, coordination and monitoring of numerous small-scale local interventions. In this context, the long-term functionality of solutions is also extremely important, so that, among other things, they constitute an essential element of buildings and infrastructural developments.

[59] E.g. the test run of the car sharing service car2go, developed by Daimler's innovation lab and launched in Ulm in 2008, is now available in 25 big cities. This is how a local business supported and incubated by the city may become a global enterprise. https://www.car2go.com/

Following the example of contemporary community-based weather forecast practices, air quality and other environmental data could also be monitored with the involvement of communities. Open data management not only has an educational effect, but can also assist local decision-making and make connections to international databases and programmes possible.[60] Cultivating and strengthening *ecological awareness* is a fundamental task, since the long-term sustainability of cities depends on the decisions of their residents. This also affects urban solid waste and sewage treatment, from on-site composting, greywater use and other solutions to awareness-raising initiatives that open up city-level facilities to the public and make their operations more accessible.[61]

The construction of *green buildings* constitutes a planning framework in which high-tech solutions and building automation ideally play a minor role. Here, emphasis should be placed on design approaches and decisions that minimize the resource needs of the built environment and the climatic burden of inter-building zones by applying appropriate structures, construction materials and spatial solutions. Managing urban heat islands also requires integrated solutions with a similar approach.

Equally important is the onsite and sustainable management of rainwater, wastewater and solar energy. Decentralised *smart grids* relieve the pressure on big utility systems, and due to their partial or total independence, their operation is more secure.

Sustainable urban development combines all of the above through systemic regulation and specialised policy tools.

Smart People

Monitoring themes:

- Education
- Creativity
- Activity
- Digital competences

Technological development and economic globalisation primarily threatens low-skilled work. In the past decades, cities that could effectively utilise and develop the knowledge of their residents were the ones that have become successful both economically and in terms of people's quality of life.

[60] E.g. the Smart Citizen Kit, which is an open-source measuring tool and database. Users can access real-time data from all meters in all cities. https://smartcitizen.me/

[61] The new waste processing plant in Copenhagen will also function as a public park, public building and recreation centre welcoming visitors, thereby effectively linking useful recreational and leisure activities while shaping people's ways of thinking.

The *knowledge economy* is mainly located in cities and downtown areas, where a diverse range of skills, knowledge and expertise is concentrated in a small area. The creative city model considers this the most productive sector of the future, and a foundation for the development of successful settlements.

To achieve this, however, it is essential to have an environment that is both appealing and *inclusive*. Apart from a culture of tolerance and cooperation, this requires the establishment of services and infrastructures – be they enterprises, cultural products, or education – that enable competences to meet and become available for others.[62] From technological devices to urban environments, a personal and user-centric approach has become mainstream, replacing mass services.

A fundamental issue in this process is *educational reform*. With regard to life-long learning, this means raising standards and awareness, as well as maintaining motivation and a sense of usefulness. For instance, games, the integration of new technological devices, and positive confirmations and feedbacks on personal investments play a defining role in this.

Cities should provide the possibility to encounter the unknown and the novel, and at the same time create a demand for such encounters. Only citizens with a sufficiently broad perspective and an interest independent of educational qualification can become successful in their personal lives, as well as for communities and settlements.

Therefore, it is extremely important to implement inclusivity in settlement development. The proper application of participatory planning builds trust, and generates interest and commitment. In other words, it maintains or strengthens cities' capacity to retain their population, thereby caring for and enriching both the urban environment and its residents.[63]

Smart Living

Monitoring themes:

- Housing
- Social situation
- Health
- Living conditions

[62] The Superkilen public park in Copenhagen is a good example of the integrating role of built environments. The park spans a city neighbourhood home to people from more than 60 countries, and its street furniture, signboards and playground equipment all originate from the homelands of the immigrants. The local community centre focuses upon encouraging education, participation, and an active relationship between different generations and communities.

[63] The recent renovation of Teleki László Square in Budapest has been a particularly successful community planning programme, resulting in outstanding architectural quality, as well as a stronger sense of responsibility and openness in the local community.

- Safety

Besides the economic performance of cities, a major factor of their competitiveness is the quality of life they offer. This includes the realisation of individual ambitions and goals, family and community relationships, and the characteristic needs of individual age groups. Moreover, it is about the extent to which a given settlement is able to make use of these goals and demands, integrate achievements into its own progress and preserve them for the next generation.

A smart city provides a solid basis for an environment supporting increasingly diverse individual and community goals. Importantly, however, it does not do so without differentiation: indeed, it offers opportunities for everyone, but not necessarily the same way, at the same place or at the same time. Therefore, in cities focusing on a *culturally active and happy life*, development is often limited to the construction and maintenance of institutions, services and the built environment, rather than growth.

Health and *security* also require long-term investment, whether specific or broader goals are concerned. Improving the physical, mental, cognitive and social health of city residents demand decisions in numerous different areas, including building and maintaining public trust and awareness, and integrating sectoral services and databases. In fact, these are the two fields where smart solutions and devices can offer great help through services such as remote monitoring, improving comfort in public spaces, and e-healthcare.[64]

The population of Europe, including that of Hungary, is ageing at an accelerating pace. For the future of cities, this implies emerging needs that demand advance preparation. Catering for special physical and mental requirements and implementing support, services and smart devices may indeed offer a feasible solution. However, these should fit into a more comprehensive strategy that integrates an institutional system promoting accessibility, creating a supportive built environment and fostering intergenerational relationships.

Personal security is a crucial issue. Technological developments such as public CCTV systems often offer simple solutions for increasing people's sense of security, yet they fail to solve real problems. Rather than developing superficial design elements, increasing the actual public security of the city is necessary for a better quality of life. However, this is a complex task.

Housing conditions determine urban quality of life for both owners and tenants, and especially for those in need. Successful cities should operate housing strategies that offer the broadest range of opportunities for new residents.[65]

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[64] E.g. smart public lighting with motion and vehicle detection, health monitoring, fall prevention, elderly-friendly developments, and incentivising and lifestyle applications.

[65] Eindhoven is home to one of the best design universities in Europe. Among other things, the city offers heavily discounted residence opportunities to students for two years after graduation,

Smart Governance

Monitoring themes:

- ICT and infrastructure
- Municipal services
- Open governance
- Integrated governance

The vision of smart cities and smart citizens presumes a political community defined by consciousness, shared competences and *joint governance*. In contemporary cities, an increasing number of actors are beginning to take part in maintenance, development and regulation activities alongside local governments. Key to their success are the relationships and collaborations they form with one another.

Responsible and active citizen participation may be encouraged by the *transparency and accessibility* of decision-making processes. Reinforcing these are data management issues, developer bases[66], and open management initiatives[67] associated with smart city solutions.

Local governments are the main actors in the spreading of e-governance and e-administration, since these are the platforms where inner government and administration systems meet end-user citizens, and where personal civil data and IT systems interact with state services. Therefore, the *active developer role and approach* of local governments become essential in the coordination of different scales, sectors and actors.

In terms of organisation and resources, the current local governmental system is not yet prepared for the above tasks. Nevertheless, it is precisely for the sake of successful long-term operation that new organisations and companies, motivated by market incentives but with results also useful for public administration, are worth establishing, even with experimental purposes.

In the case of smart governance, certain systems are expected to emerge centrally at the national level. In these instances, the main issue is compatibility, and designing truly relevant platform-based local services. The separation of data

thereby facilitating the continuous and dynamic growth of the local creative economy and businesses.

[66] See the public database of Helsinki, offering data in hundreds of topics to citizens, developers, etc. http://www.hri.fi/en/

[67] Porto Alegre pioneered the introduction of *participatory budgeting* in 1989, targeting increased democratic activity and community-integrated developments. By now, many cities have adopted this tool worldwide to different degrees and within different frameworks. In Central Europe, the programme became especially successful and popular in Poland, and is now supported by a unified, national portal.

management responsibilities should not be neglected either, since a number of smart governance systems are maintained by national institutions and market service providers, but raise local security or sovereignty issues. Local governments should be proactively involved in the clarification of such issues at all times, and could be assisted by external competences, e.g. local universities.

Smart Economy

Monitoring themes:

- Research and development, innovation
- Local entrepreneurs
- Local potential and initiatives

Cities are not only the driving force behind regional and global economic productivity, but are also cooperative networked ecosystems that provide the essential background for *businesses and innovation*. Apart from economic and regulatory incentives, central to this are the complex service-providing environments, skilled workforce, and knowledge base created by cultural activity. When combined, these factors could establish conditions that significantly improve *productivity* and competitiveness.

Smart city projects supporting the economic environment range from interfaces that make the administrative tasks of businesses easier to public development databases and a variety of other fields. Many cities strongly support the *global and local market integration* of locally operating businesses. This includes their incubation, the provision of temporary or permanent premises, and integrated service packages that support their interim settlement and locally implemented developments, or even incorporate them into the city's workings.[68]

Smart developments may also be realised by making use of the historical built environment. The merchant, handicraft, manufacturing, industrial etc. traditions of cities and neighbourhoods, along with their legacy of workshops, stores and factories, could be utilised beyond mere real estate investment purposes as potential foundations for business development programmes targeting specific fields, or for educational and cultural strategies.

No matter how dynamic the market of smart city applications are going to be in the forthcoming years, projects can only become successful and competitive if there are cities and public institutions to support and adopt them. In most cases, however, governmental bodies lack the capability and competence to launch incubation activities, although more and more local government-related incubator

[68] Amsterdam and Helsinki both operate lab programmes where, instead of business incubation, they provide testing environments for SME development projects that require continuous testing for multiple years. Collaborations, frequently joined by educational institutions, are beneficial for every partner, resulting in successful products, as well as a more attractive urban environment.

houses have been established in Hungary in the past years. The most significant help for businesses would be the opportunity to cooperate with local governments, stakeholder public institutions and service providers in the development and testing of their ideas and products, ranging from smart meters, services and education tools to healthcare and commercial applications. These are the areas where cities can act as major economic stimulants by opening up their traditionally largely inaccessible institutions towards collaborations.

This also improves the *spirit of innovation*, since anyone would consider it an incentive to look at their own environment, traditions, culture, etc. as a resource and source of inspiration. This approach could fundamentally transform heritage interpretation and availability, but also the cityscape, its attractiveness to tourists, and city branding.

5. THE SMART CITY DEVELOPMENT MODEL

The Smart City Development Model is a methodological tool, which sets the framework for settlement operation, the planning and implementation of strategies, and a monitoring system. This guarantees that a given city is committed to the introduction of smart solutions that improve long-term environmental, social and economic sustainability.

The Smart City Development Model builds upon existing planning practices, and therefore it has to include the concepts of already completed urban, peri-urban and agglomeration strategies. These strategies need to be integrated in this model in order to increase the synergies of city management and social, economic and environmental spaces, while equipping them with constantly renewing and expanding smart technological assets. Therefore, the implementation of this Model occurs cyclically, whereby monitoring evaluations are the milestones marking each new cycle. Consequently, this document is not an objective, but a means for cities to achieve their goals through the integrated administration of partnerships, urban development and management.

One of the key questions of modernisation is the ***preparedness of actors and their openness towards innovation***. A critical mass of the right skills must be available in order for various innovations to become a driving force behind prosperity. Therefore, emphasis is placed primarily on education and adaptability.

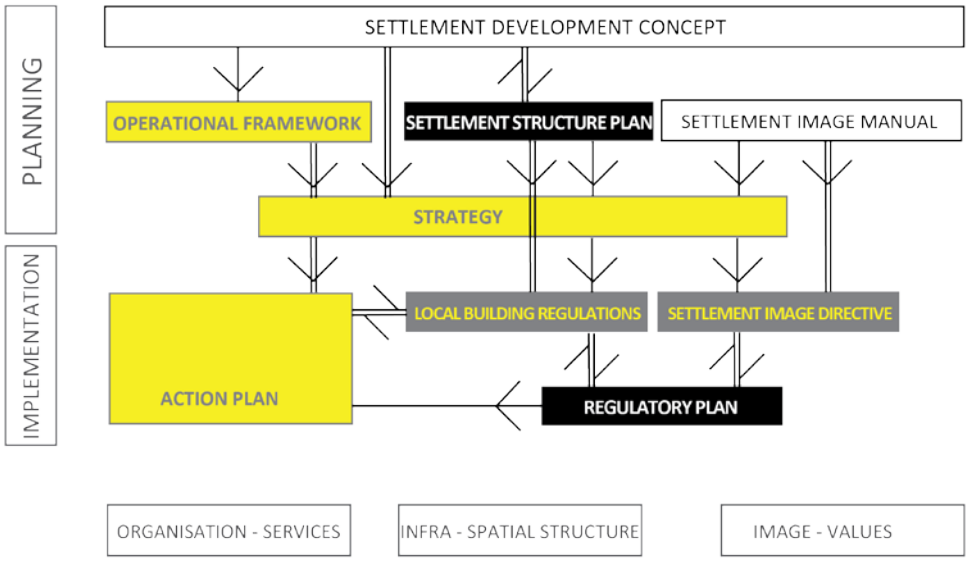
The second core aspect of modernisation spans the broad spectrum of communication, and openness is similarly a part of it. Community ***cooperation skills and activity***, and ***open governance*** increase the efficiency of investments by providing a continuous flow of information. Urban planning based on local needs represents a shift from earlier approaches: rather than producing strategies in isolation, the inclusion of the public guarantees that implementation is reasonable and serves common interests.

