Digital Development Strategy of the Kranj Smart City and Community for the period 2020-2023

The document was adopted by the city councillors of the City Municipality of Kranj (MOK) on the 19th regular session of the MOK City Council

1. Introductory definitions

The City Municipality of Kranj has adopted the Sustainable Urban Strategy of the City Municipality until 2030 which identifies the key development challenges of the City Municipality of Kranj as the centre of the Gorenjska region. The document also sets priorities by field and strategic objectives. The fact is that digitalisation can make an important contribution to achieving practically all of them.

Kranj strives towards becoming a city of opportunities; and also a sustainable, progressive and vibrant urban centre of Gorenjska. However, this overarching objective cannot be achieved without a well-organised, modern and efficient IT environment. Digitalisation is affecting practically all areas of life and work, and this will only become more pronounced in the future. Its development, based on well-thought-out strategic planning, is therefore essential for integrated development of Kranj.

We believe an easy to understand development strategy, which defines the core development concepts, specific areas and particular solutions, is the most effective basis for planning and accelerating the implementation of digital development. Furthermore, the strategy is open to new services, solutions and technologies that will become relevant in the future, so it is providing a robust basis for a longer period of development.

The aim of launching the Smart City Digital Strategy is to provide an organised ICT environment with clear coordination, integrated processes and platforms, understandable and accessible data as well as sufficient communication capacity. In such an environment, the existing and new solutions form a coherent whole with well-used information resources addressing the needs of citizens, business and city management.

In addition, the Strategy defines the development areas and some specific steps, giving it a useful implementation value in the near future.

A preliminary analysis of the state of digitalisation in the City Municipality of Kranj has shown that all key functions of the municipal administration are IT-supported and that a range of dedicated solutions are in place to support the work of the municipal administration and the needs of citizens. At the same time, however, the analysis has shown that the solutions are poorly interconnected, often deployed and managed on completely disconnected systems, and often poorly known and used by the target groups.

Therefore, the strategy is a development concept that will connect the relevant existing solutions and enable an accelerated development of new services in the integrated IT environment of the City Municipality of Kranj.

2. Assessment of the role of ICT in addressing the key challenges and objectives defined in the Sustainable Urban Strategy of Kranj

2.1. The image of the city and the development energy

Compared to the past decades, in the most recent period Kranj has lost its development dynamics, 2,500 workplaces and its identity as a progressive city. This was accelerated by the economic crisis and the collapse of traditional industry. Moreover, in terms of economic development indicators, Kranj lags behind the leading cities in Slovenia (Ljubljana, Novo mesto, Koper). Therefore, this trend must be stopped and reversed urgently. Furthermore, Kranj needs an accelerated economic transformation from an industrial to an enterprising city, based on modern technologies, services and tourism. Hence, it is necessary to encourage creativity, innovation and entrepreneurship; and to build the city's 'economic' identity on these values.

ICT is embedded in the broader concept of a smart city. As such, it provides an excellent basis for promoting an attractive environment for all types of economic activity, while the openness of platforms, data and cooperation also represents a specific competitive advantage for modern forms of digital entrepreneurship, which is particularly close to young people and start-ups. Furthermore, the city can stimulate creativity and innovation through specific challenges that provide entrepreneurs with a development opportunity, a pilot project and subsequent marketing in other environments. On this basis, cooperation has already been established in the framework of the 'Smart Mlaka' initiative, in which the companies in Kranj have shown great interest.

2.2.   Cooperation and communication at all levels

Weak cooperation and trust at all levels – between politics/administration, business and civil society, within and between sectors, between urban and rural local communities – slows the pace of change and the effectiveness of action. The fact is that a development breakthrough requires an open, transparent and one-way operation of the entire system. It is therefore considered prudent to integrate the programmes and the organisational aspects of public institutions with the aim of optimising the operations. In addition, overlapping in tasks and projects should be avoided.

This challenge is addressed very effectively by the concept of digital development, which is based on the outsets of the Sustainable Urban Strategy. Apart from that, it places equal emphasis on cooperation and openness of platforms and data, in addition to the technical solutions. Thus, open communication and cooperation in the field of digital development can have a significant impact on the broader cooperative and innovative atmosphere in the city, which is a prerequisite for harmonious and inclusive development. It is therefore necessary to involve all social groups in key development issues, from business and civil society to local authorities, as well as to bring together other environments in the Gorenjska region.

2.3.   Regional role of Kranj

Kranj has the status of a regional centre among Gorenjska's municipalities. The diversity of the region means that each of the municipalities has its own ambitions. This is why Kranj must keep its regional initiative, but, at the same time, strengthen cooperation with other municipalities. In the political dialogue, Kranj needs to continue strengthening its role as the regional centre and, regardless of the dynamics of establishing provinces in Slovenia, support the preservation and installation of new central activities in the city that are necessary and characteristic of the regional centre. It is only the concentration of a high-quality range of jobs, housing, services and social care services that provides the potential of an urban centre to which a large area gravitates.

The role of a regional hub that Kranj has been taking on, must also be supported in the digital environment. It is therefore important that the city proactively works out solutions for the wider region and engages other municipalities in the region in sharing or reusing the solutions, as well as leading by example in opening up data and platforms. In this way, it can become a regional development promoter with digital solutions positively affecting the development of the digital economy in Kranj. An example of such a regional approach could be a city loyalty-payment app/card, where expansion to a wider region and co-management of the entire system are foreseen from the start.

2.4 Coexistence of the city and the rural area

An important development challenge of the City Municipality of Kranj is to facilitate coherent development, functional complementarity and greater coexistence between the urban city centre, its suburban surroundings and the rural area. On the one hand, the majority of the population (75%) lives in the central urban part of the municipality facing specific problems of the old city, the urban and suburban districts and the degraded urban areas. On the other hand, the city centre is merged with flat suburban settlements passing into the hilly-mountainous hinterland under Jošt and Kriška gora. These places need a better connection with the city, the infrastructural equipment, access to public services and better use of synergies between the city and the rural area.

As for the coexistence of the city and the rural area, and the challenge of keeping the countryside populated in order to reduce the burden on the urban city centre, the ICT can help mainly in two aspects: digital infrastructure accessibility must not be a reason to migrate to the city centre for better living and working conditions; the other aspect is the availability of digital public services, as well as all other services reducing the need to physically visit the city centre for business or administrative matters. At the same time, with organised, transparent, targeted and attractive communication about what is happening in the city, we can attract the residents from the surrounding areas to events and thus maintain the link with Kranj as the centre of the municipality and a regional hub.

2.5. Jobs, business and investment growth

The City Municipality of Kranj has 22,552 jobs (2015), which is 2,562 fewer than in 2008. The decrease is mainly due to the decline in economic activity of large industrial systems. Consequently, Kranj is no longer an employment centre. What is more, half of persons in work are employed out of Kranj, of which 5,542 or as much as 25% work in Ljubljana. Unemployment has been falling since the crisis; however, it still stands at 2,390 or 9.5% (July 2015). Furthermore, 18% of the unemployed are under 30 years of age, and as much as 25% of the unemployed are in the prime age group of 30- to 40-year-olds. Therefore, Kranj has to change its attitude towards entrepreneurship as a whole, enabling new business activity and growth of domestic SMEs as well as consolidating the economic base also by attracting investments. (A challenge summarized from the Sustainable Urban Strategy which has changed significantly in recent years; however, the key difference remains that employment has shifted from large employers to a greater number of small and medium-sized business entities.)

The change in the structure of employers, from a few large industrial companies to a considerable number of smaller ones, also raises different expectations and the dependence of the economy on IT infrastructure. In other terms, large companies provide IT support for their business on their own, while small companies depend on the availability of eServices, public digital infrastructure in high performance, open data which they need for their business as well as development challenges. Additionally, flexible forms of employment (teleworking, working for different employers, collaborative economy, etc.), which are fundamentally based on the use of digital technologies, are becoming more and more widespread. Therefore, the development of digital infrastructure, eServices and the availability of data sources is an increasingly influential factor in a favourable economic environment, affecting both the performance and the development of existing entities, the attractiveness for new investments and the key challenge that we are facing as a country in this field – increasing value added per employee.

2.6. Concentration of ICT companies and technologies

Kranj is characterised by the concentration of companies and competences in the field of information and communication technologies (ICT). In recent years, the ICT Development Centre, a technology park, has been set up, providing the basis for further growth in the sector and for testing as well as bringing technological solutions to the local environment. The establishment of a smart community concept supporting efficient and sustainable city management represents one of the untapped internal potentials.

