Maastricht - Creating a Vision on Smart City

SMAARTRICHT

E. Georgiou, S. Sanchez, G. Sali, N. Sharoichenko, T. Benz & T. Lux
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MAASTRICHT UNIVERSITY

Executive Summary

Today´s world is more globalized than ever before. While there are many reasons for this development, it is first and foremost the evolution of the internet as we know it today. Simultaneously, a more globalized world also means a more digital world. With various aspects of our lives being digitized nowadays, including the way we communicate with other people and how business is done all over the world, challenges evolve not just for corporations to target their customers, but also for municipalities to fulfil their role. As a consequence, the idea of a "Smart city" evolved. Such a city is characterized by using different forms of data and information technologies in order to constantly improve its citizens' well-being while fostering innovation and economic development at the same time. Overall the construct of a smart city encompasses five different domains: Economy, Living, Governance, Mobility, and Environment. Each of these domains is significantly different from the others, which translates into different benefits as well as challenges. Nonetheless, it is important to note that the domains are not mutually exclusive. In practice, this means that the advancements made in one domain are very likely to affect some or all of the others.

All over the world cities have started to engage in various initiatives to become smarter and cities such as Barcelona, Eindhoven, Helsinki, or Manchester are taking the lead in Europe. What all these cities have in common is the fact that they developed a common vision of themselves as a smart city, before they engaged in specific initiatives or projects. This vision needs to be shared and supported by all relevant actors. Furthermore, it needs to be based on the local DNA of the city, thereby taking into consideration location-specific factors. To start out, a relatively narrow focus should be set that tackles one specific challenge that exists in the city. Upon completion of the first initiatives, this focus can be widened in line with the learning experiences made by the governing bodies.

In order to succeed with the implementation of a project in any domain, it is essential to consider all potential stakeholders, including municipal bodies, the local industry, as well as the citizens themselves. Additionally, a great level of coordination is essential, which highlights the importance of interdepartmental communication within the municipality. Finally, specifically to the project tailored performance metrics allow for a thorough evaluation, which in turn maximizes the potential for learning.

Taken together, the transformational process of becoming a smart city poses various challenges to the municipality. It requires a shared understanding of numerous stakeholders from different sectors that all need to collaborate in order to make the process a success. Nonetheless, we regard it as essential for any municipality to engage in the process in order to be able to continue its role in continually improving the well-being of its citizens.

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I. Introduction

The report at hand represents the first project that the Municipality of Maastricht (*Gemeente Maastricht*) has entrusted to students of Maastricht University who are participating in the honours programme called "PREMIUM Excellence programme". This programme constitutes an extracurricular honours programme for which a certain number of highly motivated master students are pre-selected. Different types of organizations participate in the programme as clients; they select their preferred candidates in accordance with the nature of their project. Our team consists of six students from different nationalities and backgrounds (ranging from psychology to law and from digital cultures to international business) selected by *Gemeente Maastricht*, our client, contributing to the project by bringing together a variety of viewpoints.

Being the first project on smart cities for the *Gemeente Maastricht* our main task revolved around providing a thorough overview of the concept of Smart City, both from an academic and a practical perspective. We have enriched our own research with numerous interviews that we conducted with officials from the *Gemeente Maastricht*, as well as with officials from other cities and associations that are familiar with the concept and have already undertaken initiatives in this field. Additionally, the cities whose officials have been interviewed are leaders in the process of becoming a Smart City.

Apart from providing an overview of what constitutes Smart City, we were asked to develop specific recommendations for the city of Maastricht while taking into account its city-specific characteristics. Ideally, these recommendations shall give an outlook onto how Smart City projects should be approached and implemented and might serve as a guidance for the urban policy-makers in charge of Smart City projects in Maastricht. On the other hand, the present work could also serve as a basis for upcoming teams working on this topic that might then focus on more specific aspects of the transformation of Maastricht into a Smart City.

In the report at hand, a conceptual definition of what a smart city translates into is given first. Next, four cities are introduced that are considered as leading examples of smart city developments. Afterwards, the different domains that constitute a smart city are explored. Here, each domain is first defined and then linked to the practical implications that it translates into. Finally, each domain is connected to Maastricht itself and further to the coalition agreement established by the municipality. Following the discussion on the different domains is an overview of potential funding opportunities. Finally, a conclusion on the key findings is given together with an overview of recommendations for each domain.

II. Definition of Smart City

i) Smart City

In the European Union, around 75% of the population already lives in urban areas and rise to 80% is expected by 2050 (Eurostat, 2016). As a consequence, cities play a fundamental role in social and economic aspects worldwide and have a huge impact on the environment (Mori & Christodoulu, 2012). Smart cities are characterized by sustainability principle whereby a balance between social, economic and environmental aspects should be established. In that sense, cities should respond to people's needs through sustainable solutions for social and economic aspects (Turcu, Berardi, 2013).