The third key element in devising smart city strategies is the application of the overarching principle of ***sustainability*** in three areas. ***Social*** sustainability can be achieved through the improvement of welfare conditions, the quality of inclusion and integration, levels of education, and other knowledge-based contents (creativity, adaptability, etc.). ***Economic*** sustainability can be ensured not only through the expansion of economic operators' entrepreneurial niche, but also with the economical and self-sustaining operation of smart systems – a task that must be included in the development strategy. Public opinion frequently associates the notion of sustainability exclusively with maintaining ***environmental balance***. While it is certainly a major component in raising awareness, sustainability is based on the interplay of all three components, harmonising social, economic and environmental interests.

The process of becoming a Smart City affects each segment of a settlement's life, and therefore a holistic approach is needed for the formulation of the Development Model. This process in itself may serve to increase participants' preparedness and open-mindedness, improve communication skills in a variety of ways, and contribute to sustainability through the understanding of correlations and the ability to make the right decisions in possession of the relevant information.

The Smart City Development Model lays the foundations for future smart city developments by structurally defining:

- development directions and content frameworks based on the active inclusion of local actors, taking into consideration the characteristics and needs of a given region;
- human capacity needed for and capable of strategic implementation;
- how to support development plans and select projects for implementation, and ways of maintaining partnership processes and communication.



PLACE OF SCDM IN THE HUNGARIAN SETTLEMENT DEVELOPMENT SYSTEM - Lechner Knowledge Centre

5.1. Structure of the Smart City Development Model

The Smart City Development Model consists of three main phases. Their timeframes, effects on a given settlement's operation, and the frequency of their necessary modification are all different.

- The ***Internal Framework for Local Government Operations*** sets out the general guidelines that guarantee the successful planning, implementation and long-term maintenance of development programmes. This explicitly long-term phase of the Smart City Development Model not only lays the basis for developments, but for the planned operation and management of settlements as well. Together and in accordance with the Settlement Development Concept and Settlement Structure Plan, it ensures that the settlement is functional in the long run while providing space for continuous developments.
    - The ***Investigation of Local Government Operations*** explores and analyses the ***Service Portfolio*** and ***Data Wealth*** of a settlement, the ***Partners*** interested in its long-term development and the ***Forms of Cooperation*** between them, as well as the local government's capability and opportunities for developmental investments' and operations' ***Forms of Financing***.
    - Part of the ***Operation Model*** is a demonstration of the ***Partnership Process***. It should include the ***Partnership Plan***, which explores the parties interested in a development, their relationships to one another, and the ***Communication Plan*** and ***Education Plan*** encompassing the whole development process. The ***Operational Structure*** presents the long-term settlement ***Service Matrix*** to be introduced and maintained, the ***Local Data Policy*** necessary for the introduction of ICT developments and the ***Operation Monitoring*** of the settlement. Additionally, it locates the ***Position of Developments*** and corresponding responsibilities within the Operation Model and the settlement's organisational structure.
    - The ***Business Model*** demonstrates the sustainable operation of the city-as-a-service emerging around planned developments. It discusses the ***Financiers*** of the settlement's development and operation, including the ***Financing of Operations*** and that of ***Developments*** as a separate chapter.

- ***Strategic Planning*** is the phase determining the medium-term objectives of settlement development and the measures necessary to achieve them. Adapting to the changing opportunities and situation of a settlement and the requirements of various state and European development framework programmes, strategies should be updated regularly at intervals stipulated by government decrees.

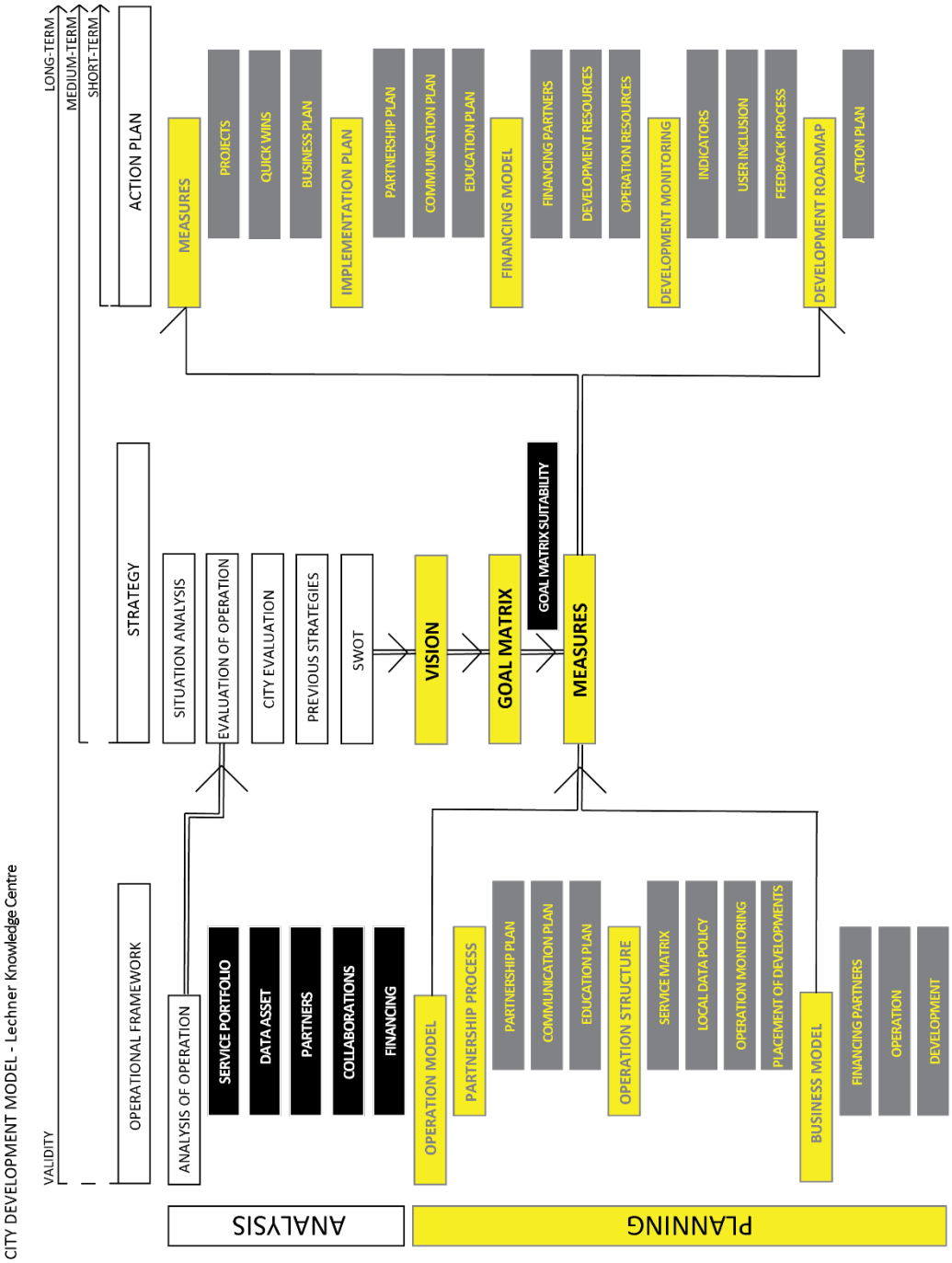
- The ***Situation Analysis*** explores the characteristics, resources, and opportunities of a settlement along with particular themes specified by government decrees.[69]
- As a pivotal foundation for strategies, the ***Preliminary Summary of Operations*** marshals the goals and necessary measures formulated in the ***Internal Framework for Local Government Operations***, the conditions of strategy implementation in terms of partnerships, education and communication, and the possible forms of financing.
- ***City Evaluation*** is conducted based on the complex indicators of the previously discussed Settlement Evaluation and Monitoring System. Complementing the Situation Analysis, it aims to assess settlements comparatively along the lines of the six cross-sectoral smart city sub-systems within the relevant settlement category.
- The ***Overview of Previous Strategies*** processes the goals and measures of sectoral and other strategic documents in force, and summarises the still relevant goals and corresponding actions formulated in them.
- Drawing together previous analyses, ***SWOT*** organises the internal (strengths and weaknesses) and external (opportunities and threats) factors of developments.
- The ***Vision*** is the essence of a strategy in the making, which can be easily communicated towards experts and the public alike, and is in line with future visions of the Settlement Development Concept.
- The aim of establishing a ***Goal Matrix*** is to mediate between local needs, resources and opportunities and the desired vision that fits into regional, national and international frameworks. It lays the foundations for measures included in the medium-term plans of a settlement.
- ***Measures*** define the decisive steps towards reaching goals, including the necessary actions for the implementation of partnership, communication and education plans.

- The ***Action Plan*** is meant to build up a programme with specific steps that help a settlement reach its goals. The plan itself is concerned with the establishment of an operational framework and the implementation of measures necessary for reaching strategic aims. Essential to its success are precise scheduling and financial planning, and therefore it is usually created for a shorter term than the Strategy. Should there be changes in priorities or external/internal financing circumstances, this document ought to be able to address them.
    - The ***Detailed Measures*** section elaborates on previously established goal-based actions, dividing them into separate ***Projects***. This involves identifying and highlighting ***Quick Wins***, i.e.

[69] Government Decree 314/2012. (XI. 8.) on the concepts of settlement development, integrated settlement development tools and strategies, and their special legal institutions

projects that produce results instantly or within a short period. It also includes the ***Business Plan***, which considers individual project expenses, along with the costs of communication and education activities supporting the completion of a given initiative.

- The purpose of the ***Implementation Plan*** is to organise the ***Development Partnership Plan***, ***Development Communication Plan*** and ***Development Education Plan*** proposed in the ***Detailed Measures*** section, which are essential for the execution of developments. These help compose the hierarchy and interconnectivity of developments and the corresponding steps that support implementation.
- When setting up a ***Financing Model***, it is necessary to consider the possible ***Financiers*** of the given project, and then proceed to explore ***Development Resources*** and ***Operational Resources*** accordingly.
- The ***Monitoring of Developments*** is intended to provide a follow-up on preliminary expectations, assumptions, and their realisation. It is assisted by ***Indicators*** assigned to goals and measures, as well as ***User Inclusion***. Establishing a ***Feedback Process*** is likewise desirable, including the appointment of organisations responsible for monitoring.
- In light of the above, a detailed programme plan shall be set up, which contains a ***Development Roadmap*** presenting the temporal schedule of projects, and a detailed ***Action Plan*** derived from it, organising the schedule for the forthcoming two years.


SMART CITY DEVELOPMENT MODEL - Lechner Knowledge Centre
VALIDITY
LONG-TERM
MEDIUM-TERM
SHORT-TERM
ACTION PLAN
MEASURES
PROJECTS
QUICK WINS
BUSINESS PLAN
IMPLEMENTATION PLAN
PARTNERSHIP PLAN
COMMUNICATION PLAN
EDUCATION PLAN
FINANCING MODEL
FINANCING PARTNERS
DEVELOPMENT RESOURCES
OPERATION RESOURCES
DEVELOPMENT MONITORING
INDICATORS
USER INCLUSION
FEEDBACK PROCESS
DEVELOPMENT ROADMAP
ACTION PLAN
STRATEGY
SITUATION ANALYSIS
EVALUATION OF OPERATION
CITY EVALUATION
PREVIOUS STRATEGIES
SWOT
VISION
GOAL MATRIX
GOAL MATRIX SUITABILITY
MEASURES
OPERATIONAL FRAMEWORK
ANALYSIS OF OPERATION
SERVICE PORTFOLIO
DATA ASSET
PARTNERS
COLLABORATIONS
FINANCING
OPERATION MODEL
PARTNERSHIP PROCESS
PARTNERSHIP PLAN
COMMUNICATION PLAN
EDUCATION PLAN
OPERATION STRUCTURE
SERVICE MATRIX
LOCAL DATA POLICY
OPERATION MONITORING
PLACEMENT OF DEVELOPMENTS
BUSINESS MODEL
FINANCING PARTNERS
OPERATION
DEVELOPMENT
ANALYSIS
PLANNING

5.1.2. Internal Framework for Local Government Operations

[A] Internal Framework for Local Government Operations

The Smart City Methodology does not focus exclusively on designing developments that target the introduction of ICTs and other technologies, since they are mainly concerned with urban operations, basic infrastructures and their functioning. Rather, in order to meet positive expectations (i.e. personalised, efficient, data-based services; resource management; improving environmental quality), the operation model and processes of a given settlement should be thoroughly examined, and the necessary measures devised accordingly.
A fundamental requirement in smart city operations is the realisation of **four horizontal principles**:

- improving service quality and efficiency
- saving energy and other resources
- involving citizens and improving quality of life
- creating economically self-sufficient systems

In order to uphold these principles, an ***[A1] Investigation of Local Government Operations*** is necessary, as well as the establishment of the derived and intended ***[A2] Operations Model*** and the supporting ***[A3] Business Model***.