For the management of the City Municipality of Kranj, this challenge presents one of the key development opportunities, which is why a number of activities are already underway, building on existing local competences in the field of ICT and establishing a smart community concept. However, this concept needs to be implemented with two key objectives, both prerequisites for a smart community with a real impact on the living and working environment. The first objective is to establish a robust, integrated IT environment that will enable coordinated management, process integration, data sharing and sufficient IT infrastructure for data storage, processing and transfer. The second objective is to provide a wide range of specific solutions to improve citizens' satisfaction, increase the productivity and development potential of the economy and ensure long-term sustainable development. Together, these two aspects form a solid basis for the continuous cyclical development of all aspects of community life and work.

2.7. Young people and young families

In order to ensure a long-term demographic and economic vitality of the city, special care must be taken to ensure a living environment that is favourable to young people and young families. Furthermore, Kranj needs to maintain the current positive demographic trends resulting from high birth rates, immigration from other countries and intensive multi-dwelling building construction in recent years: an above-average natural increase per 1,000 inhabitants (2014: Kranj 3.9, Slovenia 1.1), a lower average age (Kranj 41.7, Slovenia 42.5) and the percentage of young people aged 15 and younger (Kranj 15.7%, Slovenia 14.1%). The recent population growth has thus led to an increased demand for kindergartens, primary schools, school gyms, especially in the inner city area. Taking this into account, the existing youth support programme needs to be modernised in order to be open to innovation, to foster the talents and creativity of young people, especially the coming-of-age generation, to activate them in the society, to create jobs and to encourage them to start a family in Kranj. Furthermore, it is necessary to enrich the public open space with content, improve its quality and adapt it to the needs of the new urban generations.

In addition to the growing need for physical infrastructure, these (favourable) demographic trends in Kranj imply that even more attention should be paid to the digital environment which has been increasingly important for today's urban generations. On the one hand, it provides an environment for learning and career prospects, and on the other hand, it has an important impact on their social development and their link to the environment. It is therefore important that

the community development also actively seeks a connection with younger generations through digital technologies, thus including them in community development and responding to their needs.

2.8 Transport system and infrastructure

Despite the trends towards sustainable mobility, Kranj's transport system and travel behaviour of the locals remain traditional. Although the motorisation rate has been declining, it is still standing fairly high (2014: 513 cars/1000 inhabitants, Slovenia: 522). The need for parking in close proximity to the apartment, business or place of work is most pronounced in the old city centre and in urban districts (e.g. Planina), while the space and financial means to invest in parking garages are very limited. What is more, the bicycle and pedestrian network is in its infancy, and the city's passenger transport is underused. Also, transport subsystems are not sufficiently interconnected through a modern passenger hub.

Consequently, traffic is a major contributor to CO_2 emissions, and the city centre also experiences occasional excess levels of particulate matter in the air. Due to the changes in traffic flows (intensive daily labour migration towards Ljubljana, to out-of-town shopping centres, etc.) and the suburbanisation, the city is facing poor traffic flow on the eastern part, in the direction of the motorway. The links between the city and the rural areas require modernisation from a safety point of view. It can be concluded that the entire transport system is not adapted to the needs of today's users, and in particular does not support the needs of daily mobility within the urban area as well as in the sphere of influence of the city, the neighbouring municipalities and Ljubljana.

Therefore, fast and frequent public transport links to the airport, to Ljubljana and to the surrounding developing business and tourist centres are crucial for the development of Kranj. Additionally, a long-term planned high-speed rail connection between Ljubljana, the airport and Kranj is of exceptional importance for the city of Kranj, as it can significantly invigorate and strengthen both the regional and national role of the city in the conurbation of Ljubljana.

There is no doubt that information and communication technologies cannot replace the need to develop physical transport infrastructure; however, they can affect the strain on existing infrastructure through better flow management and the introduction of new mobility models. In order to improve traffic flow management, it is essential to have a broader integrated management of all traffic signage and to link all systems in the city and its surroundings, which allows optimisation according to the current situation, and also enables anticipation and prevention of undesirable traffic situations.

New mobility models, largely based on public systems and the possibility of sharing transport means, have as their end result especially fewer vehicles in traffic (moving and stationary). In these mobility concepts, a mental shift from vehicle management to passenger/goods management is also necessary. Therefore, one of the key prerequisites is that all mobility systems are tightly connected in real time and, operating together, continuously optimise the time spent by passengers or goods on their journeys.

2.9.   Natural resource management and climate change

The City Municipality of Kranj has made significant progress in the recent five years and moved closer to legislative goals in the field of waste water disposal and treatment, adapted public lighting to requirements for energy efficiency and reduction of light pollution, and carried out several energy renovations of public buildings. Nevertheless, challenges remain in the natural resource management: waste water disposal and treatment in settlements with a population density >20 people/ha must be addressed by 2017 (2017/2021). With the Sustainable Energy Action plan (SEAP), Kranj has committed to a 21% reduction in greenhouse gas emissions by 2020 compared to 2006, to a 20% increase in energy efficiency and to 20% of its energy supply coming from renewable energy sources. Apart from that, the city can also make a significant impact on the environment and save financial means for its citizens by managing waste more efficiently. Protecting agricultural land on the outskirts of the city and using it for local food production poses an important challenge for the city's decision-makers. Moreover, consideration and climate change adaptation are not yet embedded either in the planning or the management systems of the city, nor in the consciousness of the population.

In the field of natural resource management, ICT also plays an important role in two aspects in particular: firstly, it enables the optimisation of municipal systems, and secondly, influences the information and the habits of citizens and businesses. The fact is that the systems for optimising waste, lighting, water, sewerage and energy management are well developed and available on the market; however, they need to be implemented in a coherent smart community system and constantly upgraded, which is gradually happening in Kranj, both through better management by public utilities and through the transfer of particular systems to specialised contractors (e.g. energy performance contracting).

Information on the environmental situation has also been improved through publicly available measurements of various parameters. Furthermore, a more active influence on people's habits can also be ensured through an effective rewarding system (city loyalty system) and support for citizens and businesses with information, comparisons and solutions for better energy efficiency, mobility, waste management, etc. The basis for these solutions already exists partly in the measurements and data available from various sources; however, they need to be up-dated by linking them, focusing on specific comparisons at household and business level, and also offering elaborate solutions to improve the situation. In the field of agriculture, there is already a number of effective and tested solutions that reduce pressures on the environment. In addition, local self-sufficiency and shortening the supply chains can also be significantly improved by using ready-made solutions for local self-sufficiency.

2.10. Spatial planning policy

The investment potential (mainly for retailers) of degraded land and preserved natural areas in the city and its hinterland is limited to a small space and agricultural land on the outskirts of the city, and is exploited mostly without any control or concept. However, local small and medium-sized manufacturing and service companies could not find affordable locations that is why many of them have moved to neighbouring business zones in Šenčur and Naklo. In 2014, a new Municipal Spatial Plan was adopted, providing the basis for activating vacant land around the existing industrial and business zones in the city and promoting the redevelopment of unused degraded land and vacant buildings for new public, commercial or other city-forming programmes.

There are 88.87ha of categorised degraded urban areas in the City Municipality of Kranj, or 160ha in total, including those most probably degraded. The Planina district, with more than 15,000 inhabitants in a small area, is also identified as an area of suspected social degradation. Nevertheless, the green surroundings, the confluence of the Sava and Kokra rivers with their canyons, the nearby suburban flat forests and the surrounding hills offer an attractive living environment which is becoming increasingly important with changing lifestyles. The rural area of Kranj is still widely used for outdoor activities throughout the whole year. Some areas have already been landscaped; however, the arrangement of paths, playgrounds, jogging tracks and thematic trails is not systematic and integrated. Moreover, the sites are not linked into a safe network of cycling and walking trails connecting the city to its green surroundings.

ICT does not play a crucial role in spatial policy planning, since the latter is primarily concerned with physical land-use concepts. However, the quality of planning, monitoring and promotion of the desired use depends on spatial systems for recording ownership, use and existing physical infrastructure, which are already well developed at national level and linked to specific local solutions, which are also in use in the City Municipality of Kranj. In order to encourage better space management, existing public IT systems can be further enhanced by more targeted communication with the local population, companies and potential investors. Furthermore, we can encourage the targeted use through a loyalty scheme, where healthy lifestyle and preferred mobility modes can be rewarded to encourage the use of the infrastructure that is already available.