It is important to highlight as a premise that becoming a Smart City does not only mean the mere application of the latest technologies. Rather, it regards technology as a tool to improve the citizen´s well-being (Johanna Juselius, personal interview, 05.04.2019). The concept of Smart City has its origins back in the 90's and it was focused on the significance of new information and communications technologies (ICTs) with regard to modern infrastructures within cities. Eventually, Smart City is a hard-to-grasp concept which has been contested by different scholars leading to the existence of many definitions and similar concepts (smart cities, intelligent cities, digital cities). In fact, it is a concept that has been used for hard domains such as buildings, energy grids, natural resources, water management, waste management, mobility, logistics and soft domains such as education, culture, policy innovation, social inclusion and government. The proposed definition in the present report of Smart City is the following: *"Smart Cities initiatives try to improve urban performance by using data, information and information technologies (IT) to provide more efficient services to citizens, to monitor and optimize existing infrastructures, to increase collaborations among different economic actors, and to encourage innovative business models in both the private and public sector"* (Marsal-Llacuna et al., 2014).

ii) Leading Examples

The smart city concept is growing rapidly all over the world. Cities of all sizes are aiming to improve the quality of life of their citizens. According to Juniper Research (2016), "European cities are forging ahead with efforts to become smart cities, with 60 % of the world's leading smart cities based in Europe. It was found that innovation to reduce congestion and energy consumption were key initiatives across many European cities". Therefore, there are many leading examples of smart cities in Europe which

obtained the "smart" qualification. In the following section, Amsterdam, Barcelona, Helsinki and Eindhoven are introduced as such leading examples.

Amsterdam:

Amsterdam has received international recognition as one of the world's leading examples of a successful smart city initiative (Angelidou, 2014). More specifically, it won the World Smart Cities Award in 2012, as well as the European City Star Award in 2011 (Angelidou, 2014). Their targeted structure is an urban innovation ecosystem in which partnerships between companies, research institutions, authorities and the citizens of Amsterdam are brought together to foster collaboration. Currently, it comprises more than 70 partners, including IBM and CISCO (Zygiaris, 2013; Angelidou, 2014). These collaborations helped the city to attain more than 40 smart city projects such as smart grid (electric grid that uses digital communications technology that allows for two-way communication between the utility and its customers), smart parking and home energy storage (Cohen, 2014; Smart Grid, n.d.). Furthermore, Amsterdam focused on using the city as an urban laboratory, which includes new mobility solutions, open connectivity and energy transition (Angelidou, 2014; Cohen, 2014). One of the most well-known projects of Amsterdam is the Climate Street. It took place in one of the most popular shopping streets in Amsterdam, Utrechtsestraat, where several energy-saving technologies were placed. Some examples of these technologies are smart plugs, smart lighting and smart meters as well as energy displays (Angelidou, 2014). In addition, dynamic traffic management, faster Internet, natural water-cooling and electric water transport were some other elements of their smart city projects (Lohrmann, 2016). Moreover, in an attempt to raise awareness amongst the citizens regarding the importance of energy consumption, 400 households in Amsterdam were equipped with new energy management systems (Angelidou, 2014).

Barcelona:

Barcelona is known for its smart city initiatives. Named as the European Capital of Innovation in 2014, Barcelona achieved to implement more than one hundred smart city projects, which makes it one of the leading and successful examples (Van Hooijdonk, 2017). Moreover, it is hosting the annual Smart City Expo World Congress, which supports the growth of the 'smart city' industry (Van Hooijdonk, 2017). It is a city that seeks to both foster economic growth and improve citizen's welfare (Angelidou, 2014). The engagement of citizens and the private sector is one of the main strategies in Barcelona. Therefore, the collaboration among stakeholders such as businesses, government authorities, residents, as well as academic institutions is crucial (Angelidou, 2014). Barcelona puts emphasis on social and human capital. Correspondingly, new services for citizens with open public data have been placed in an attempt to provide the citizens with the opportunity to participate in the management sector and to offer up-to-

date information (Angelidou, 2014). In addition, smart lighting, electric vehicles, smart garbage bins, smart parking systems, digital bus stops and ubiquitous connectivity with Wi-Fi in public transport and places are some of the successful projects of the city (Van Hooijdonk, 2017). Furthermore, Barcelona focuses on urban innovation. The 22@Barcelona District is one of the most well-known and successful examples of the city. It is an innovation district which includes smart city standards with green infrastructures, equipped with high-technology, mobility, housing and improve the quality of life (Bakici, Almirall & Wareham, 2013).