[A1] Investigation of Local Government Operations[70]

The **Smart City Methodology** brings profound and lasting change into urban operations; thus, a thorough exploration of city services, the digital urban infrastructure and data wealth, the operating organisations, the financial background, and opportunities of operation is indeed indispensable for its successful application. For this reason, it is recommended to carry out ***the investigations listed below***, performing not only statistical data collection and processing, but on-site condition surveys, expert interviews, focus group discussions, and public opinion polls as well. The scheduling of all this should be addressed in the ***[A2a1] Partnership Plan***.

[A1a] Service Portfolio[71]

- an introduction to the city's own liabilities and service obligations, tasks from the central government, and duties concerning city residents and businesses
- an exploration of the range of services provided by other market-based businesses (privately held companies and state-owned enterprises) in the settlement area

[70] Based on the PAS 181:2014 Smart City Framework (2014, BSI Standards Publication)

[71] ***Relevant regulatory and development documents:***
Act CLXXXIX. of 2011 on the local governments of Hungary

- a transaction-level demonstration of the ways in which citizens and businesses get in contact with city systems and services
- an examination of relationships between current services, and an assessment of their interoperability

[A1b] Data Wealth[72]

- the mapping of the digital data wealth of the city
- an investigation of the range of data generated by various city services; their method of storage and publicity
- a summary of previous and ongoing ICT projects in the city, and their results and conclusions
- current public data service obligations; forms of disclosure and citizen information

[A1c] Partners

- an introduction of the consumer segments of services available in the city, supported by a survey
- the mapping of actors currently excluded from digital services, including the reasons for their exclusion
- the identification of potential local financiers for city developments
- the mapping of stakeholders to be included in the operation of individual city services

[A1d] Forms of Cooperation

- an investigation of existing, functioning platforms between various actors in the city

[72] ***Relevant regulatory and development documents:***
Digital Agenda of Europe
Act LXVI. of 1992 on keeping records of the personal data and address of citizens
Act CXCVI. of 2011 on national assets
Act L. of 2013 on the electronic information security of central and local government agencies
Government Decree 142/2015. (VI. 12.) on the execution of Act CCXX. of 2013 on the general rules of cooperation between central and local government registers
ASP 2.0
IKIR (Integrated Public Services Information System)
Government Decree 1035/2012. (II. 21.) on Hungary's national security strategy
DNFP (Digital Nation Development Programme)
White Paper on Hungary's National Data Policy

[A1e] Forms of Financing[73]

- an assessment of the financial opportunities and inner resources of the city
- an examination of the possible obstacles of introducing a service-oriented operation model in the city

[A2] Operation Model

Becoming a Smart City is a road of continuous progress and development. One of the first steps in the process should be to create its framework, the ***[A2b] Operational Structure***. The city should plan its ***[A2b1] Service Matrix,*** which the local government and its businesses, as well as other actors – i.e. state institutions and companies, and market enterprises – seek to offer to different citizen groups and local businesses. It is essential to establish the framework and regulations of the ***[A2b2] Local Data Policy*** in order to provide for the storage, management and secondary use of service-generated data. The city administration should also set out the methods of the planning, implementation and long-term maintenance of necessary developments, i.e. ***[A2b4] The Placement of Developments*** in the city operation model, at the beginning of the process. The ***[A2b3] Operation Monitoring*** system of the city, comprising the methods and frequency of citizen satisfaction surveys on urban services and the quality of the city environment, as well as feedback opportunities on the results, should also be defined.
On its own, city management is insufficient for successfully developing and operating a smart city. The volume of changes and long-term commitment require the close cooperation of key internal and external actors. The ***[A2a] Partnership Process*** should not be set out exclusively in relation to development planning: indeed, the model of the city-as-a-service builds upon continuous feedback from its users – residents, local businesses, and visitors – and their active contribution to city life. The city management should formulate an official supervised schedule for the involvement of key actors, which constitutes the ***[A2a1] Partnership Plan***. First, it should cover the involvement of key actors in operating the city in a way that makes the Smart City Methodology clear and understandable for everyone. This includes an explanation of the **concrete benefits involved**, and the ways in which they can commit to developments and **be an active participant** in them. Second, it should provide inter-sectoral partnership opportunities for the city, and make contact with other cities to exchange experience and collaborate on developments. Simultaneously, it should continuously communicate the status of developments, the results achieved, and information relating to the operation of the city, which are set out in the ***[A2a2] Communication Plan***. The numerous groups of actors to be included should receive appropriate guidance for more active engagement with city life – the ***[A2a3] Education Plan*** serves to identify and schedule these tasks.

[73] ***Relevant regulatory and development documents:***
Act CLXXXIX. of 2011 on local governments in Hungary

[A2a] Partnership Process[74]

Partnership, communication and education are central to every element of smart city operation. Together, these areas constitute the partnership process key to running a smart city, and planning and implementing developments. Therefore, it is essential to identify corresponding principles and to plan necessary measures. Although these three areas are closely intertwined, it is worth taking into account and laying out the main considerations and tasks related to participation, communication, education and training separately.

[A2a1] Partnership Plan

Mapping every key stakeholder of city operation

For a successful application of the Smart City Methodology, setting up a partnership plan is indispensable. It is important to deliberate and find the place of local residents, businesses, and civil organisations in the operation and development of the city. This ensures that on each occasion, actually affected stakeholder groups are identified and addressed appropriately, be it about opinions, the establishment and implementation of development programmes, or satisfaction with city services and its feedback to the operation and development processes of the city.

Proposals for establishing an inclusion strategy:

- *The goals and desired results of inclusion and participation – in what way would settlement operation, life and development be improved by allowing local stakeholders to be more engaged?*
- *Required levels of participation in given processes – with reference to the 'participation ladder', what is the desired level of participation? (Data collection, consultation, delegation of tasks, etc.)*
- *Principles defining inclusion and participation – what horizontal principles could the city formulate in relation to participation?*
- *Operational plan of inclusion and participation*

[74] ***Relevant regulatory and development documents:***
Manual to participation planning in settlement development activities
Government Decree 218/2009. (X. 6.) on the content requirements of regional development concepts, regional development programmes and spatial plans, and the detailed rules of their interrelations, drafting, harmonisation, adoption and publication
Government Decree 314/2012. (XI. 8.) on the concepts of settlement development, integrated settlement development tools and strategies, and their special legal institutions
Article 5 of Regulation (EU) No. 1303/2013 of the European Parliament and of the Council

- *Organisational framework of inclusion and participation – What formal and informal institutions support participation in individual processes? (Committees, working groups, etc.)*
- *The most important city actors sought to be involved – Who are the actors first addressed and given a role within the institutional planning system?*
- *Methods to be applied in inclusion – What are the methods of participatory planning? (Planning workshops, surveys, labs, etc.)*
- *Communication strategy – What are the communication tools and methods of the planning process?*

[A2a2] Communication Plan

An indispensable requirement of establishing a smart city is to exploit the opportunities offered by ICT devices, integrated and open data use, and the cooperation of local actors. The common ground for these three areas is communication, and thus it is vital for the strategic planning and operation of smart cities to be supported by a well-founded *communication plan*. In the context of smart city developments, communication spans two major fields:

Smart City campaign – The Smart City Methodology can only transform the life of a city if its actors and those affected by the strategy become acquainted with, and then start relating to this approach to an ever-increasing degree, finding inspiration in the opportunities that arise along the way. For this to happen, it is vital to communicate a powerful message that reaches the majority of city residents and actors, captures their interest and encourages their subsequent commitment. Therefore, it is important to devise communication tools suitable for conveying this message (slogan, logo, etc.).

Possibilities of being informed and engaged – 'Smart citizens' are informed, active and proactive when given the opportunity to remain up-to-date with city affairs and planning, and to become active participants in communication processes. Besides passive communication tools (websites, internet platforms, etc.), active ones are equally important (local media, social media, apps, etc.) in the inclusion of less engaged residents. Focus is shifting from simple information transfer towards addressing and including citizens, and consequently towards establishing a two-way communication.
When formulating a communication strategy, the following should be considered:

- Communication team establishment and composition
- Situation analysis of the city's communication environment
- Communication goals
- Communication target groups
- Main messages
- Tools and activities
- Resources

In other words, it should be determined *what kind of message* to send, *to whom* and *with what purpose*, what kind of responses to expect and how to manage them, as well as *what the best communication tools* and their *resource needs* are.

Proposals for establishing a communication strategy:

- *Composing a simple to-the-point message – The smart city approach represents a kind of paradigm shift in comparison to previous urban development trends. This should be widely acknowledged, which requires a simple and inspiring, but at the same time strongly expressive and relatable message (or messages) that is easy to understand. This message should constitute the core of every communication activity.*
- *The messages and contents communicated can be prioritised and queued instead of being sent all at once. It is worth considering the inspiration-education-confirmation sequence here.*
- *Top-down communication should be complemented by communication between local actors. Individual messages may be more authentic when coming from peers rather than from higher levels.*
- *Communicate in plain language – the goals of city development often cover everyday areas such as transport, security, and livelihood. Applying heavy technical jargon in these contexts is unnecessary.*
- *Tell stories – conveying a message through domestic or foreign examples is much more effective than didactic explanations.*
- *Utilise 21th-century technology creatively, since the concept of the smart city itself is founded upon the exploitation of ICT opportunities.*
- *Unexpected and unusual ideas are often the most effective way of conveying a message.*
- *Devote sufficient resources to communication, as the success of the strategy might depend on it.*
- *Communication about the future involves both statements and questions. Do not be afraid to formulate questions on unexplained, open areas – this also provides an opportunity for the participation and feedback of target groups.*
- *Besides composing messages, it is equally important to channel feedback in a planned, transparent and consistent manner. Managing two-way communication and establishing the right way of interaction may be the most crucial factor in generating confidence and lasting commitment.*

On the whole, the communication plan establishes a framework for conveying the strategic approach of the smart city to various actors, laying the foundations for inclusion and partnership. Later on, **the communication needs of certain activities in the *[A2a1] Partnership Plan*, and that of *[B8] Measures* induced by new developments, should be identified from time to time. Correspondingly, a new and specific *[C2b] Development Communication Plan* should be formulated in the given phase of planning or implementation.**

[A2a3] Education Plan

A smart city is inconceivable without 'smart citizens', 'smart users', and 'smart governance'. Therefore, a fundamental pillar of the Smart City Methodology is education, i.e. shaping attitudes, sharing knowledge, and developing skills. Without these values, residents would be unable to function as a smart community in a smart city. Consequently, the education plan is in close connection with the ***[A2a2] Communication Plan*** and the ***[A2a1] Partnership Plan***. Communication activities are indispensable for shaping attitudes, and inspiring and energizing local actors. The best terrain for building partnerships is mutual learning and the utilisation of acquired knowledge and experiences within a community.
Like every other plan, the *education plan* linked to the Smart City Methodology should also outline the current situation in light of smart city knowledge and skills, and then identify the main target groups, and corresponding goals and tools. Since there might be fundamental differences in the preparedness, basic skills and motivation of target groups, we should also be 'smart' – i.e. creative and innovative – when it comes to the tools we seek to apply. Drawing on traditional approaches, we can organise *fieldtrips*, *trainings* and *courses*, apply *participatory action research* and the educational opportunities of modern *ICT technologies*. Besides, *new tools* may also be invented.

Proposed contents of the education plan:

- *Education partnership – identifying individuals and institutions responsible for the coordination of educational activities (education team composition)*
- *Outlining and analysing the current situation with regard to smart city knowledge and skills*
- *Specific goals of education corresponding to smart city services and planned developments*
- *Target groups of education (including all key actors), corresponding goals and tools, resource needs and scheduling*
- *Incubator and accelerator programmes offered for local businesses interested and involved in smart city operations*
- *The planned management, channelling and improvement of feedback from the target groups of the education programme*

In conclusion, the education plan supplies a framework for planning and implementing the preparation of various user groups, in order for both planned developments and partnership-based city operations to function in the long run. Furthermore, **the education needs for *[B8] Measures* induced by new developments should be identified later on. Accordingly, a new and specific *[C2c] Development Education Plan* should be formulated in the given phase of planning or implementation.**

[A2b] Operational Structure[75]

Smart city developments are typically long-term, often costly, yet inevitable investments for settlements. To this end, it is vital to have a **supervisor responsible for the development process**, just like in the case of any other project. International practice suggests that delegating this role to a single organisational unit already existing within the operational hierarchy of the city, and composed exclusively of local governmental actors, is not enough. Key to the consensus-based planning, successful implementation and long-term functioning of smart city initiatives is the **obligatory establishment of a multi-actor organisation to coordinate and manage developments** (planning, implementation, operation, monitoring and feedback). Its role, relationship with the city's operational structure, and authority concerning priorities and resources should be made clear and transparent in each city.