2.11. Old city centre revitalisation

Over the last five years, the historic city core, known as 'the old Kranj', has undergone extensive renovation of its open spaces, municipal infrastructure and major cultural heritage buildings. Unfortunately, spatial renewal has not yet been followed by economic or social recovery. In the summer of 2015, there were sixty empty and eight abandoned units in the town, so today we are talking about a functionally degraded area. Therefore, co-financing of rents by the City Municipality of Kranj has been established, a city manager has been introduced and the first joint actions launched to counterbalance the out-of-town shopping centres; however, the measures are not (yet) showing results. The old Kranj needs a more proactive, systematic and long-term approach to attracting new activities, marketing the city, managing traffic, revitalising abandoned buildings, engaging with citizens and comprehensively managing the socio-economic renovation

Today, it is no longer possible to manage tourism flows and provide information on the offers, events and features of specific locations without the use of online media. Therefore, there is no need for the promotion of its use, but rather an organised web presentation and an active integration of the desired information into key online tools such as search engines, tourism platforms and online shopping tools. Some promising solutions have already been developed, however, they are insufficiently linked and promoted. When considering the content of the old town, it is also necessary to seek an attractive link between the cultural and historical environment and attractive content in terms of offers and events, which should not be in direct competition with traditional shopping centres. The tools available in the form of web-based solutions, virtual and augmented reality, as well as the monitoring of visitor numbers and movement, can make the city centre much more attractive to tourists and locals, while at the same time allowing for

more targeted and better-planned visitor services.

Last but not least, the digital industry itself is a very environmentally friendly and a high added-value activity, so we could also look in this direction to fill the vacant space and further revitalise the town centre.

2.12. Changing lifestyles

The citizens of Kranj place a high value on active leisure and health care. Therefore, ensuring broad and equal access to programmes, events and public infrastructure in the fields of culture, sports, social care, health care, intergenerational cooperation and lifelong learning is an important starting point for future action. The challenge lies in adapting the facilities and timetables to changing lifestyles, as well as maintaining and improving quality public spaces and facilities for people to gather and engage in recreational activities, both in the city and in the countryside. Residents want to see different urban events in their neighbourhoods that contribute to their well-being and integration of the locals into the community and the local environment. These are financially less demanding activities.

Information technologies play a key role in seeking opportunities, free capacities, networking with different interest groups, and organising sport, recreation and cultural activities, by providing information and booking services, monitoring activities and progress, and communicating positive impacts. The city's communication platform can play a key role in this aspect; however, it is essential to work closely with all activity and service providers and use relevant information sources and platforms. Apart from that, it is also worth noting that 'gamification' tools are also effectively enhancing sport and cultural activities, adding a new dimension of integration and a new attractiveness to sport, cultural or social activities.

2.13. Cooperation with Ljubljana and other European urban centres

Ljubljana is one of the growing metropolises of the Central Europe, where capital, knowledge and jobs are increasingly concentrated. The Spatial Development Strategy of Slovenia places Kranj in an urban agglomeration of conurbation with Ljubljana. It is also due to its proximity to Ljubljana that Kranj is losing its former power, so it needs to find a new purpose and take advantage of its proximity to the capital. Furthermore, it is essential to cooperate with Ljubljana in the field of public transport, higher education, research activities, culture etc.

The nearest cross-border cities are Klagenfurt and Villach, which, however, do not have a direct impact on the development of Kranj. Despite this fact, it is still reasonable to monitor their development and connect within the framework of cross-border programmes. The city's development dynamic is also enhanced by its openness to the international space, which is why it is important for Kranj to strengthen cooperation with similarly dynamic European cities and to use their best practices in the city management. It is necessary for the city to use the exceptional network of 20 twin cities in ten EU member states and South-East European countries. It is precisely in the development of 'smart communities' that we have seen the most active integration of cities in the entire European area recently, as they are all facing similar challenges brought about by the Fourth Industrial Revolution, demographic changes, environmental, and transport changes. The substantive integration of business, management, logistics, education and many other areas can be very effectively revitalised through the interconnection of IT systems, as they are increasingly forming the basis for all activities. At the same time, it is reasonable to seek a sensible compromise between the use of standardised solutions and platforms, and the city's own identity. While standard solutions allow for streamlined development and integration, they should not, of course, be a reason to lose the city's own identity by copying the content of other cities.

3. Definition of the baseline and management of the IT environment

Given the identified development challenges of the City Municipality of Kranj, the set strategic orientations and the role of IT in their implementation, it can confidently be said that a well-thought-out IT development is crucial for the success of the City Municipality of Kranj. Furthermore, success can be defined as a quality environment in which people live and work, where both locals and those commuting to the city are satisfied, efficient and continuously making progress towards sustainable development.

Although some general opportunities of digital technologies have been identified above in relation to the development challenges, it is by no means possible, either now or in the future, to identify with certainty the specific technologies and solutions that are best suited to achieve particular objectives. Therefore, it is necessary to define the basic principles of IT management and development, which must be technology-neutral and open to new technologies, platforms and solutions that we cannot even imagine today. It is only such content and a technologically independent

concept that allow us to have a robust management and development system which will not be constantly changed and endangered by new technologies.

It is therefore necessary to take into account the extreme technological complexity, rapid changes and unpredictable future. In order to be able to pursue the substantive objectives in a stable and consistent manner in such an environment, the following four key management aspects have been identified:

- organizational aspect,
- process,
- data environment,
- IT infrastructure.

3.1. The organisational aspect of managing the IT environment

In today's society, digital systems represent the nervous system of the entire community, transmitting information that has a significant impact on our lives and work. Having this in mind, it is also crucial to understand that these systems must be managed and coordinated centrally, as this is the only way to integrate the systems and seize the synergy opportunities. The parallel, unrelated development of IT systems can provide an adequate basis for supporting a closed business or administrative system; however, from the point of view of the City Municipality of Kranj as the development manager of the entire community, the goal is precisely to link all the digital systems.

In order to achieve connectivity, central coordination and, to some extent, decision-making on IT development must be established:

- firstly, within the framework of the city administration of Kranj,
- secondly, within the framework of all public services including public enterprises and concessionaires,
- thirdly, in the context of the entire public system including education, health care, social services and the non-governmental sector, which is directly linked to the City Municipality of Kranj in the form of co-funding or programme implementation,
- The ultimate goal is a coordinating body between all segments of society, coordinating digital development for the public sector, the economy, civil society and educational as well as research activities.

Within the framework of the city administration, a department and a competent person with powers will be established to coordinate IT development, investments, links to external contractors, selection of solutions and standards, as well as data management. Furthermore, a Chief Digital Officer (CDO) should be at least equivalent to the heads of key departments in the city administration, a member of the Mayor's collegiate body and take part in all important decisions about the development of the City Municipality of Kranj. Just like the finance department must always be involved in decision making to ensure financial resources, the CDO needs to be involved in order to provide IT support and manage processes and data. Moreover, individual departments of the city administration cannot produce IT solutions on their own without coordination with the CDO, and cannot make IT investments without the CDO's approval. The key to this is the Mayor's support and the understanding that only coordinated IT development can assure concerted actions of the city administration.

With all public services provided by the City Municipality of Kranj through its departments, public enterprises and institutions it has established, and by awarding concessions to external contractors, the municipality is already facilitating coordination in the form of collegiate body chaired by the Director of the Municipal Administration. The CDO of the City Municipality of Kranj regularly participates in its sessions; moreover, IT solutions of all these services are discussed there and coordinated with the CDO. Additionally, the City Municipality of Kranj, as the provider, founder and (co-)financier of these activities and their regulator, can and must require such coordination in the interests of the rational use of public funds and efficient functioning of all public services. Connecting of processes, exchanging and sharing of data, and linking IT investments are guided by public interest, but certainly also by political interest of the city administration, as it can provide both citizens and businesses a better living and working environment as well as sustainable development.

The entire public system operating in the City Municipality of Kranj includes a number of other entities, often established by state authorities or their concessionaires. These entities are generally independent legal entities, deciding independently (within the framework of legislation and guidelines) on all aspects of their business. Therefore, the City Municipality of Kranj cannot formally interfere with their decisions (schools, kindergartens, healthcare providers, employment services, pension and disability insurance, environment, etc.). Nevertheless, they form the whole of public services used by citizens and businesses in Kranj, so cooperation, also in the form of informational

integration, is necessary to provide better services for citizens, as well as economical operations. At regular meetings of these organizations or in bilateral talks under the leadership of the municipal CDO, the possibility of connecting IT systems is also discussed, mainly in the form of data exchange and linking digital services. As for co-financing the actions by the City Municipality of Kranj, an obligation and method of data provision could also be added to the formal agreements, in order to be used for the ongoing monitoring of activities and the improvement of IT services for the residents. Furthermore, in the discussions and when outlining proposals, it is necessary to constantly point out the advantages that both sides and especially the end users of public services will gain through linking.