Helsinki:

Finland's capital is another leading example of a smart city. In Helsinki's case, the collaboration between municipalities promotes the evolvement of a 'Smart Region'. Thus, the concept of smart city is not limited to a single municipality but rather encompasses a variety. It removes the boundaries between bureaucratic organizations, so as to succeed in building a future smart region (Hielkema & Hongisto, 2013). On the other hand, Helsinki is piloting smart city projects in existing urban areas. An example of such an area is the smart Kalasatama district, where test procedures are taking place (Van Hooijdonk, 2017). More specifically, citizens in this district are testers of these new smart services and technologies, while, at the same time, providing feedback. Some of the pilot projects include waste collection systems and car charging facilities, which helped to reduce the traffic of garbage vehicles by up to 90 per cent (Van Hooijdonk, 2017). In addition, smart grids and applications that plan efficient traffic routes helped to reduce the energy usage by up to 15 % (Van Hooijdonk, 2017). Moreover, living labs (e.g workshops) for smart cities is a social artefact which brings people and organizations together in an attempt to create both joint and individual outcomes (Hielkema & Hongisto, 2013). When it comes to the Helsinki's region, living labs aim to create a shared vision which brings collaborative projects, citizens experiences and ideas as well as business communities together for the public interest (Hielkema & Hongisto, 2013).

Eindhoven:

Eindhoven was appointed as a national 'Brainport' by the Dutch government in 2004. The Dutch city Eindhoven was selected as one of four innovation regions to strengthen the dynamic and economy of the Netherlands (Fernandez-Maldonado & Romein, 2010). Eindhoven is well-known for its remarkable case of urban development. This achievement was mainly based on high-tech development of the city, which also helped to overcome socio-spatial issues, such as how to build new infrastructures. Moreover, the city is known as a centre of technological innovations as it is the town where the Philips Electronics multinational firm was founded (Fernandez-Maldonado & Romein, 2010). Eindhoven University of Technology together with the municipality shared their vision for a roadmap for public lighting in the

city. Philips and its partner Heijmans are into an open conversation for making this vision a reality (Newsroom, 2017). Building on the collaboration of four key stakeholders, which includes the municipality, the citizens, university and business, the city can create smart city opportunities. Furthermore, Eindhoven is building a dashboard to monitor the progress of the city, while at the same time creating applications via which everyone can have access to the open data of new projects, ideas and developments. An example of such a project is the Citybeacon, which is an interactive street kiosk that allows people to connect with the city.

As illustrated above, cities are active in different areas of life in order to become a smarter city, or even smarter region. In the following chapter, the dissection of the concept of Smart City is made in an attempt to provide a more detailed structure to the different domains that Smart city concept is built upon.

III. Domains

Smart City can be divided into different components (Giffinger, 2010) such as: (i) Smart economy, (ii) Smart living, (iii) Smart governance, (iv) Smart mobility, (v) Smart environment. These domains are related to urban life aspects, for instance, Smart economy to industry, Smart living to security, well-being or education, Smart governance to E-democracy, Smart mobility to logistics and infrastructure and Smart environment to efficiency and sustainability. In the following subsections, a further description of the abovementioned proposed components is depicted.

i) Smart Economy

Smart economy represents one of the key building blocks of a smart city. Throughout the world of academia and among practitioners, numerous definitions for what a smart economy constitutes emerged. Some refer to the smart economy as the intersection between the economy and the smart city itself (Smart Cities Berkeley, 2012). While this is a very broad definition, others focus on more specific aspects. For example, the EU´s Lifelong Learning Programme highlights the importance of e-commerce and ICT-enabled innovation next to the development of industrial clusters for a smart economy, all of which are enabled by "local and global interconnectedness and international embeddedness with physical and virtual flows of goods, services and knowledge" (Sachsenmeier Marinescu, Oliveira, Silva, & Verhijde, 2015, p.7). On the other hand, Davies and Mullin among others argue that a smart economy is a "green" economy at the same time. Here, a reduction in carbon dioxide emissions by the industrial sector is actively encouraged. Furthermore, governmental investments towards a "clean economy" play a substantial role in achieving the aforementioned objective (Davies & Mullin, 2011). What all these definitions have in common is their focus on the interconnectivity between the city and its surrounding industries represented by businesses of all sizes located in the respective geographical area. In the medium- to long-term, a trend towards a sharing economy is anticipated (Kumar, 2016). Characteristics of this trend include the formation of different alliances among business actors to facilitate a collaborative advantage through the efficient use of resources.

Despite the availability of various definitions of what marks a truly smart economy, it remains unclear up to date whether a smart city is considered "smart" because of its economy or whether a smart city in itself is responsible for the workings of the economy. In other words, it is yet to be proven whether a smart economy makes a smart city or the other way around.