However, there is no universally applicable best practice for every city regarding the establishment and operation of such an organisation. Based on domestic experiences and international proposals, it is recommended to apply a two-tier operational model. The first step is to establish an **organisation for strategic management and coordination**, which follows the transformation process from preparation to development and implementation, makes sure that the ***[B7] Goal Matrix*** is implemented and takes care of its monitoring. Typically, this organisation is a consortium consisting of city administration and representatives of various sectors. It is not necessarily a legal entity – instead, the emphasis is on a wider and more efficient representation. Simultaneously, it is advisable to create an **appropriate framework for operational management** in coordination with the city's long-term operation model and concept, thereby facilitating the practical implementation of the city-as-a-service concept. There can and should be overlap between the actors of the two organisations, the extent of which varies from city to city in practice, depending on current and planned operation models. At the strategic level, actors change frequently, with new potential actors appear and previous ones drop out as the process of becoming a smart city unfolds. At the operational level, organisational changes can be expected in conjunction with the expansion of the city's operational portfolio, such as its own public transport company, renewable energy companies, etc. In view of developments, it is necessary to clarify the allocation of functions and establish a hierarchy between

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[75] ***Relevant regulatory and development documents:***
A manual of participatory planning in settlement development activities
Government Decree 218/2009. (X. 6.) on the content requirements of regional development concepts, regional development programmes and spatial plans, and the detailed rules of their interrelations, drafting, harmonisation, adoption and publication
Government Decree 314/2012. (XI. 8.) on the concepts of settlement development, integrated settlement development tools and strategies, and their special legal institutions
White Paper on Hungary's National Data Policy
Settlement Evaluation and Monitoring System
Act CLXXXIX. of 2011 on local governments in Hungary

the two organisations, with particular regard to addressing interim needs for change in relation to city management and individual projects.

Appointing a management organisation, clarifying its function and authority, and defining its *modus operandi* within the city administration system

, Based on international best practices, we propose the following for the successful and efficient establishment and operation of such a management organisation:

- *Management should be accountable. Both on the political and the administrative level, actors from within city operations and with real authority should be in charge of the implementation of smart city developments. These actors should have actual influence in organisational priorities and resource allocation.*
- *Not every key actor is expected to commit to smart city developments from the outset. However, during implementation, it is necessary that a broad range of stakeholders eventually become dedicated to supporting the programme as it progresses. A smart city should not appear or function as a top-down initiative, and therefore it is advised to divide leadership roles during the phases of planning and implementation, involving as many prominent representatives of each sector and organisation concerned as possible.*
- *For the in-depth long-term transformation of city operations, it is necessary to compile a **[A2b1] Service Matrix** and formulate a **[A2b2] Local Data Policy** in accordance with national and international laws, facilitating local development goals. These two should collectively serve to realise the smart city vision. Individual elements may originate from different actors, but consensus is indispensable in three points:*
- *Firstly, a comprehensive **[A3] Business Model** is needed, along with determining an **[A2b3] Operation Monitoring that indicates successful operation**. Secondly, it is essential to make stakeholders aware that necessary actions and changes, based on the **[C4c] Feedback Process** from performance and development projects, should take priority. Thirdly, a commonly defined system is necessary for the ways in which the management handles risks, problems, and contradictions that various actors reveal.*
- *For a successful implementation of the development, members of the management organisation should collectively possess a wide range of experience in strategy development, business planning and operation, the inclusion of key actors, marketing, commerce, and technology management.*
- *The structure of the management organisation should be open and flexible. Needs, requirements and priorities change over time as developments progress. The management organisation should be able to respond to these changes and to feedback on the initiatives implemented, while ensuring the continuity of the process.*

[A2b1] Service Matrix

The services available within a given settlement can be associated with numerous different institutions, organisations, and market actors. Operating organisations only tend to take into account the development and financing of the public services they maintain. For residents and local businesses, however, what matters is the

entirety of locally available services, regardless of the organisation or administrative level they belong to.
Therefore, apart from describing direct operator tasks, it is essential to compile the fullest possible picture of available services and their providers, the resources necessary for operating them, as well as the relationship between services and target groups, when creating the city's service matrix.
This approach handles services of the state, settlements and public institutions together with that of businesses, and civic and other actors, thereby bringing residents – i.e. the actual target audience – into focus, rather than operators. From this perspective, it is necessary to outline correlations and overlaps between individual services, with special attention to possible shortcomings and improvements.
It is the task of the management organisation to coordinate individual actors' public and local services, to involve appropriate service providers and resources in development opportunities, and to initiate own solutions. Overall, the quality of the full local portfolio would determine the success and sustainability of its individual components.
From the citizens' point of view, the following questions should be considered: How can I find a solution to a given problem locally? Who can help with it? Who is the best for this purpose?
From the perspective of city management, the questions are as follows: What are the roles of individual institutions and enterprises in relation to urban services? In what ways can the local government contribute to, improve and stimulate them? How can they become successful in business?

[A2b2] Local Data Policy

Data is one of the main pillars of the future economy. In fact, a large amount of data is already being generated through the operation of local governments, public service providers, public utility systems, and other services. In order for their **primary (public)** and **secondary (economic and social) uses** to produce the best results, it is necessary to establish a local data policy.
Local data policies should adhere to the principles, structure and measures of the National Data Policy. Furthermore, and similarly to the service matrix, when looking at the types, sources and managers of data, local actors other than the local government and public service providers also need to be included for the whole picture.
In accordance with the structure of the National Data Policy, the establishment of a local data policy ***may be divided into the following steps***:

1. Data Wealth Assessment
This step comprises the assessment and consolidation of the data wealth of local governments and local, regional and national public-sector organisations, as well as the establishment of a framework for systematic collection, recycling and development.
Due to the comprehensive scope of the programme, it is worth considering the application of non-centralised solutions. For market enterprises, data collection and processing could present an equally valuable opportunity to the application of already existing and available data in developments.
– Data wealth overview (census of data sets, data custodians, data managers, collection methods, formats, protocols, and metadata organisation)
– Data collection consolidation (sorting and unification of data sets, collection methods and organisations)
– Data recycling preparation (processing and database development)

2. Data Wealth Utilisation Programme
This component focuses on data recycling, with the purpose of developing services and products and stimulating the economy, with the involvement of external partners.
– Demand-based utilisation (data collection, the establishment of user partnerships, market analysis, and data provision for market buyers and users)
– Supply-based utilisation (launching and operating hackathons and facilitative programmes; research and development, and incubation activities with partners)

3. Competence Development
This part entails the development of the organisational and knowledge base of local governments and public service providers, which enables the strategic activity of local governments concerning data wealth and management. This critically affects the internal, public and business-oriented utilisation of data, as well as activities stimulating the economy and improving competitiveness.

4. Data Platform Building
Last but not least, the fourth element is aimed at building basic infrastructures based on data collection and processing, which provide a variety of opportunities ('enabler platform' model, sensor systems for public utilities, infrastructures, etc.). At the pilot phase, the target levels should be investments, neighbourhoods, streets, squares, localities or perhaps districts, which can be scaled up over time. Creating opportunities for the external use of platforms is important here, just like launching incubator and development programmes that build upon these opportunities.

[A2b3] Operation Monitoring

A properly constructed and continuously operating monitoring process can ensure that the ***[A3] Business Model*** and services function successfully. Feedback received through this system makes corrections and the adequate integration of additional developments possible.

Indicators defined in the monitoring system are values which, when measured, make relations traceable between initial conditions, the aims of planned developments, and the success of their implementation. A single indicator is not necessarily sufficient for measuring a particular development aim in itself, and indicator types may also vary (e.g. numerical and automated data; measured, questioned, and qualitative information). Selecting the appropriate indicators helps management organisations and participating actors to optimise decisions and operation.
When selecting indicators derived from the ***[A3] Business Model*** and the ***[A2b1] Service Matrix***, ***the following questions should be considered***:

- What are the criteria for success?
- What needs to be measured in order to achieve it?
- Where does the relevant information come from?
- What kind of information is the most appropriate, and with what methods can it be collected?
- How can collection be financed on the long run?
- How can the measured programmes be improved and corrected based on indicator results? Would corrections be traceable with the indicators?

Apart from defining indicators, it is also necessary to determine data sources and methods of collection. Operation monitoring should be built into the ***[A3] Business Model***.
It is advisable to harmonise the structure of operation monitoring with bigger corresponding systems (with the Settlement Evaluation and Monitoring System at the national level, and with relevant international guidelines and standards). Taking datasets described in these frameworks to compile indicators enables the external utility of locally appropriate operation monitoring systems, e.g. when comparing the operation of national settlements.

[A2b4] The Placement of Developments

Key to a settlement's operational structure is a definition of the organisational and process-based models of its developments, which makes its operation and development mechanisms easy to follow and understand for both internal and external actors. This facilitates the involvement of external resources and their best possible utilisation, as well as the sustained functioning of partnerships.
The establishment of an **organisational unit responsible for developments** may coincide with the previously discussed management organisation, or can be a part of it. It is necessary to specify the appropriate competences and roles for handling physical investments together with the development of corresponding services. When defining the partnership relations of the organisational unit, policymakers should consider the actors directly or indirectly affected by the development, the collaborations to be established with them, and their delegated ad hoc and permanent tasks.
It is also of paramount importance to set up **development process models** that are comprehensible for external actors as well. For internal participants and

potential external partners, investors and entrepreneurs alike, it is clear priorities, target areas, and easily traceable processes that incentivise participation and the involvement of further resources in developments. For that, a sufficiently flexible development model should be created that defines cornerstones, key steps, conditions and processes, thereby making project routes clear from initial ideas to implementation and operation. Thus, along with internal measures, external initiatives could also be channelled into the settlement vision and goal matrix.

[A3] Business Model

For the successful implementation and long-term maintenance of smart city developments, it is important for cities not only to plan concrete projects, but also to account for their financial implications and specific steps of preparation, maintenance, and continuous development. Consequently, it is indispensable for a settlement to assess its internal and external opportunities, and start planning developments accordingly for the sake of expanding these opportunities. Although often disregarded beside environmental and social sustainability, the economic sustainability of a city is equally important. Only those processes and services can function successfully in the long run that require minimal external resources, or none at all. For smart city developments, this includes the adoption of the city-as-a-service approach. For this reason, based on cities' current operational conditions, an operative organisation should be appointed – perhaps with only a few members at the beginning – for the management of service portfolio operations and corresponding development processes.
Prior to development planning, a city should create its own business model: following the investigation of the ***[A1e] Forms of Financing*** and potential ***[A3a] Financiers***, appropriate plans should be formulated for both ***[A3b] The Financing of Operations*** and ***[A3c] The Financing of Developments***. The business model should secure **internal resources** to the maximum possible extent, for at least the partial financing of future developments. This is a key component of the city-as-a-service approach, since this is how the continuous development of locally available services affecting citizens' wellbeing, mood and living conditions can become a part of the city's operation.
Achieving the long-term success of various developments and their results requires a city to consider concrete measures in its ***[C1c] Business Plan***. Not only is it necessary to pinpoint ***[C3b] Development Resources***, but identifying and securing subsequent ***[C3c] Operational Resources*** is also crucial.

[A3a] Financiers

The financing of compulsory local governmental services is covered by the state from dedicated resources, task-based or otherwise. This financing practice typically only enables the normative completion of tasks, but is largely insufficient for developing or improving them. Finding resources for the planned new tasks and services outlined in the ***[A2b1] Service Matrix*** is therefore indispensable.

Although their formulation and development can occur through dedicated funding sources, their operation requires supplementary resources unless market-based options are available.
Depending on the given service, business financing resources may require new kinds of collaborations with changing partnership forms (e.g. longer-term, more risk-oblivious and wider in scope) and different investment return paths on the part of business operators. An innovative solution is the incorporation of various forms of community funding into development implementations, and into settlement tasks and services that produce significant public benefit but with a net loss.
New kinds of collaborations function most effectively when based on partnerships, and therefore it is necessary to map possible ***[A1c] Partners*** and existing ***[A1d] Forms of Cooperation***. City residents, local businesses, and civic organisations may not only act as users and stakeholders, but also as financiers, and it is the municipality's responsibility to devise a framework for these relations as a part of its ***[A] Internal Framework for Local Government Operations***.

[A3b] The Financing of Operations

An important consideration for settlement services is the area served. For each service, it is possible to determine the critical user mass required for an economical and efficient operation. Therefore, addressing questions pertaining to functional urban areas, settlement networks and regions are inevitable when dealing with area-based services. Examples of such services include public transport, smart grid systems, and district heating.
In the city-as-a-service model, local government services can also be considered products that can be marketed and operated.
Operational resources may not necessarily be of material nature. Churches and civil society organisations also play an active role in the everyday lives of settlements, not only in their cultural and social scenes, but in public services and operations as well. Running a given service may be more cost-effective if it is more flexible and scalable than the local governmental structure. As a result, it is important to find those partners who are interested in the city's successful and efficient operation, and would run a given service for the good of the urban community with higher efficiency.