The most effective way to forge links between all social groups in a local community is through a coordinating and advisory body, modelled on the digital coalition established at national level. At the level of the City Municipality of Kranj, issues related to the development of the Smart Community are addressed by the already established Kranj Smart Community Strategic Council. It is important for all of its members to have at least a satisfactory understanding of digital technologies and to be accepted as a relevant representative of their interests in the sphere they represent. In addition to the exchange of materials and consultations organised by the representatives within their own field, it is reasonable for the Strategic Council to meet at least twice a year to coordinate the direction of development on key projects that affect all groups.

Structure of Digital Development Coordination:

3.2. The process of managing the IT environment

In terms of the processes implemented by the City Municipality of Kranj, it is necessary to outline the key ones, insofar as this is not already covered by the municipal administration or by other contractors within the municipality. A full review does not require detailed process inventories, which are usually a time-consuming as well as challenging task. It is often difficult to clearly define the processes which in practice are implemented in different ways.

However, it is necessary to define the key processes especially in terms of input data and the resources used in the processes. In addition, it is necessary to define the operators and responsible parties, key decisions in the execution of processes and output data as process results. In this way, it is possible to identify the existing resources for input data and resource needs for the processes that may be the result of other processes. Moreover, it is simple to identify overlapping in activities, decisions and procedures. Afterwards, optimization can be carried out gradually, which is the basis for a more rational implementation of processes as well as solid IT support.

The review and process optimisation in the aspects described above also result in a more transparent and economical business, which can reduce the workload of staff through better integration and IT support. This step, which usually relieves the burden on employees, also provides stronger support for continuous improvement, as they see it as beneficial to their work. What is more, every process optimisation and relief of staff also implies more human resources available for development tasks and improvements.

The process review which is gradually complemented and also modified for specific projects, should serve as a basis for planning IT solutions, their integration, data sharing and the rationalisation of IT support. Additionally, uniform IT support can be applied, maintained and developed for comparable processes.

3.3. Managing data environment

The most challenging and also the most important task is to provide an overview of the entire data environment of the City Municipality of Kranj, as this is the basis for:

- an overview of the municipality's key asset – data
- defining the content, meaning, and uniform understanding of the data
- defining persons responsible for specific data and databases
- defining the status of data in terms of accessibility, confidentiality, storage, updating, etc.
- compiling a data dictionary that enables data sharing and publication as well as the development of new services based on the available data

The first step in the 'Kranj Smart City' IT platform is to identify the technology and location for a 'data lake' – a database where all relevant data for co-management and sharing will be collected. The vast majority of data is generated by existing processes within the city administration and public service providers, but some are also relevant from external sources (e.g. environmental data, traffic, tourism flows, etc.).

The data lake of the City Municipality of Kranj collects data identified in the identification process as being of (potential) interest to the municipal administration, the public or business. These data are then transferred to the data lake, or a permanent active link is established to them for later use or sharing. It is not necessary or even reasonable to load all data as they are not of interest for purposes other than the basic process in which they are generated. For example, if we keep a history of parking occupancy for individual parking spaces, it is not necessary to transfer this to the data lake; however, it does make sense to store the parking occupancy data as we can communicate this to the public. Apart from that, analytical information can be obtained in terms of occupancy by parking space, by hour, by season, etc. Another example is when a concessionaire keeps minute readings of energy consumption by individual households. In this case, it makes sense to transfer to the data lake only depersonalized data on the highest, lowest and average consumption of the household according to the area and the type of building. In this way, the data lake remains more economical as larger volumes of data are harder to manage, and, additional, storage costs rise as well. The technological design of the data lake and data traffic will follow the reference architecture (SynchroniCity) and the architecture of the Enterprise Service Bus (ESB).

The key to data management is to describe each piece of data and dataset with attributes (metadata) defining the location, meaning, 'owner' of the data, accessibility, updating, level of confidentiality, storage time, and other attributes that are decided upon when setting up the data lake and data management system. Once the method of data description has been defined, it becomes the mandatory standard for all existing data inventories (which do not yet have such descriptions), and the standard for all new solutions that use and create data. At the same time, the SRIP PMiS guidelines are also taken into account, which defined recommended data standards in cooperation with various providers and professionals in this field.

Furthermore, this also commits all current and future IT solution providers to make an inventory of their data (irrespective of the application) and make it accessible independently of the specific application. And this is precisely a key measure to ensure that, in the long term, we do not find ourselves in a 'vendor lock-in' situation where we completely depend on the provider of a particular IT solution, mainly because we do not know how and cannot access our data without the provider's application. Moreover, the inventory, management and access to data sources will be comparable to the those used by the national OPSI portal, which is based on data standards that have been established for the wider European area, and thus open to international exchange as well exchange with other compatible domestic data sources.

The basic method of exchanging data between different sources and services is via application program interfaces (APIs). Therefore, as part of the rules for managing the data environment, standard APIs are specified for use by all data exchange services. Standardised APIs allow, on the one hand, the integration of new services into existing (open) data sources and, on the other hand, the integration of new services into a uniform communication platform, which is organised according to the principle of life events (and not according to the organisation of the City Municipality of Kranj).

Once the technology and location of the data lake as well the inventory and management method have been determined, the data discovery phase is inevitable. In this phase, all data sources and their attributes are gradually described. In the process, we will undoubtedly discover data sources that we did not even know existed; moreover, we might find duplicated data where we have to decide which set is the 'right' one. In some cases, certain data will not have a clear 'owner' (who is responsible for the data and can make changes to them); furthermore, some data will be outdated, while other will be technically inaccessible. What is more, there may be data that are not properly processed in terms of the GDPR requirements, etc. These examples are mainly to remind us that compiling and recording data is a complex and time-consuming process that never really ends. Yet this is crucial, because just as it is important for a municipality to have its physical assets inventoried, it is also important to have its data assets recorded.

However, it makes sense to plan the dynamics of data discovery according to the needs for the use of (shared) data. First, those data are recorded that already provide the basis of existing services for citizens, the business or the municipal administration itself; and then those that we need to develop new services and, of course, the key data for managing the municipality. Subsequently, as services and processes have been developed and integrated, the data are recorded, and the expected gaps are closed and ambiguities are resolved. At the same time, as soon as an inventory standard has been set, an inventory of the data is required as well as a proper integration to the data lake as one of the general requirements for all existing, and especially new IT service providers.

3.4. Provision of ICT infrastructure

ICT infrastructure relates to all the equipment required to use information support for business processes and other services provided by the City Municipality of Kranj. This includes:

- office IT equipment, ranging from various types of computers to printers, readers and other peripheral and personal communication equipment
- central server equipment that provides the necessary processing power for data processing and memory capacity for its storage
- communication equipment that enables various forms of data transmission from local networks (LAN, WiFi, ...) to IoT (LoraWan, narrowband, etc.) and broadband networks in various versions (optical, wired, 3G, 4G, 5G, etc.)
- sensor equipment, which includes various environmental sensors (e.g. air quality, water), devices for reading various values (e.g. energy consumption, water) and detection of various conditions (traffic counts, occupancy of car parks, etc.).

3.4.1. Office IT equipment

The City Municipality of Kranj already uses both purchased and rented office equipment, therefore it would be appropriate to carry out an assessment of the rationality of various business models for providing this equipment. The key aim is not the immediate change of the business model, providing the existing one is adequate, but rather to obtain information for future decisions and new orders.

It is necessary to include as many positions as possible in the chosen business model (purchase or rental), including those in business entities that are commercially independent but are connected to the City Municipality of Kranj (institutions, concessionaires, etc.). This will allow more favourable purchase or rental conditions to be achieved.

It also makes sense to standardise the equipment that has already been partially implemented, as this enables easier maintenance, exchangeability, faster installation and learning how to use it, as well as the use of standard software tools that vary depending on the operating systems and types of computers. The type of equipment is usually determined according to the nature of the work (data and text entry, graphic applications, etc.) and the complexity of the workplace (operational work, monitoring and control, etc.) and the rank of the equipment user (clerk, manager, etc.).

3.4.2. Server equipment

In terms of server equipment, several factors must be taken into account when deciding on the type of equipment, the most important of which is the way it is provided.

The key decision is whether the server equipment provides the following:

- On premise system support on the premises of the City Municipality of Kranj, where the municipality also fully manages and maintains the servers; this includes all necessary licences for databases and operating systems, data protection, operational reliability, hardware and software upgrades, etc.

- in server collocation, where the municipality rents or buys the necessary server equipment and places it in a server room managed by an external contractor. This assumes care of the physical environment (e.g. air conditioning, power supply stability, physical security), and the municipality maintains the servers as its own in a logical sense (e.g. system support, licences), similar to having them on premise but instead remotely.

- in the Cloud, where the municipality only leases a certain amount of processing and memory power in the system environment that it requires for its needs (e.g. Microsoft or Oracle databases and other requirements based on the operating system and database management), while the administrator of the Cloud takes care of everything else (e.g. upgrades, licences, backup in multiple locations).