[A3c] The Financing of Developments

It is important to keep in mind that the introduction of the city-as-a-service model demands the regular monitoring of service quality, usefulness, and user satisfaction, and that further developments may become necessary depending on results. Moreover, ICTs become outdated much more quickly and therefore demand more frequent replacement than physical infrastructures and the built environment. While the majority of expenditures on physical infrastructures are on maintenance and renovation, digital and ICT-based services also involve the

added costs of constant development. In the long run, covering these costs from ad hoc development resources is not recommended; rather, they should be managed and planned as part of operating costs. In other words, it is advised that development costs are incorporated into the city's ***[A3] Business Model***.
According to the Smart City Methodology, developments should constitute a part of the city's long-term operation model; therefore, market resources and repayable funds should play an increasingly important role in financing developments, supplementing possible own resources. If the local government considers itself a market operator, and the development of a given service as that of a marketable product, then these resources can be targeted more easily.
A sustainable way of financing requires new forms of cooperation with investor partners, which could vary from project-level collaborations and sectoral partnerships to the joint ownership of the entire operating and development organisation.

5.1.3 Strategic Planning

[B] Strategic Planning

The next chapters help settlements establish their future developments, outlining the main steps of forming a strategy, which is at the same time the strategy for implementing the ***[A] Internal Framework for Local Government Operations***.
Besides the ***[B1] Situation Analysis***, the ***[B2] Preliminary Summary of Operations***, and the ***[B4] Overview of Previous Strategies***, the summary of relevant results on the six sub-systems[76] of the ***[B3] City Evaluation*** (smart mobility, smart environment, smart citizens, smart living, quality of life, smart governance, and smart economy) are also part of establishing a strategy. This – like the above– includes the 'SMART'-related strengths and weaknesses of the city, which serve to complement the ***[B5] SWOT*** chart. Based on these analyses, the settlement's ***[B6] Vision*** can be formulated, which should be easy to communicate, based on local characteristics and acceptable for every actor affected. Mediating between the desired vision that fits into national and international frameworks and local needs, resources and opportunities is the ***[B7] Goal Matrix***.

[B1] Situation Analysis[77]

For a settlement to plan medium or long-term developments, it is necessary to explore its characteristics, situation, resources and opportunities. Therefore, the first step of strategic planning should always be a situation analysis. The aim of this phase of work is to summarise, along with the central definition of the smart city, the results and conclusions of analyses constituting the basis of the Integrated Settlement Development Strategy.
In the development period of 2014–2020, the binding documents for settlement developments are the **Settlement Development Concept** and the **Integrated Settlement Development Strategy**. Underlying these strategic documents is an highly detailed **Preliminary Study** that presents the current situation of settlements, and is partly based on registered data from the TeIR information system of Lechner Knowledge Centre. It is advisable to complete the situation analysis based on this document, backed by additional studies and more up-to-date data. Questions and themes supporting additional studies are grouped here according to the specialised sections of the Foundational Study. The sequence of these sections follows that of the methodological proposal for Settlement Evaluation and Monitoring.[78]

[76] Smart City Tudásplatform - Metodikai javaslat, Lechner Tudásközpont, (2016, Lechner Tudásközpont)

[77] ***Relevant regulatory and development documents:***
Government Decree 314/2012. (XI. 8.) on the concepts of settlement development, integrated settlement development tools and strategies, and their special legal institutions

[78] Településértékelés és monitoring - módszertani javaslat, Lechner Tudásközpont, 2016

- **Society** *(E.g. To what extent does the age composition, level of education, income situation, etc. of the population support the spread of smart solutions? What potentials and obstacles help and hinder the development processes?)*
- **Human infrastructure** *(E.g. What are the already ongoing smart processes in institutions of education, healthcare, community education, culture, social care, as well as sports facilities, and what are the obstacles yet to be overcome for the sake of development?)*
- **Economy** *(E.g. Does the current business structure facilitate the spread of smart solutions? Based on the business structure, are there collaborative and business potentials for realising future investments and increasing competitiveness? Is there a basis for a creative and green economy?)*
- **Landscape and natural features** *(E.g. What are the most important landscape and natural features affecting the settlement's recognition and tourism, and what smart devices could be applied to disseminate knowledge about them? What conflicts need to be solved in order to improve the settlement's environment and quality of life? What are the city's potentials for renewable energy consumption and production?)*
- **Green surfaces** *(E.g. To what extent do they improve local micro-climatic conditions? What kinds of use value do they have? What conflicts need to be solved in order to strengthen the role of green surfaces in public welfare?)*
- **Built environment** *(E.g. How widespread are smart solutions in households? What are the most important features in the settlement's built environment affecting its recognition and tourism, and what smart devices could be applied to disseminate knowledge about them? What is the current state of buildings' energy efficiency, and what does their energy map look like? What energy-related local regulations and measures are in effect for new buildings?)*
- **Transport** *(E.g. What are the already existing smart solutions in a settlement's transport system – community, bicycle, car, truck, railway, etc.? What further opportunities and obstacles affect development opportunities?)*
- **Public utilities** *(E.g. What developments are necessary for basic public utilities to provide living conditions of smart city standards? What changes can be observed in the energy consumption of the settlement? What is the condition of central energy supplies (district heating), and what are the opportunities for their modernisation? What kind of service quality do the settlement's communication service providers offer?)*
- **Environmental protection** *(E.g. To what extent does the settlement's environmental condition conform to expectations about the quality of life? How environmentally aware are the residents? What community programmes are there concerning environmental protection? What are the major conflict areas, and what problems could be solved with the help of smart solutions? What is the share of renewables in the settlement's energy mix? What local initiatives and support systems are there for energy efficiency?)*
- **Disaster management** *(E.g. Are there any established forecasting systems in the settlement? What solutions exist or are possible for residential disaster alert?)*

- **Urban climate** *(E.g. How vulnerable is the settlement to climate change in terms of exposure, sensitivity and adaptability? How does this affect human health, the economy, water management, etc.?)*
- **Local governmental management, tools, and the institutional system** *(E.g. What is the share of the development of smart solutions, the improvement of the quality of life, the modernisation of public services, etc. in the local government's budget? To what extent are citizens and other stakeholders included in determining this? Are there any referents, groups, committees, or forums related to strategic planning, energy modernisation, or environmental protection?)*
- **The possible spillover of urban developments into the sphere of influence** *(E.g. What kind of cooperation exists between the settlement and its environment, and what are the affected areas? Are there common strategies and complementary development ideas?)*

At the end of each specialised evaluation, it is necessary to include a short summary, the highlights of which can be applied as SWOT elements (e.g. "*Favourable conditions for renewable energy use* – strength: these conditions strengthen the city's adaptive potential to today's environmental challenges.") Furthermore, the supporting work phase should also make clear the differences between the 'SMART' potentials of various city neighbourhoods (e.g. the importance of public utility cards in segregated neighbourhoods; that of signalling systems and surveillance cameras in ageing neighbourhoods).

[B2] Preliminary Summary of Operations

The ***[A1] Investigation of Local Government Operations*** and the implementation of the established ***[A2] Operation Model*** and ***[A3] Business Model*** not only defines new goals, but designates concrete measures as well.
Based on a review of the ***[A1] Investigation of Local Government Operations***, the organisational and business models can be outlined, which consider existing local settlement management solutions, complement them with internal and external resources, and enable the expansion and successful long-term functioning of the development and service portfolio.
Based on the summary, it is possible to determine concrete tasks that are indispensable for the development of actors partaking in settlement management and the relationships between them; providing the necessary competencies and resources for development and operating tasks; and building relationships between settlement management and local residents, businesses, and other stakeholders.
The implementation of the ***[A2b1] Service Matrix***, the ***[A2b2] Local Data Policy*** and the ***[A2b3] Operation Monitoring*** generates concrete measures and projects.

[B3] City Evaluation

Part of laying the foundations for ***[B] Strategic Planning*** is the city evaluation and a summary of its results related to the aforementioned six sub-systems.[79] Similarly to the above, this should include the strengths and weaknesses of the evaluated city, serving to complement its ***[B5] SWOT*** analysis.
Due to deviations in conditions and levels of development, the evaluation system is defined according to settlement types, and is applicable to cities with county rights in its current state. The aim of the evaluation is to determine the relative development levels of cities within each category, based on indicators of the six sub-systems.
Once a city's position is determined in each of the six sub-systems, the evaluation system compares it with the average value for the given settlement category, analysing the city's strengths, and weaknesses that need to be improved. The evaluation consists of a quantifiable data-based section, accompanied by a textual summary.
The first survey/audit/status report recording the city's initial state shall be followed by annual evaluations, enabling the continued monitoring of cities' development, and the shifts within individual sub-systems.

[B4] Overview of Previous Strategies

As far as possible, a new strategy or concept builds upon the results of existing strategies and developments. This requires cities to collect and process their hitherto completed strategic material (from the beginning of the EU business cycle of 2006). It is recommended to organise strategic documents systematically to examine the validity, relevance and connections of a given document to other ones in effect.
It is useful to summarise the goals set in various documents, and the results the city expects or expected over different timeframes. Still relevant and valid objectives and measures should be compiled in a table with the help of the six sub-systems[80] mentioned previously (**smart mobility, smart environment, smart citizens, smart living**, **smart governance, and smart economy**).
With regard to completed major developments, summing up results and key conclusions is important. How successful was the development? Has the city reached the goals it set? If not, what were the difficulties and obstacles? Were there any positive or negative side effects of the measures implemented? What problems and difficulties arose during the operation and maintenance of the investment?
The textual summary should discuss the extent to which the goal matrix, emerging from previous documents still relevant to the city's future, conforms to the basic definition of the Smart City Methodology.

[79] Smart City Tudásplatform - Metodikai javaslat, Lechner Tudásközpont, (2016, Lechner Tudásközpont)
[80] Smart City Tudásplatform - Metodikai javaslat, Lechner Tudásközpont, (2016, Lechner Tudásközpont)

Smart City Methodology:[81] a development methodology for settlements and settlement groups to improve their natural and built environments, digital infrastructures, and the quality and efficiency of local services through the application of up-to-date and innovative ICTs, in a sustainable manner, and with the increased inclusion of their residents.

[B5] SWOT

The SWOT analysis consists of the most significant conclusions and facts drawn from city-related situation analyses, preliminary plans and local information. The components of the SWOT analysis should be clearly identifiable in the ***[B1] Situation Analysis***, the ***[B2] Preliminary Summary of Operations***, and the ***[B3] City Evaluation***. The more specific the statements, the more they serve to determine intervention logic and development directions. The city's internal attributes (strengths, weaknesses) and external factors affecting smart city development directions (opportunities, threats) **should be identified with the inclusion of local actors, jointly finalising the SWOT elements.**
The SWOT analysis connects the identified facts with strategic aims. By filling in the table, measures and interventions constituting the basis of the prospective strategy's ***[B7] Goal Matrix*** become available.

[B6] Vision[82]

One of the main challenges of planning is detaching ourselves from our everyday problems. Involuntarily, we are trying to solve these issues first, instead of looking to the future and outlining a comprehensive image and a vision to strive for. When formulating a vision, stakeholders declare the kind of 'future' they want to achieve according to their desires and needs. Reaching a consensus and identifying common elements help set the main planning directions and goals, whereas other individual ideas add further nuances to the image.
Formulating a vision should be an **iterative and cooperation-based process** included in the ***[A2a] Partnership Process***.
Asking the right questions is vital: **how do we want to see the city in 10–20 years, and what kind of city do we want our children to inherit?** We can answer these questions by working together or in smaller groups. By summarising results, we can gain a consensual vision, alongside potentially contradictory aims and recommendations. It is crucial that the community receives feedback, and that

[81]Government Decree 314/2012. (XI. 8.) on the concepts of settlement development, integrated settlement development tools and strategies, and their special legal institutions

[82] ***Relevant regulatory and development documents:***
Government Decree 314/2012. (XI. 8.) on the concepts of settlement development, integrated settlement development tools and strategies, and their special legal institutions
Government Decree 218/2009. (X. 6.) on the content requirements of regional development concepts, regional development programmes and spatial plans, and the detailed rules of their interrelations, drafting, harmonisation, adoption and publication

contradictions and excessive expectations are clarified, since the aim is to formulate a **shared and realistic** vision acceptable for everyone affected. Once we have arrived this far, the shared vision should be boiled down to one concise, catchy line, a sort of slogan, with a clear and understandable message for everyone. The vision thus formulated is an important link in the community planning process, since it ensures that the actors representing different sectors and planning in smaller groups are heading in the same direction, thereby laying the foundations for a coherent strategy free of internal contradictions.

The vision should also include the opportunities opened up by smart technologies, smart data and smart collaborations, and integrate them into the city's main socio-economic, political and environmental strategies.