The City Municipality of Kranj currently provides its own server equipment on its premises and also maintains it for the needs of supporting the business processes of the city administration and some external users. At the same time, the preliminary analysis also showed that a significant part of the existing solutions and data is sited with external contractors in cases where it is not directly related to the financial and documentary operations of the city administration or in cases where the City Municipality of Kranj uses external databases (spatial data, public records, etc.).

The establishment of a data lake, management and transfer mechanisms for data and the establishment of an umbrella communication platform (web and mobile applications) will require additional server capacities. The introduction of new solutions, such as the city card, solutions in the field of mobility, energy, security, etc., will require additional server capacities. In this case, the key decision is whether these capacities are provided on the premises of the City Municipality of Kranj or in the form of Cloud services.

All additional server capacities required by the City Municipality of Kranj due to the introduction of the smart city concept are provided in the form of Cloud services, located in Slovenia, in order to meet the legal requirements relating to the location of (personal) data. The existing support for business processes will be maintained on the premises of the City Municipality of Kranj, as the server infrastructure is relatively new, therefore it will be necessary to strengthen the personnel and separate system maintenance and user support (at least two people with separate tasks). When there will next be a requirement for a major upgrade of equipment, as well as for the support of internal processes of the municipal administration, the feasibility of switching to a Cloud service will be considered, taking into account the following:

- The City Municipality of Kranj has very limited (personnel) resources, which are already overburdened and cannot take on the burden of establishing a central IT platform with a data lake, data management and an umbrella communication platform, neither in terms of availability nor due to professional requirements.
- Acquiring new highly professional staff to manage demanding IT equipment is very difficult in the public sector due to restrictions on remuneration, therefore stable professional support for just the own needs of one local community is considered risky.
- Cloud services have developed well recently, there are competent providers with the latest technology on the domestic market, and this is also reflected by the great interest among providers offering dedicated service packages specifically for local communities.
- Establishing own infrastructure is associated with a significant one-time investment in equipment and licences, which must be repeated periodically, while the lease of Cloud services is financially predictable and is transferred to the current monthly rental cost, which can be reliably predicted in budget documents.

- The scope of rented services in the Cloud can be dynamically adapted to actual needs, which change when new services are introduced, and recently business models of billing according to actual use (pay as you go) are also available based on the processing power and memory capacities used.

The decision to (gradually) transition to the Cloud is demanding and strategic, as it is not realistic to expect that all the necessary infrastructure and professional support can be restored on the premises of the municipality at any time. The area of data management and control over processes (which run in the Cloud) is of key strategic importance, as it enables the municipality to switch to another provider in the event that it is dissatisfied with the services offered by one Cloud provider. Increasing needs and competition in this area are an important guarantee that commercial conditions will also be increasingly favourable. Today, it cannot be claimed that the Cloud services of an external provider are automatically cheaper than they would be if the City Municipality of Kranj provides its own equipment and support, however, taking into account all the indirect costs and risks that the municipality assumes in the case of its own equipment, such a decision also makes economic sense. Of course, the rapid development of technology means that it will be increasingly difficult to keep up with technological innovations. Specialised providers have strong development teams for this and it is much easier to follow new trends and update their range of products and services for their users.

The use of the Cloud of an external provider also requires the adjustment of disaster recovery plans, which are prepared in cooperation between the City Municipality of Kranj and the provider of Cloud services. In doing so, it is necessary to take into account all situations that can be foreseen, including when the external provider no longer provides services. Should this situation arise, it is also necessary to ensure that the City Municipality of Kranj has the ability to transfer data and processes to another provider without the previous provider's participation.

3.4.3. Communication equipment

The following guidelines must be adhered to when ensuring the transfer of data at all levels for individual purposes and types of communication networks:

- Local wired networks on the premises of the City Municipality of Kranj and related entities are already mostly covered by ethernet LAN networks, wherein it is necessary to ensure sufficient connection capacity to the external network (at least 100Mb) and fast internal connectivity with routers and switches with gigabit speed. This helps to ensure uninterrupted work and the use of Cloud solutions. It makes sense to employ simple measurement to check bottlenecks in local networks and external connectivity speed, while also replacing outdated routers and switches with newer ones, as they do not represent a large cost, and they have a considerable impact on work efficiency and user satisfaction.
- Standard and sufficient coverage should be established in all the facilities of the City Municipality of Kranj, with wireless WiFi networks, which must be separate (and protected) for use by employees and at the same time available with separate access and names (e.g. WiFi_MOK_guest) for visitors, customers and business partners. Good WiFi signal coverage enables employees to work efficiently and use mobile devices, and guest networks can also be connected to current information upon check-in, which can be the same in all networks of the City Municipality of Kranj.
- The WiFi network is already accessible in some public areas (e.g. the city centre and the centres of local communities), therefore it makes sense to expand it only in areas where there is a high frequency of tourists and other guests. Otherwise, wider coverage of the public WiFi network, which would lead to additional costs, does not make sense due to the good coverage of the LTE signal, which is also accessible to visitors and the EU at local rates (due to the 'Roam like at home' regulation). Data on the number of devices registered in public WiFi networks must be made available for the needs of city activities (e.g. the Institute for Tourism and Culture can monitor the number of visitors to the old town). The availability of public WiFi networks should also be clearly marked in places that are more frequented by visitors.
- Bluetooth and other short-range connections should only be used to connect individual devices that are controlled by the users themselves, while for external access they should be closed and well protected with passwords to ensure there are no security risks.
- Provision of external connectivity via optical and wired access should be left to external providers. When choosing the aforementioned together, the access speeds (in addition to the price) provided by the provider must also be taken into account as a decision-making element. Despite the fact that external networks are

managed by commercial providers, it is necessary to regularly communicate potential problems in access and to request higher streaming speeds where they are needed and are not yet guaranteed. This allows the external provider to direct upgrades and investments in the access points that are most important for the City Municipality of Kranj. When developing optical access, it is necessary to develop the infrastructure in a balanced way in the city itself as well as in suburban and rural areas. In accordance with the building legislation, the City Municipality of Kranj should also provide sufficient free channel connections for all investments, which can be used by external network providers for upgrades.

- the development of IoT networks is left to external providers, albeit by way of an agreement that ensures accessibility to all potential users. The City Municipality of Kranj can thus avoid investing in these networks and their maintenance, and the provider of the IoT network ensures better utilisation. As a basis for the provider's interest in opening the networks to all potential users, the infrastructure of the City Municipality of Kranj, which is made available to the external provider for the installation of antenna equipment, can also be used on the condition that the networks are also opened to other users.

3.4.4. Sensor equipment

Sensor equipment includes various environmental sensors (air quality, water quality, etc.), devices for reading various values (consumption of energy, water, etc.) and detecting various states (traffic counts, occupancy of car parks, etc.). Various sensors for the detection of environmental parameters convey important information for citizens, as well as for the management of all systems whose operation affects the characters of various substances in the air, water and soil. Due to the large differences in price and based on the accuracy of the measurements for general informative use, it is suggested that cheaper sensors are used than those used by specialised organisations that require professional measurements. This means that several measuring points can be ensured however, at the same time it is necessary to ensure:
- control of operation of the sensor

- the identification of significant deviations or inconsistencies that may indicate a possible fault

- a clear indication of the accuracy of the sensor during measurements

Simultaneously, before using sensors in a specific location and for a specific purpose, it is always necessary to check if there is already a publicly available measurement. The Agency for the Environment of the Republic of Slovenia has set up a series of high-quality measuring points, from which data is regularly published publicly and which can also be used for such services within the City Municipality of Kranj.

Devices for remote reading of various values, particularly energy and water consumption, enable regular monitoring of measurements in real time. The frequency of measurements largely depends on the energy autonomy of the measuring device (battery consumption), therefore, whenever possible, it is advisable to opt for measuring devices with an external power supply, thus enabling measurements to be taken more frequently and complete autonomously. Communication with these devices usually takes place over the Internet of Things (IoT), broadband or public GSM networks. The choice of sensor device based on the type of communication with the environment also depends on the availability of these networks. It makes sense to cover the urban area using IoT networks (Lorawan, Narrowband), while GSM communicators can also be used for more remote locations, as such highly autonomous devices are already available on the market (if direct connection to a broadband network is not possible).

The municipality should constantly encourage the operators of energy and water networks to introduce smart metering systems, while also providing access to measurement data for information needs, various services for citizens and the economy (alarms, consumption comparisons etc.) and analytics at the municipality level. Analytical data can only be collected at the municipality in aggregated (depersonalised) form in municipal systems (providing the municipality is not the direct operator of the system), and only aggregated data can be provided to the public. If network operators also provide users with individual services (status monitoring, comparisons, etc.), these services must include access protection (passwords or certificates), and such online services must also be connected to an umbrella communication platform (link to a specific service of the network operator). It is also highly desirable that the services of different managers are harmonised in terms of design and function, so that they all work as part of a single system for users, and unification of the user interface also facilitates their use.