The above-mentioned concise vision demands justification by summarizing and elaborating on how stakeholders imagine the future of a given city. It should also discuss how the development and future state of individual sub-systems are affected, and how to measure the achievement and realisation of the vision.

[B7] Goal Matrix

By making urban operations 'smart', a city also has to create a policy of continuous development – in other words, it should incorporate the regular revision of goal matrices and measures into the ***[A2b] Operational Structure***. To this end, one of the aims of the Smart City Methodology is to compile the city's various sectoral and comprehensive strategic documents into a unified framework, and to establish a goal matrix that may become the basis for future documents across different sectors and topic areas. A settlement's goal matrix should conform to comprehensive national and international development goals and professional documents that lay the foundations for the directions and financing frameworks of medium- and long-term developments. The goal matrix mediates between local needs, resources and opportunities, and the desired vision that fits into national and international frameworks.

When presenting goals hierarchically, the needs, suggestions, and steps supporting their fulfilment have to be justified. It is also advisable to elaborate on correlations with other goals and sub-systems. As a principle to follow, lower-order goals should be identifiable in higher-order ones, along with an explanation of interventions.

The formulated goal matrix has to correspond to the city's previously established and updated strategic aims. The goal matrix of smart city developments should function as an umbrella for the goals of strategic/development documents that are decisive in the city's development and planning.

In any kind of development, a smart city should conform to the following four horizontal principles:

- improving service quality and efficiency,
- saving energy and other resources
- involving citizens and improving quality of life
- creating economically self-sufficient systems

It is also possible to build the goal matrix from the bottom up, alongside the formulation of measures and interventions. There is no methodological significance of whether strategic aims develop around planned interventions first, and then culminate in overarching goals, or the other way round, i.e. consensual decisions determine broader visions, which are subsequently divided into strategic objectives and measures. A goal matrix is clear and coherent when the structure of its logic remains unimpaired.

[B7a] Conforming to domestic and sectoral development documents

The established goal matrix and corresponding measures should conform to the aims of EU-level, national and relevant sectoral strategies. Elaborating on these connections is necessary for embedding the settlement's goals into the national and international sphere, and for ensuring that it conforms to national and international frameworks. This helps identify and secure connections to the programmes that may partially finance the measures necessary for achieving p goals.

[B8] Measures

Measures are the defining steps towards achieving goals. Their relationships to one another are clarified in the ***[B7] Goal Matrix***, and their place in the entire development programme is defined in the ***[C5] Development Roadmap***. It is important to keep in mind that objective-oriented measures may change over time due to internal and external circumstances, especially in terms of the steps of their actual implementation. It is therefore advised to include a more detailed elaboration on specific measures within the ***[C] Action Plan.***

5.1.4. Action Plan

[C] Action Plan

The action plan sets out the path toward reaching goals. It should provide sufficient facts and details to make clear

- what characteristics and needs it builds upon,
- that there is real chance of achieving targets, and
- that the partnership possesses the knowledge and procedures guaranteeing the effective implementation of developments.

At the same time, a certain degree of flexibility should be maintained in order to be able to react to unpredictable or changing circumstances.

[C1] Measures

Measures are the defining steps towards achieving aims. Their relationships to one another is clarified in the ***[B7] Goal Matrix***, and their position in the entirety of the development programme is defined in the ***[C5] Development Roadmap***. In the case of these measures, it is important to keep in mind that they may change in time and due to internal and external circumstances. Therefore, it is advised to organise them into data sheet format. After formulating specific ***[C1] Measures*** and ***[C1a] Projects***, it is worth including key actors in thinking about the steps, changes and measures that would produce instant or short-term results, i.e. ***[C1b] Quick Wins***.

Proposed contents of Measures data sheets:

- ***Measure:*** *Naming the measure.*
- ***Strategic aim:*** *Description of the strategic aim to be achieved through measures.*
- ***Justification:*** *Explaining in a few sentences what factors support the necessity of the measure; referring to the conclusions of the situation analysis, SWOT analysis, and/or local needs, as well as how the measure contributes to achieving the above-mentioned strategic aim and the comprehensive goal. Which of the six smart city sub-systems is developed through the implementation of the measure in question? Which city evaluation criteria are targeted for improvement?*
- ***Connections:*** *The measure's synergies and possible complementary nature should be defined; e.g. what other measures are necessary to carry out at the same time to have the most effective positive impact; and in what kinds of integration does it serve the achievement of goals the most? The role of measures within the context of smart city sub-systems should also be explained.*
- ***Contents of the measure:*** *Describing the actions to be implemented; what steps and components constitute the measure.*
- ***Eligible activities and project proposals:*** *Listing the projects belonging to particular measures.*
- ***Beneficiaries:*** *Defining, by project, the beneficiaries eligible for funding.*

- ***Project selection criteria:*** *Selection criteria guarantee that aid is actually granted to projects contributing to reaching strategic aims. Therefore, the criteria defined under individual measures should be in logical correlation with goal(s) corresponding to the measures, as well as the contents of smart city sub-systems. This section should define a few content-related principles that determine project selection for a given measure. Selection criteria should at all times be specific, transparent and traceable, in order for their contents to be clearly identifiable during decision preparation, implementation and external audit.*
- ***Output indicators:*** *Target values should be proportionate to the resources allocated to the measure. Further indicators may be added to the following compulsory ones:*
  - Number of funded projects
  - Number of funded beneficiaries, broken down by category (businesses, local governments, civil organisations)
- ***Result indicators*** *measure the efficiency of a project's operation. Responsible actors, the planned frequency of measurements, and the methods of data processing and evaluation should also be indicated, clarifying which actors are authorised to intervene in projects based on the results.*
- ***Communication:*** *a communication strategy is necessary for the introduction of a given measure and the achievement of its aims. This section should describe its main elements, scheduling, and dedicated resources guaranteeing implementation.*
- ***Education:*** *Is education necessary for the successful implementation and long-term functionality of the measure? If so, which actors' education is planned to be used, in what form, with what kind of tools, at what rate, and from what resources?*
- ***Business plan:*** *Planning the financial background and financing model necessary for the successful implementation, long-time functioning and maintenance of the measure.*

[C1a] Projects

Individual projects may be defined as part of ***[C1] Measures***. Their position in the entirety of the development programme is defined in the ***[C5] Development Roadmap***. Just like in the case of goals and measures, it is important to keep in mind that projects may change over time and due to internal and external circumstances. Therefore, it is advisable to organise them into data sheet format.

Proposed contents of Project data sheets:

- ***Project:*** *Naming the project.*
- ***Developer:*** *The institution, business, civil organisation, etc. responsible for carrying out the project.*
- ***Project promoter:*** *The person responsible for the project and their contact details.*
- ***Justification of the project****: Explaining in a few sentences what factors support the necessity of the project; referring to the conclusions of the situation analysis, SWOT analysis, and/or local needs, as well as how the project contributes to achieving the*

above-mentioned strategic aims and comprehensive goals. Which of the six smart city sub-systems is developed through the implementation of the project in question? Which city evaluation criteria are targeted for improvement?

- ***Connections:*** *The project's synergies and possible complementary nature should be defined; e.g. what other projects are necessary to carry out at the same time to have the most effective positive impact; and in what kinds of integration does it serve the achievement of goals the most? The role of the project within the context of smart city sub-systems should also be explained – what would happen in the absence of the development?*
- ***Contents of the project:*** *Describing the actions to be implemented, and the steps and components that constitute the project.*
- ***Aim of the project, expected results****: Describing the desired results and effects of project implementation. Be aware that the project goals should contribute to at least one medium-term strategic aim.*
- ***Output indicators:*** *Target values should be proportionate to the resources allocated to the project. Further indicators may be added to the following compulsory ones:*
  - Tangible and quantifiable results of activities listed in the project contents
  - The number of targeted subjects reached, broken down by type (resident, business, local government, civil organisation)
- ***Partners, stakeholders****: The most important stakeholders, especially the partners contributing to implementation and the ones to be included in the project.*
- ***Preparedness:*** *(a) Project idea: preliminary material has not been created yet. (b) Project initiative: preliminary material already exists (e.g. preliminary studies, authorisation plans). (c) Project plan: a detailed concept is already formulated (e.g. the documentation of a former project that did not win).*
- ***Total costs (one-time):*** *The total expenses of the project, including costs of preparation, implementation, and the requisite communication and education costs.*
- ***Maintenance costs (ongoing)****: The expenses of project maintenance and results monitoring.*
- ***Scheduling:*** *The expected launch date and duration of the project.*
- ***Resources:*** *Forms of financing project implementation and subsequent operation.*

[C1b] Quick Wins

A quick win is a planned component of developments, and its **results manifest themselves in the short run**, ahead of or complementing long-term outcomes. The actual results and perceptible effects of large-scale, multi-actor developments often differ significantly. This may present a problem concerning their social and community integration, as well as the maintenance of political or financial support. Quick and well-structured steps showing spectacular results can maintain continuous awareness of measures, and provide an opportunity for the testing and flexible adaptation of certain development elements.

It is important that quick win elements should strongly correspond to the actual goals and contents of measures, thus increasing their credibility. However, planning extremely costly campaign-style elements is not necessarily advisable –

instead, it is much more important that the effects build upon one another, gradually and continually strengthening the awareness and acceptance of measures.

[C1c] Business Plan

The specific business plan for individual measures should cover not only the investment costs of each project, but also the expenses of the communication and educational steps necessary for their successful implementation, and the costs of processes ensuring the measurability of projects' success.

[C2] Implementation Plan

The ***[C2a] Development Partnership Plan***, ***[C2b] Development Communication Plan*** and ***[C2c] Development Education Plan*** essential for development implementation should be based on the previously mentioned tables of measures. These documents help compose the implementation plan relevant to the whole development programme, and describe the hierarchy and interconnectivity of developments and corresponding steps supporting implementation. In the process of scheduling, one should consider which **forms of partnership ([A2a1] Partnership Plan), communication ([A2a2] Communication Plan)**, and **educational events ([A2a3] Education Plan) promoting the city-as-a-service approach** constitute a general framework that provides a context for the implementation plan determining development phases. **[C1b] Quick Wins**, jointly decided upon with partnership actors, should also be considered.
Importantly, the implementation plan requires constant revision following the progress of smart city developments, and continuous feedback. Key actors previously left out or excluded may join in, potentially changing the coordinating organisation and the composition of groups. Implemented measures may expose unpredictable problems, and necessitate tests and new means of communication. Similarly, educational contents and methods may change.

When scheduling smart city developments***, the following proposals demand consideration***: [83]

[83] Based on PAS 181:2014 Smart City Framework (2014, BSI Standards Publication)

- *low-investment projects with quick wins should be prioritised*
- *steps necessary for system-level transformation should be prioritised, based on the results of the interoperability test of existing city services*
- *before beginning widespread dissemination, the steps of introducing a new service should include feedback from early user experience*

[C2a] Development Partnership Plan

Compared to the *[A2a1] Partnership Plan* concerning city operations, this document is different in terms of key actors, but not in its method of establishment. Also included in the data sheet of individual ***[C1] Measures***, user groups of a given development should be identified, along with their inclusion in shaping development contents, and possibly in their actual implementation. Furthermore, ways of user participation in measuring development effects and providing feedback to the city administration should be investigated, as well as the costs of individual steps and the potential sources of financing. Corresponding actions should be scheduled in conjunction with the planning of a development, and included in the ***[C2] Implementation Plan***.

[C2b] Development Communication Plan

In comparison to the *[A2a2] Communication Plan* concerning city operation, this document schedules the means and events of communication necessary for implementation, which also need to be indicated in the data sheet of the ***[C1] Measures***. It is worth thinking about the timing, audience and kinds of media through which to provide information and establish two-way channels of communication. Furthermore, the costs of individual steps and potential sources of financing should also be specified. The scheduling of corresponding actions should go hand in hand with the planning of a development, and included in the ***[C2] Implementation Plan***.

[C2c] Development Education Plan

Compared to the *[A2a3] Education Plan* concerning city operation, this document sets out the educational steps and tools necessary for the implementation and long-term functionality of measures. This is also to be indicated in the data sheet of the ***[C1] Measures***, specifying whether the utilisation, effective operation and maintenance of a planned development requires the motivation, information or training of stakeholder user groups with different backgrounds and opportunities. The audience, form, tools and planned duration of necessary trainings and information campaigns should also be indicated, alongside the costs of individual steps and potential sources of financing. Corresponding actions should be scheduled in tandem with the planning of a development, and included in the ***[C2] Implementation Plan***.

[C3] Financing Model

In order to establish a financing model, various ***[C3b] Development Resources*** and ***[C3c] Operational Resources*** should be located. If a project is backed by

profitable financial planning, financing opportunities arise from various reimbursable resources and market instruments.
The city should also identify the local and global actors who would benefit from the new types of infrastructures and services, and ask what their business benefits are from the development. Would it result in more efficient resource management? How invested are they in realising these benefits, i.e. are they potential ***[C3a] Financiers***?