Various other detectors of presence (people, vehicles, etc.) should also always enable the transmission of data to the central system in its original form (occupancy of car park lots, traffic frequency, etc.), so that they can be used to build

online services, however, if the data also includes personal data (presence of persons) it can only be used in an aggregated form. When detecting various conditions in the environment, attention should be drawn to the increasingly useful, accurate and reliable tools that are based on the analysis of the video recording from which the conditions can be identified (occupancy of car parks, counting visitor numbers, access to protected areas, etc.). When using these methods, it is important to clearly define the possibility of storing the video recording and ways of extracting personal data (e.g. covering of faces) and to clearly mark the (public) areas that are under video surveillance. If the storage of video recordings is not permitted or reasonable, only the analytical data derived from them (e.g. the number of visitors) will be transmitted while the recordings themselves will not be stored.

When collecting various data from sensor devices in the central data lake (original or aggregated), it is necessary to follow the agreed standard of recording data, from which at the minimum it must be clear what, where (including geolocation data) and how often it is measured, together with the result of the measurement, as well as who manages the measuring site and who owns the data.

4. Definition of the key segments and architecture of the common IT environment

Specific services for citizens, the economy or system operators can (and to a large extent already do today) be developed independently of each other in separate systems, however, one of the key foundations for building a 'smart' community environment is the integration of systems and the sharing of data. In order to ensure such integration for existing and new processes is possible in the long term, the following are required:

- a content manager of the common infrastructure who is also responsible for coordinating various stakeholders and their subsystems and data

- space for data storage (data lake)

- a data management system

- a common communication platform that enables access to data and services of various stakeholders in one place, payment, citizen engagement and management of the system for influencing user behaviour (loyalty system)

From an organisational point of view, the operational coordination role for such a system must be assumed by the municipal CDO with the support of the municipal management. In addition to construction of the system, the CDO must primarily take care of the integration of various stakeholders and processes, the exchange of data and the direction of the development of new services for citizens, the economy and the municipal administration.

The physical infrastructure must provide memory and processing capacity for data storage, processing and transmission. Technical and functional specifications, a decision on the business model and implementation of the order must be prepared for the following:

- rental (purchase) of the required capacities in the Cloud

- providing the necessary system and licensed software for managing the data lake

- provision of an open system of connection and data transfers to/from various connected systems and their data sources (API interfaces, streaming platform)

- development of a common communication platform in the form of a web service and a mobile application

The order can be made according to individual content sets, albeit with one comprehensive order to obtain a (consortium) offer, whereby all physical and software equipment is provided to the client as a service of an external contractor, with adequate insurance of data and services of the City Municipality of Kranj. This, to a great extent, avoids coordination challenges, which are generally professionally demanding and (in the case of a single offer) must be arranged by the providers themselves within the consortium. The service model (SaS) of provision of infrastructure also enables constant business and technical adaptation to the client's current needs (payment according to actual consumption – Pay As You Go, memory, processing capacities and the number of licences based on current needs). In the case of a consortium offer and, as a result, comprehensive management of the technical part of the system by an external contractor, the latter must also provide complete system support, and the City Municipality of Kranj can thus

deal with content solutions.

When providing the necessary capacities of the Cloud, providers of public Cloud infrastructure in Slovenia or within the EU are sought, in order to ensure adherence to the legal requirements in the field of data storage and protection. The City Municipality of Kranj will continuously ensure that all databases are clearly listed and always accessible to the owner of the data, to prevent dependence on a specific technological solution or provider. In order to additionally ensure independence from providers as well as the transparency and flexibility of solutions, priority will be given to open-source solutions, which for the client, may also be a mandatory requirement for certain key functionalities. This reduces the probability of dependence on the provider and the probability of poor quality software solutions.

Schematic representation of the entire system:

Any public tenders for the establishment of the IT environment shown or other form of cooperation with potential providers must be based on the client's substantive requirements. The content requirements must be thoroughly
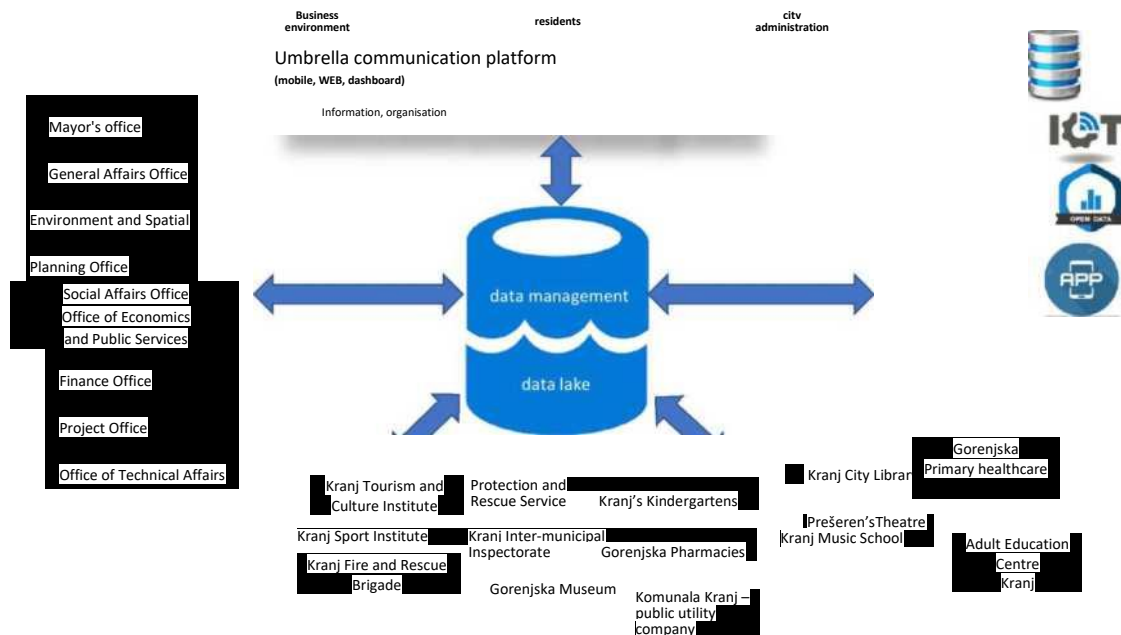
studied and elaborated in detail and used as a basis for the proposal of a technical/technological solution, which should be defined by potential solution providers.

Functional requirements for establishing the following common digital platform:

- A catalogue of meta data from all relevant data sources. The catalogue will contain a description of the context of the information (what the data means, in which format it is stored, how it is used, who is the owner of the data, how often the data is updated, who are the users of the data, etc.). The final goal is a clear understanding of all the data available in the various ICT systems of the City Municipality of Kranj, and based on this, the establishment of a database from which various business analytics procedures and machine learning algorithms will be used.

- Architecture and implementation of the data repository in the central data lake, with the aim of establishing conditions for better decision-making by the management of the City Municipality of Kranj based on analytical reports and data science. Important data must be catalogued and normalised before being stored in the data lake, in accordance with existing regulations in this field (GDPR, anonymization). The data lake must enable the storage of structured and semi-structured data, and the use of public Cloud infrastructure must also be enabled.

- Implementation of unified data orchestration between all important data sources and users of this data. These systems must allow for immediate ('On the Fly') classification of meta data (data Metacataloguing), transfer, modification of data (pipeline/transfer/modification) and the ability to correlate data. Different data sources can be combined with each other in order to get a better insight into the individual process. Data Governance Rules must be applied to all data.

- The 'Open API' concept must be used, with the aim of providing data to all important customers in a standardised way. The API interface must be established on demand and must support all standard data formats.

- The creation of business analytical reports must be dynamic and flexible, it must cover all important data sets of the Municipality of Kranj and related organizations, and data visualization must also be supported. It must not be limited by data type, data source or database architecture.

- The solution must support central management with artificial intelligence (AI) and machine learning (ML) algorithms, which must include all important data sets of the City Municipality of Kranj. The entire lifecycle of data must be supported from a central administrative site, based on open-source standards.

- During the implementation of the project, a basic set of key project indicators (KPIs) will be determined, so that it will be possible to monitor development of the city using analytical reports in real time. ISO standard 37120:2018 (Sustainable cities and communities - Indicators for city services and quality of life') can serve as a basis for determining KPIs, though not as an exclusive basis, since the size and all the tasks of the City

Municipality of Kranj are not entirely comparable to larger European cities.

As a technical solution for ensuring the accessibility of open data sources, preference in use is given to the existing solution for the open data portal at the national level, which also includes datasets from the area of Kranj. Thus, an application solution that has already been developed at the state level can be used for the needs of the local open data portal and/or the inclusion of local data sets in the state portal with the appropriate definition of meta data descriptions.

5. Definition of the content of development areas

Uniform IT infrastructure for connecting systems, collecting data and communicating between systems and with the environment enables the rapid, transparent and rational development of numerous tangible solutions. In talks to date, the following content areas of the development of smart city digital solutions have been highlighted as a priority (mainly within the framework of the 'Smart Mlaka' initiative):

- energy management
- automatic remote readings
- management of traffic flows
- establishment of a support environment for autonomous driving
- control and security
- waste management
- monitoring of environmental parameters
- management of public lighting

These areas have been highlighted by providers of tangible solutions or by representatives of the City Municipality of Kranj, so they can serve as priority areas for the establishment of specific functional solutions as part of a common platform.

As part of the project group for local self-sufficiency, solutions are being developed to ensure connections between local food producers and their customers, especially public institutions. The city platform will include a solution that, on the one hand, enables joint public ordering and collection of requirements while adapting to the current availability, while on the other providing a solution for a comprehensive review of the currently available quantities of various local agricultural products. Local producers and consumers will be included in the system with the aim of shortening supply chains, reducing the carbon footprint, promoting local food self-sufficiency and raising the quality of nutrition in (public) institutions.

Nevertheless, for a comprehensive approach, it is necessary to take into account a wider range of areas, as illustrated in the graphic below.

The content division of areas is defined on a fixed basis (at least for a certain period), so that platform users can get used to a certain data structure and functionality. The areas shown in the graphic above are taken into account, as are the existing definition of areas in Kranj's online solutions and structures used by other cities in Slovenia and further afield.
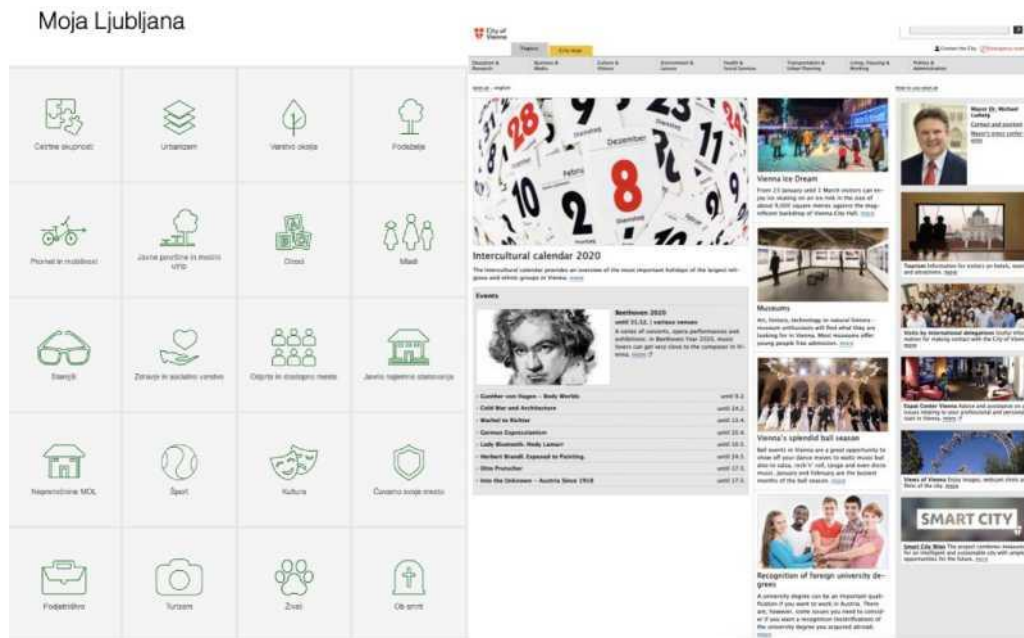
A graphic of the structures of the Ljubljana and Vienna city websites, showing an example of structuring content.

On the basis of the examples described above, the actual division of content should be the result of a discussion, which must also include the views, desires and reactions of the public, as it is extremely important that the structure primarily suits the users of the platform and should not be based solely on the views and interests of the developers themselves. In order to provide an excellent user experience, the logical placement of content on the page is recommended, working with one of the designers who specialise in designing user interfaces for online solutions. However, it is not just a matter of graphic design, but rather – and above all – the determination of priorities, the method of dialogue

and the layout, which are based on in-depth interviews carried out with the target groups. One of the key goals that must be pursued by all developers of the wide range of digital solutions that together form the city municipality's digital platform is an excellent user experience. It is not enough that functionalities are available, their wide, mass use must also be ensured. Therefore, the solutions should be thoroughly thought out and co-designed with focus groups of end users to ensure simplicity, transparency and intuitiveness, which, in addition to the direct benefits for users, are key elements in ensuring the actual mass use of the solutions by various target groups.

The goal must be focused implementation of activities that bring tangible results and will be visible and positively evaluated by citizens. The starting point for all activities should place people – citizens – in the centre and their key life situations, which are optimised by smart solutions. In addition to the economic effects, which are often the only criterion, the social and environmental effects of the planned projects should also be taken into account.

During the coronavirus pandemic, very important new elements related to 'smart communities' also came to light. Together with its key stakeholders, the City Municipality of Kranj therefore also defined plans for the establishment of working from home and distance learning, including the way the municipality's governing bodies and related entities operate. By carrying out an orderly review of data sources, the City Municipality of Kranj can also provide alternative remote services, better information for citizens and organisations in such situations, and plan solutions for ongoing monitoring of events via health data, data on various transactions, traffic, telecommunications and others, as well as data from personal mobile devices, as long as compliance with the GDPR standard for the protection of personal data is ensured.

Below is a list of starting points for further discussion and a working definition of content areas:

- City Municipality of Kranj
- education, research, development
- environment, urban planning, housing, water and energy supply
- economy, services, trade
- agriculture and local self-sufficiency
- healthcare and social services
- tourism, culture, history and events
- traffic, mobility
- news, media

One of the components of the digital platform is the uniform card system, which (through horizontal functionality) can be linked to various digital services, including various partners (from the public and private sector) and is open to all users. The development and implementation of the uniform city card system is planned as a separate project, which nevertheless takes into account the following key directions as part of the joint strategy:

- the city card enables the integration of various existing payment methods, connection to various sources of funds, based on users' requirements, and also enables the loading of credit from various sources and payment from prepaid credit on cards
- it is used as a method of user identification which, in connection with the so-called 'loyalty systems', provides various promotions, rewards, discounts and other incentives that the city can use to influence users' behaviour
- smart devices, which can be used as a means of payment and identification in contactless or online interaction
- the design of the system must be open to expansion to the entire Gorenjska region and flexible in integrating or connecting with other municipalities in the region and beyond
- through the identification of users and the use of different payment methods, the system must also be open to integration with existing public and private service providers and existing systems (bike, car rental, tickets, tourist services, etc.). Taking legal restrictions into account, it must also be open to the inclusion of offers from private contractors, as the aim is for it to become a universal means of identification in the city and possibly in the wider region, which also enables various forms of payment.

When looking for application support for the necessary functionalities, priority will be given to existing – especially high-quality – local solutions. For areas where there are no suitable and accessible solutions, close development cooperation will be established, especially with the local IT industry. The City Municipality of Kranj will also actively support the promotion of implemented solutions developed in local companies in order to accelerate the development and success of the IT industry as an important part of the local economy.

6.   Knowledge and digital competences

International findings clearly show that smart cities and communities projects are only successful if, in parallel with the introduction of new services, solutions and technologies, intensive training of all stakeholders takes place.

There are no systematic activities in the area of digital competences and raising innovative potential and entrepreneurship in the City Municipality of Kranj and in the wider region. Even the youth knowledge competitions and extracurricular activities organised by the Association for Technical Culture of Slovenia (ZOTKS) are not sufficiently present in the region.

The City Municipality of Kranj will become a model municipality for activating talent and promoting innovation and entrepreneurship with a regional and wider impact, as it considers knowledge and competence as a key condition for the successful use of digital services in practice. Activities in this area must bring measurable results for all target groups, with a special emphasis on young people and teachers.

During the coronavirus pandemic, very important new elements related to the field of 'knowledge' came to light. Some of the most important include: remote learning and working, health topics, digital competences for 'online' life (shopping, dealing with administration).