[C3a] Financiers

The implementation of planned ***[C1] Measures*** may not only occur via dedicated funding sources.
Depending on the given service, business financing resources may require new kinds of collaborations with changing partnership forms (e.g. longer-term, more risk-oblivious and wider in scope) and return paths, even on the part of business operators. An innovative solution is the incorporation of various forms of community funding into the implementation of developments.
These new kinds of collaborations function effectively when they are partnership-based, and therefore it is necessary to map out possible ***[A1c] Partners*** and existing ***[A1d] Forms of Cooperation***. City residents, local businesses, and civil organisations may not only act as users and stakeholders, but also as financiers; for which the city should establish a framework as a part of its ***[A] Internal Framework for Local Government Operations***.

[C3b] Development Resources

For a successful implementation of smart city developments, the city should explore further funding opportunities besides the previously identified ***[A1e] Forms of Financing***.
Appropriate resources should be assigned to the measures of the goal matrix: internal sources, external market sources (with their types indicated), or aids (with their precise identification).

Forms and features of external support for the implementation of smart city developments:

- ***Non-repayable support:***

Non-repayable support is a direct financial contribution that does not have to be paid back. Its source may be the EU budget, including one of the EU institutions, organisations (e.g. Horizon 2020 programme), or member states (e.g. domestic operational programmes) as direct providers of funding. It may also be granted from the central national budget or local government resources. Supports should at all times be provided in accordance with EU regulations on state aid, which fundamentally determine the conditions of aid applications, such as eligible applicants (beneficiaries), aid intensity, and eligible costs.

- ***Financial instruments:***

Financial instruments are repayable aids. They are instruments of ownership or partial ownership, taking the form of investments, loans, collaterals, or other means of risk sharing, which may occasionally be combined with non-repayable funds. The terms of application for financial instruments are typically more favourable than market conditions, and EU regulations on state aid apply here as well. The programming period of 2014–2020 gives special attention to financial instruments (8th funding priority of the Economic Development and Innovation Operational Programme), and planned EU concepts predict that resource allocation rates will be shifting further towards financial instruments.

- ***Repayable support:***

Beneficiaries have full repayment obligations on repayable support, which is not to be confused with financial instruments (credit, capital, and guarantee). The two forms of support are distinguishable: if the aid is not equivalent to one of the financial instruments, but defines repayment rules, then it should be considered repayable support. The distinction is significant due to EU regulations, since different rules apply to the two categories. In the programming period of 2014–2020, repayable supports are not involved in Hungarian Operational Programmes.

The above listed forms of support can be combined, and a complex smart city development project may be implemented through a mix of different types of funding.

The forms and features of external market resources for the implementation of smart city developments are as follows:
The above described financial instruments (credit, capital, and guarantee) belong to this category; compared to aids, here the resources are provided either by market actors or the state as a market operator (market economy operator through the application of market conditions). Therefore, applying for market-based financial instruments entails stricter conditions than financial instruments provided through aids.
During the planning and implementation of smart city projects, choosing the right resource combination is crucial. The forms of financing described above – aids/support and market resources – may be combined, allowing ample room for planning. It is recommended to explore all funding opportunities, since resting on multiple pillars is key to successful project implementation. We should bear in mind not only the initial investment needs of a given project, but the serious costs of maintenance as well. To cover these expenses, we may occasionally count on various support resources.

[C3c] Operational Resources

For each project, returns expected at the level of the whole service/project matrix may involve significant profit, or public services requiring long-term financing. In

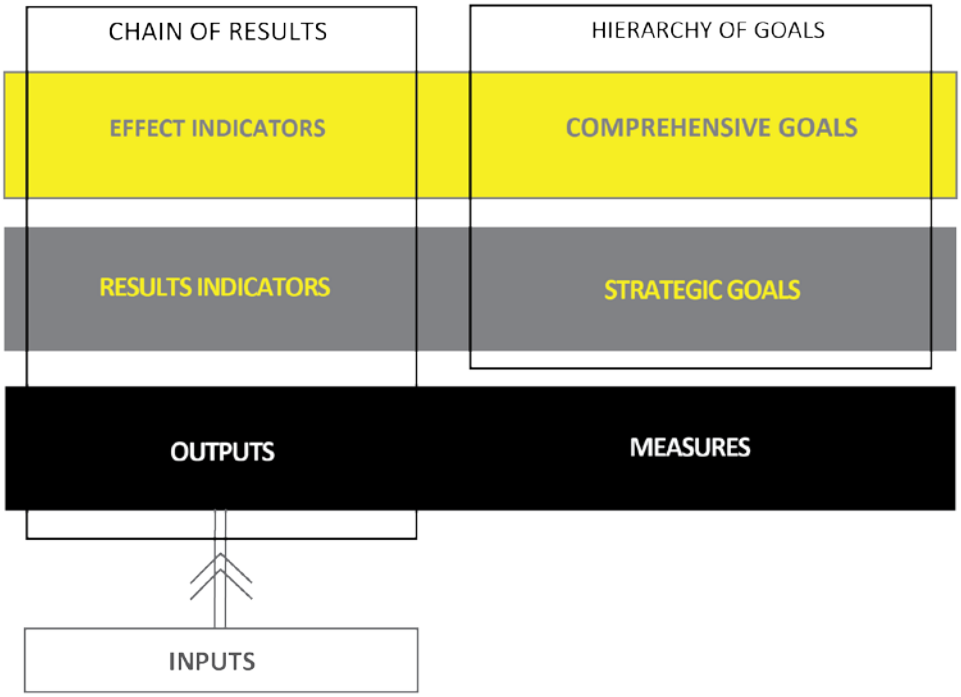
the case of the latter, the proper measurement and detection of realised social benefits is necessary (defining indicators and benchmarks).

[C4] The Monitoring of Developments

For development implementation, it is essential to establish an effective monitoring system. A basic requirement is that it should support the goals formulated in the ***[B7] Goal Matrix*** and the Smart City Methodology, provide a follow-up for preliminary expectations and assumptions, and at the same time be dynamically adaptable to requirements, identifying critical points and making necessary changes and modifications possible.

[C4a] Indicators

The completion of the ***[B7] Goal Matrix*** is monitored via indicators corresponding to target hierarchy levels, as shown in the following illustration:



A COHERENT SYSTEM OF GOALS AND INDICATORS - Lechner Knowledge Centre

Effective urban development requires a definition of indicators at the level of measures and projects. Since the Smart City Methodology should in principle serve both the fulfilment of the goals of operational programmes that provide development resources and the long-term aims of the city's other strategic documents, *outcome indicators* should be assigned to general objectives. The municipality should preferably determine these indicators. Outcome indicators are complex, reflecting the results of multiple measures. Therefore, it is advisable

to attune outcomes to beneficiaries' goals. The monitoring system to be established should conform to the EU's resource use directives and the settlement evaluation and monitoring system of Lechner Knowledge Centre.

In relation to the proposed indicators, we may define

- *target values,*
- *the frequency of measurements,*
- *the establishment of incentive systems, and*
- *the appointment of responsible parties.*

[C4b] User inclusion

Besides contributing an added data source, user inclusion in development monitoring is a two-way process: the opportunity of participation also improves project support and sustainability. Citizen inclusion may occur via traditional means (surveys, questionnaires, focus groups, etc.), and to a growing extent through digital methods or users' own devices. Thus, measurements may end up on the same platform as specific services, resulting in continuous data provision rather than campaigning.

The process of user inclusion requires careful planning. It should be established simultaneously with development planning and implementation, confirming necessary steps in the ***[C2a] Development Partnership Plan***. It is also important to deal with digital competency gaps revealed during previous assessments. Therefore, when planning the steps of the ***[C2c] Development Education Plan***, they should be addressed separately, determining the appropriate tools and necessary resources.

[C4c] Feedback process

Measuring development efficiency is only useful and effective if the city is capable of evaluating and processing collected data, and drawing possible conclusions from them. Should a development fall short of expectations, it becomes necessary to review, modify and transform the given service or its implementation. For the processes of monitoring, evaluation, revision, and modification, an organisation with decision-making and intervention rights should be set up, comprising all service users who participate in the monitoring process, the strategic and operative branches of the city administration, the operator of the given service, the company implementing the development, and the financier alike.

[C5] Development Roadmap

The development roadmap is the schedule of a project, clarifying the system of relations in a city's operation and the specific steps of planned developments. The roadmap helps to coordinate and make transparent the measures or projects that require the same procedures and, considering the entire development, the steps to prioritise for successful implementation and financial feasibility. It is also

suitable for reviewing whether the necessary resources are available at the busiest points and periods of projects, whether developments need to be re-scheduled or supplemented, or if planned actions need to be adapted to changing needs and realities.
The roadmap should mark the decisive milestones where a partial feedback collection and review is necessary for the process. Periodically, it is advisable to schedule projects that produce quick and spectacular results with minimal investment, ensuring the continuous interest of city residents.
The roadmap coordinates the ***[C1a] Project***, ***[C1b] Quick Wins***, the partnership, communication and education procedures of the ***[C2] Implementation Plan***, and the ***[C3] Financing Model***. The aim is to collect and manage every step, planned task and necessary expenses within one coherent system.

[C5b] Action plan

With the help of the ***[C5] Development Roadmap***, a detailed action plan may be formulated for the forthcoming two years, examining feasible projects, their correlations and recommended connections, the availability of resources (e.g. own contributions), and other liquidity issues. It is advisable to identify the key projects indispensable for reaching the set objectives, or the procedures that constitute an axis for corresponding projects to be based on.

5.2. Directives and evaluation criteria of establishing the Smart City Development Model

- ***Open and cooperative:***

A successful Development Model mentions the planned platforms that aid cooperation between various innovative sectors and organizations, presents ideas on resident participation, and connects institutions responsible for developments, actions, and targeted beneficiaries and communities. It states the framework for the continuous improvement of urban operations and necessary actions, while creating a transparent and easy-to-follow planning and decision-making process that urban actors can feel involved in. It declares its goals and expectations in relation to planned platforms of smart urban technology.

- ***Citizen and business-centred:***

It builds upon citizens' and businesses' realistic needs and expectations towards the city and its operation, indicates possible incentives facilitating creative and active participation, and presents the scheduled introduction of co-design and co-production measures concerning the transformation of city services. The planned transformation of urban operations is not merely about benefitting residents and businesses, but also, crucially, about their cooperation.

- ***Participation-based:***

It is inclusive, based on local needs and ideas, and with the contribution and support of urban actors, communities and businesses.

- ***Integrated:***

It coordinates solutions for demands identified by local actors while keeping in mind the existing urban, regional, national, or EU programmes, as well as other local resources.

- ***Economically sustainable:***

It builds consistently upon the city's resources, special characteristics, existing skills and identified external opportunities, while seeking new organisational and operational solutions for minimizing risks and shortcomings.

- ***Digital:***

It elaborates on the digital connections and integration of the city as an organisation, the urban actors and the material environment, and introduces planned steps towards complete digitalization. Furthermore, it sets the city's goals for existing and nascent digital assets.

- ***Realistic:***

Its aims are clear and measurable, and the outlined development goals and action plan are logical and feasible.

5.2.1. Separation and definition of roles

Everyone in the daily life of a settlement should be an active participant of any of its urban development programmes. There are four main groups of actors, and the implementation process generates individual responsibilities, rights and obligations for each and every one of them, taking their own motivations into consideration. It is supremely important to clarify tasks and responsibilities, since it is counterproductive for actors to try to complete others' duties, without having agreed on sharing them. Therefore, functions and competences should be specified in smart city strategies.

Actors:

1. **Residents, local businesses and institutions**
   Ultimately, the best indicators of the success of an implemented strategy are the main designators of targets and directions. Their work may become a significant resource in settlement development, from planning to implementation and long-term maintenance. Motivations and opportunities include:

   - A more liveable and more comfortable settlement environment, and advanced public services, e.g. transport, public administration.
   - Improved living conditions, advanced education, healthcare, and social system.
   - Improved general wellbeing, and a pleasant and liveable city environment. Forming local attachments and a sense of responsibility towards the settlement. Strengthening community initiatives and participation.
   - Increased public safety, resulting from environmental developments, services and programmes.
   - Improved working conditions and opportunities due to a smart business environment. Family-friendly workplace solutions, and remote work systems.
   - Expanding digital literacy and internet access, resulting in increasing competitiveness on the job market. Better employment prospects.
   - Improvements in equal opportunities and e-inclusion due to various digital trainings and developments.
   - Opportunities for simple and effective participation in city development and public affairs. Continuous two-way communication with the city administration and other actors.

2. **Local governments and administration**
   The main task of local governments is to launch and organise smart settlement projects. It is their responsibility to convert the needs and ideas arising from local actors into strategic aims and instruments required for their achievement. They play a prominent role in establishing strategies by continuously mediating local needs, keeping sustainability in focus,

monitoring strategy implementation, and fine-tuning. Their motivations and opportunities include:

- Improving quality of life, establishing a sustainable and attractive city environment, where the number of active employees is increasing – or at least not decreasing – and the economy is expanding.
- Establishing and maintaining advanced urban services (public transport, public safety, e-governance, city cards, etc.), and contributing to a positive perception of the city and to the increase of stakeholder satisfaction.
- Developing an effective and easily operable urban infrastructure.
- Intensively increasing the city's knowledge capital: attracting educational and research institutions to the settlement.
- Encouraging investments, and facilitating the establishment of companies with an attractive economic environment.
- Increasing international recognition and competitiveness.
- Creating or affirming a unique identity that is different from other cities in the country.
- More direct, two-way communication and relationships between residents, market and institutional operators and the city administration; greater citizen satisfaction.
- Creating safer city environments.
- Cutting costs, and making operations more effective.
- The accumulation of political capital due to satisfied voters.

3. Market enterprises

The role of market enterprises is prominent, especially in the implementation of the action plan, since in this capacity they appear as solution suppliers and developers. Their motivations and opportunities are as follows:

- A predictable and simple local administration and a regulatory environment that supports smart developments, improves enterprises' business environment, and encourages cooperation
- Improving the local economy would also increase the competitiveness of local businesses internationally. Expanding export opportunities.
- Obtaining skilled, prepared, and creative workforce.
- An open and entrepreneurial local government, supplying open data for simpler and more efficient service developments.
- Settlements supporting smart developments create adequate incubation and innovation environments for starting and developing businesses, and provide opportunities for testing development ideas, as well as for living lab platforms, cooperative service providers and public institutions.
- Cost savings and efficiency gains achieved through smart city services may provide significant advantages for businesses.
- Direct revenue growth for businesses offering various services.
- Indirect revenue growth through a competitive economic environment; new investors move to the city.

4. **Central state administration**
   State administration plays a prominent role in the implementation of smart settlement strategies, especially regarding the transparency and standardisation of settlement tasks, developments, platforms and data, as well as the coordination of domestic and local services and institutions. Motivations and opportunities include:

   - Ensuring measurability and comparability by providing a central settlement evaluation and monitoring system, reducing initial expenses for settlements (audit), and helping them with future surveys and monitoring.
   - Providing certain service elements centrally, most of which cannot be managed in an economically sustainable way at the settlement level, or the interoperability of which is a basic requirement best provided at the state level.
   - Guidelines: formulating smart city standards, directives and applying them in practice.
   - Providing direct state or EU resources, and supervising and tracking use.
   - Creating more liveable, sustainable and competitive settlement models through supporting the establishment and implementation of smart city strategies.
   - Localising international good practices, and disseminating national good practices internationally.
   - Continuously shaping the legal environment, and removing legal obstacles.

5.2.2. The communication–education–development balance

After the completion of various development projects, they often fail to produce the expected results, and the reasons for this may not necessarily lie in an incidentally faulty implementation. In fact, it is possible that the targets had been insufficiently defined in the first place, and the implemented solutions satisfied these objectives perfectly, regardless of the results.

Oftentimes, problems are caused by a lack of attention to communication, and therefore the project fails to develop a proper relationship with its end users. This may pose difficulties as early as during preliminary surveys and the formulation of goals, but during the actual implementation of the project, it is especially important to update stakeholders about progress on a regular basis, and provide them with the opportunity to give feedback on results.

Education is equally important since, even if users are aware of the introduction of a given service or product, it cannot achieve the desired results unless people can use them and fit them into their everyday lives and routines.

Therefore, when devising any kind of smart city solution, special attention should be paid to the continuous and collective development and fine-tuning of the three pillars of services, education and communication.

During the establishment of the strategic and action plans, an external and internal communication and education plan should be produced. The communication plan is essential for ensuring the motivation of key actors, and for strengthening the commitment of citizens.

The efficiency of the communication plan can be maximised by a conscious and structured utilisation of all communication channels available.

5.2.3. Sustainability

Besides sustainability in a social and environmental sense, economic sustainability is also of vital importance in the establishment of smart city strategies.

The completion of a business plan should precede the launch of projects and the implementation of developments, providing for the resource needs of the initial investment, and the later operation and maintenance of various project elements. In the absence of this step, already implemented project elements have to be stopped and eliminated over time, or resources have to be reallocated from other services, which would ultimately result in the deterioration of service quality.

This is why it is necessary and worthwhile to consider projects as a complex whole since, if we look at a project as an entity made up of vertical project parts of services and products, it becomes clear that it consists of both profitable (e.g. energy efficiency investments) and non-remunerative (e.g. surveillance systems) investments.

As long as a good and realistic business plan is formulated as an attachment to a smart city strategy and action plan, the settlement can research resource options for already existing project ideas instead of looking for a specific project to fit available EU-level or domestic support. The business plan should clearly indicate the resources allocated to individual elements and profitability calculations. This way, the aid fulfils its real function, acting as a catalyst for developments and improving payback time.

Based on national and international experiences, both market and state resources should be included in developments, and smart city projects should also be realised through a mixed financing model.

Large investments may follow the support system and methodology of EU resources temporally and in terms of models and methods.

Some of the projects to be implemented may be financed through resources from various Operative Programmes, either as flagship programmes or as tenders, whereby the local government submits a funding application by composing a development programme, and then implements the project through public procurements. During the implementation of complex strategies, it is a major task to coordinate the different operational programmes launching at different times.

Past experience suggests that the financing of the operational period presents one of the greatest difficulties. Therefore, with regard to investments and services, the project and settlement administration should consider market-type financing models as well. From the very beginning, special emphasis should be given to creating new cost-efficient services that add to the revenues of the local government, along with establishing the organisational forms to coordinate the process.

5.2.4. Fostering social inclusion

Participatory planning succeeds if it starts at the early phases of planning. This means that key actors should be identified before the specific planning of project contents, and the process of community inclusion should be defined with their involvement. Since many settlements lack past experience in cooperating with local actors, ample time and energy should be devoted to building it up in the initial phase of planning. Of course, it is also important to retain and increase partner activity, and to provide clear and correct information continuously.

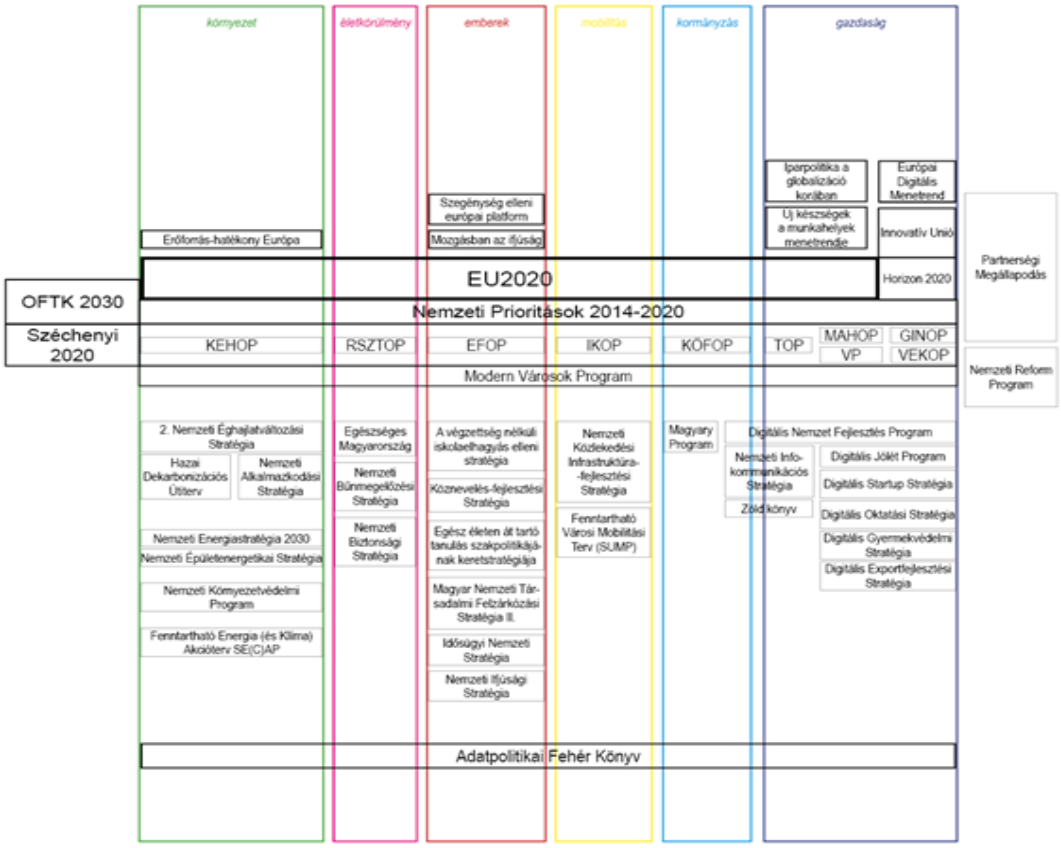
Necessary steps are as follows:

- The first proposed step of community planning is the **establishment of a group coordinating and managing the planning process**. It should consist of a few members and prepare the planning process, define the tools of communication and specify necessary procedures. Its task is to plan, process and evaluate the necessary research, proposals, surveys, questionnaires and data collection, as well as to provide continuous information.
- A tool supporting participatory planning is the **analysis of stakeholders**. This starts with the exploration and analysis of people, organisations, and institutions that potentially affect settlement development, and may later refer to selecting ways of involvement.
- The **joint focusing of the planning process** occurs in workshops, which provide an opportunity for both information sharing and ensuring the commitment of actors. Workshops may be organised thematically, or on a sectoral and territorial basis.

- In the next phase of the institutionalisation of the planning process, **thematic working groups** may form, managing the comprehensive planning of a specialised field, and assisting applicants later on.
- **Community planning** is an open learning/thinking process that individuals and institutions of the region are free to join, and those already involved may become even more committed to further projects and collaborations. Good communication is essential once again – first, it illuminates the frameworks and objectives of the process, and second, it gives an up-to-date picture of the current state of the planning process, the results achieved so far, and the anticipated steps.

5.3. The Smart City Development Model's connection to current strategies and programmes

The illustration below shows the place of the Smart City Development Model within the system of various concepts, strategies and programmes concerning Hungarian settlements. This model aims to be an encompassing compilation of the material created thus far through different strategies and programmes. However, its aim is not only to assign projects to resources used in accordance with various programmes, but to lay the foundations for sustainable long-term urban operations. To this end, it seeks to process previous material in an integrated fashion, while keeping in mind the already mentioned four horizontal principles: *improving service quality and efficiency, saving energy and other resources, including citizens and improving quality of life, and creating economically self-sufficient systems*.



CURRENT DEVELOPMENT PROGRAMS IN HUNGARY – Lechner Knowledge Centre

5.4. The Smart City Development Model's coherence with international standards

Many smart solutions applied in urban development and operations rely not only on local governmental partnerships, but on market-based, civic and educational ones as well. Expectations of business sustainability and innovative solutions, and the competition with products that are available worldwide and target both business and residential users require that these solutions be widely applicable and constantly improved. For this reason, it is essential that the means, methods, and measures of developments should be interoperable and internationally compatible, thus helping cities share data and experience with one another and aiding market operators, and civic and other parties in implementing commercially viable developments.

For now, only a few comprehensive international standards and directives exist in the field of smart development, but many more frameworks are currently being composed. The most widespread global platforms are applied in settlement

evaluation, strategic planning, technical solutions, data management and infrastructures. Upon devising the Development Model and formulating the general directives, we relied on two standards widely accepted within the European Union.

For the structuring of the Development Model, the steps of decision-making and horizontal aspects, we considered the British Standards Institution's *Smart City framework – Guide to establishing strategies for smart cities and communities* (PAS 181; 2014), a publication for British cities that also provides solutions for interoperability.

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Standards

Multiple groups within the International Organization for Standardization are currently engaged in the creation of documents on the smart city thematics. The central working group is TC 268 Sustainable development in communities.[84] The following includes standards already finalised and in progress.[85]

ISO 37120 Sustainable development & resilience of communities - Indicators for city services & quality of life
ISO/TR 37150 Smart community infrastructures - Review of existing activities relevant to metrics
ISO 37101 Sustainable development & resilience of communities - Management systems - General principles & requirements
ISO 37102 Sustainable development & resilience of communities – Vocabulary
ISO/TR 37121 Inventory & review of existing indicators on sustainable development & resilience in cities
ISO/TS 37151 Smart community infrastructure metrics - General principles & requirements
ISO/TR 37152 Smart community infrastructures -- Common framework for development & operation

The development of the British Standards Institute's (BSI) set of standards is coordinated with ISO standards for conceptual and operational interoperability.

BSI PD 8100:2015 Smart cities overview – Guide
PAS 180 Smart cities – Vocabulary
PAS 181 Smart city framework – Guide to establishing strategies for smart cities and communities

84 http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=656906

85 See the different types of ISO publications at: http://www.iso.org/iso/home/standards_development/deliverables-all.htm

PAS 182 Smart city concept model – Guide to establishing a model for data interoperability
PD 8101 Smart cities – Guide to the role of the planning and development process