A 'Knowledge Action Plan' will be prepared for the area of 'Knowledge', which will cover the following group and institution goals (the target groups are all citizens):

- primary schools
- secondary schools
- students
- active employees
- pensioners
- teachers – a particularly exposed target group

The institutions involved are public institutions and all institutions connected with the City Municipality of Kranj, especially:

- Kranj City Library,
- Adult Education Centre of Kranj,
- Association for Technical Culture of Slovenia,
- OpenLab,
- BSC – Business Support Centre,
- Kovačnica *(a business incubator and coworking space)* and others.

In the case of the aforementioned target groups, a review of the situation and the preparation of actual measures is necessary:

- review of the situation and identification of needs based on experience during the coronavirus pandemic – discussion and survey in public institutions in the field of education, adult education and support institutions
- review of the situation and identification of needs in the field of digital competences and activities to promote extracurricular activities (projects, research assignments, knowledge competitions, summer camps, etc.) – discussion and survey in public institutions in the field of education, support institutions (BSC, OZS - Regional Chamber of Crafts of Slovenia, GZS - Chamber of Commerce of Slovenia, ...) and other actors
- raising awareness – reviews of good practices from the EU and globally
- raising awareness – connecting and involving relevant innovative companies for the field of 'smart communities'.

As an element of the preparation of the 'Knowledge Action Plan' and actual measures, coordinating interactive workshops are held with the aim of co-creating solutions and activities in the field of 'knowledge'. The workshops are

conducted using the approach of open innovation and creative thinking (so-called 'design thinking'). Head teachers, progressive teachers, ICT administrators in schools and those responsible for this area from the City Municipality of Kranj are invited to the workshops.

The 'Knowledge Action Plan' must include a clear definition of the following activities:

- specific activities for the systematic regulation of distance learning and education in the region
- a proposal for the 'online' organisation of the event titled 'Prebojniki' (*Outliers*) by the City Municipality of Kranj;
- activities for achieving digital competences by individual target groups
- 'Multimedia Knowledge Centre' (establishment of a platform for exchanging knowledge and acquiring digital competences, which will be connected to the umbrella IT platform of the City Municipality of Kranj)
- establishment of a ZOTKS regional centre and definition of its role for strengthening digital competences and innovation potential in the region
- upgrade of the Talents Innovation Entrepreneurship project, which strengthens the skills of teachers and young people in the region
- connection with the 'Business Incubator' project
- support for the realisation of the goals of the smart city and community digital development strategy of the City Municipality of Kranj by 2023

7. Definition of actual steps, solutions and functionality

Gradual implementation of the strategy will include the following steps:

- analysis of existing IT solutions used by the city administration, related organisations and other solutions used by citizens and visitors
- creation of proposals, discussion and adoption of the digital development strategy of the smart city of Kranj
- establishing an organisational structure for managing the IT development of Kranj
- provision of basic IT infrastructure (through tenders, projects or partnerships) including a data lake and a communication platform
- analysis of existing data sources, which will determine key data sets and priorities for their transfer to the data lake
- transfer of existing services for citizens, companies and city management to a common umbrella communication platform
- selection of new solutions and functionalities and their development and integration into the common IT environment of 'smart' Kranj
- consolidation of the acquisition and use of data according to the 'only once' principle with defined custody and sharing of data
- consolidation of IT support for the business processes of the City Municipality of Kranj and related entities

The list of existing IT solutions shows a range of services that are already in operation, which are interesting both for citizens and the management of the city. The initial set of common platform functionalities is set out below:

- GIS system for recording infrastructure and dedicated use of space with an integral spatial data platform
- Municipal 'eye' (for reporting errors and the state of infrastructure)
- publication of events in Kranj, events calendar
- KrSkolesom bike scheme
- Speed cameras
- KrPovej citizens' initiative
- Portal of road closures
- Parkmewise parking payment system
- environmental atlas (measuring the state of the environment)
- traffic conditions (via control centre)
- water and energy supply parameters
- monitoring the number of visitors in the city centre

- data on the offers of business property
- location and price of car parks
- Visit Kranj (cultural and tourist information)
- Accommodation and reservations
- AR Kranj (virtual reality display of attractions)
- reviews of energy and water consumption, warnings (solutions of public companies and concessionaires for communication with users)

Based on the proposals that have already been identified and the shortcomings of existing solutions, the following functionalities can be developed:

- Remote reading of water and gas consumption, connection to electricity measurements and preparation of a cumulative review of consumption at the level of the settlement of Mlaka and web and mobile applications for monitoring individual household consumption and warning of significant deviations. For these needs, the network operator will set up an IoT (LoraWan) network for communication with measuring devices and forward accumulated and depersonalised data to the umbrella platform. Conditions for using the IoT network for other needs are also defined.
- Remote reading of electricity consumption will be enhanced by the electricity network operator with the possibility of monitoring several parameters and consumption in more frequent time intervals using the 'push' method. The readings will be forwarded to the umbrella platform in a cumulative form. If the operator establishes a Narrowband IoT network, it will also determine the conditions of use for other purposes.
- With the exchange of data between network operators, the possibility of a joint review of water and energy consumption will be available for individual households, as well as warnings of deviations. To use this service, the user must agree to the exchange of data and notification at the level of the consumer site.
- The possibility of joint billing of water and energy costs through a collective account in digital form is being investigated, for which payment using the city card system may also be possible in the future.
- Establishment of a city card system, which enables citizen identification and payment of services (or access to free services) that are included in the city card system.
- The functionalities of the municipal 'eye' solution (in addition to public lighting) are extended to other areas of public infrastructure (roads, energy infrastructure, public areas, etc.) and messages from the system are connected to the systems of operators of individual types of infrastructure (Domplan, Elektro, Vigred, etc.) to shorten the time required for action to be taken.
- Data on the number of visitors in the city centre are forwarded by the WiFi network operator to the Institute for Tourism and Culture and made available to other potential interested parties and for possible public publication.
- An umbrella communication platform and its operator are selected (possibility of upgrading the iKranj application), functionality is supplemented by integrating the above solutions by content area, ensuring the publication of publicly available data and enabling citizens to register individually in order to monitor data and regulate relations with infrastructure managers at the household level.
- For the collection and exchange of data between different subsystems, a data lake will be established, a standard for recording and describing data, and standards for exchanging data in various record formats (API interfaces) will be established.

These key parts of the comprehensive 'Smart Kranj' system should first be established at the level of the settlement of Mlaka and as part of the 'Smart Mlaka' initiative, in order to be able to test the operation in the form of a pilot project, establish connections between subsystems and check the response of end users to the combined and new services offered.

8. Conclusion of aims

From the analysis of the situation and the proposals of individual public system managers, it is clear that the City Municipality of Kranj has established a series of services for monitoring consumption, system operation and communication with users.

The key task in the first phase is to establish the entire structure of the IT environment of 'Smart Kranj' at the level of one settlement – as part of the 'Smart Mlaka' initiative.

This environment includes:

- existing systems to support operations and management of public infrastructure
- establishment of a platform for collecting, processing and transmitting data
- establishment (upgrade) of an umbrella communication platform in the form of a web and mobile application

The further development of 'Smart Mlaka' will serve as a pilot project for the establishment of the 'Smart Kranj' platform, for which it will be necessary to clearly define all standards and functionalities as well as business relationships between stakeholders in the system. After a fixed period, a decision must be taken as to whether such a system will be built and managed by the city municipality or whether it will be entrusted to an external operator. In any case, it will be necessary to provide resources for its maintenance and development, as the system will be constantly developed and upgraded.

The process of consolidating the IT environment, which is the basis of so-called smart communities, is a long-term process, which can only bring a gradual, long-term, but reliable improvement of the IT environment if it is based on clear rules and a strategy for the digital development of the community. The technical requirements and possibilities for data exchange and connection of processes are also a key part of the entire system, as this is the only way to enable the connection of existing services and the development of new services, which are all part of the unified system of the 'Smart City' of Kranj.

In order to monitor the effectiveness of development in the field of digitisation, indicators of user satisfaction, system efficiency and the impact on the sustainable development of the City Municipality of Kranj will also be defined and regularly monitored. Methodologies developed as part of key European projects in the field of smart communities will be used, which will also enable Kranj to realistically assess its own progress in various areas and constantly compare the situation with other reference cities, especially in the context of the 'Intelligent City Challenge' project consortium. Based on connected data sources, a digital twin of the city can be designed and monitored in real time, which will be an excellent tool not only for monitoring the effects of development, but also for predicting the results of the introduction of innovations and changes.

Compiled by:
Boris Koprivnikar, Sincular, consultant
prof.dr. Janez Bešter, Faculty of Electrical Engineering, University of Ljubljana
Ana Vizovišek, Sector for Development and Smart Community

Tomaž Lanišek
Head of the Sector for Development and Smart Community

Matjaž Rakovec
Mayor