Nonetheless, in our view, this relationship should be seen as a constant interplay between the two. A city can only be considered "smart" when its economy is competitive and makes efficient use of resources while acting sustainably. This allows for further applications in other fields, such as mobility or safety. At the same time, it seems unreasonable to believe that an inefficient and unsustainable economy can persist in a smart city over time.

For a municipality to make its surrounding economy smart, different opportunities exist. Taking the example of Helsinki or San Sebastian, the municipalities actively encourage the collaboration between various stakeholders (Johanna Juselius, personal interview, 05.04.2019 & *Fomento de San Sebastián* (FSS), personal interview, 16.05.2019). These include not only different departments within the municipality working together on cross-functional projects but also members of the local university on various levels, as well as numerous companies located in the greater Helsinki area. Together these different groups can achieve a collaborative advantage that creates a profitable situation for all of them. Similarly, the collaboration between Philips and the Eindhoven University of Technology proves to be beneficial for both parties. Other means to foster such developments can take the form of certifying and awarding efficient and sustainable business conduct in the area or to actively encourage businesses and individuals to share their resources such as machines or office space (Development Asia, 2018). Such an initiative could be facilitated through the creation of different platforms that allow for such an exchange. Existing platforms in this field include Peerby or Backfeed. People use Peerby to share their personal assets, such as tools, with other people in the same geographic area (Peerby, 2019). Backfeed, on the other side, is focusing more on businesses than end-consumers considering itself "social operating system for decentralized organizations" what translates into enabling open-source collaboration without a central form of coordination required. Consequently, it helps in bringing together businesses with freelancers for collaboration (Backfeed, 2019). Similar platforms could be created by municipalities or with the support of them, which would help in achieving greater efficiency in resource usage and in facilitating the development of collaborative advantages.

Connecting the idea of a smart economy to the coalition agreement of Maastricht signed in 2018 reveals that the city has already incorporated large parts of it in its vision for the upcoming years up to 2030. Here, the growing importance of collaboration between different stakeholders has already been realized in the past, as can be seen by the development of the connection between the Belvédère district and the Sphinx Quartier. Furthermore, the growing pressures for a sustainable city are highlighted. The key for Maastricht is now to combine the benefits of both wide-ranging collaboration efforts and sustainability trends, in order to position itself as a truly smart city in the long-term. This will lead to Maastricht becoming even more attractive for doing business, while at the same time recognizing its responsibility in maintaining its surrounding ecosystem.

ii) Smart Living

Smart living is a trend which involves innovative solutions aimed at making the life of people sustainable, productive and efficient while taking into considerations the basic needs of the citizens of the city (Smart Living Projects, n.d.). In general, smart city projects aim to use technology and information so as to achieve an effective city, which can improve the quality of life for all citizens, including physical health, education, security, wealth and a clean environment (Hayati et al., 2017). Correspondingly, smart living projects are using technologies and systems in order to help cities enhancing the accessibility and interactivity of urban services (Lai, 2015). According to recent studies, more than 30% of intercity traffic is caused by drivers who are searching for a parking spot (Smart living Projects, n.d). This can be both a time-consuming process and loss of energy. Therefore, systems and applications were designed in an attempt for vehicles to easily find free parking spaces. These systems consist of car sensors in which drivers can get guidance and are informed of possible available parking spots (Smart Living Projects, n.d). An example of such a system is the iPark application, which enables users to view and book available parking spots by using their phones (Lai, 2015). In addition, these sensors can provide valuable data for the city, such as statistics, to gain information on where there is traffic and at what times of the day (Smart Living Projects, n.d). Furthermore, smart living projects intend to construct buildings quicker and cheaper while using more efficient construction materials. Examples of such innovative constructions and architectural concepts are flexible floor plants, prefabricated homes as well as retrofitting (the action of adding new technology or features to older systems).

Nevertheless, the role of human capital, as well as education in urban development, is crucial for a smart city. In order for smart cities to be successful, citizens' inclusion is vital. Therefore, a key element is the inclusion of smart people (Madakam & Ramaswamy, 2014). The 'smart people' concept comprises of various factors like affinity to lifelong learning, social and ethnic plurality, flexibility, creativity, cosmopolitanism or open-mindedness, and participation in public life. Problems associated with urban agglomerations can be solved by means of creativity, human capital, cooperation among relevant stakeholders, and their bright scientific ideas and "smart solutions". The label smart city, therefore, points to clever solutions by creative people (Albino, Berardi & Dangelic, 2016). 'Smart people' generate and benefit from social capital, so that the smart city acquires the meaning of a mix of education/training, culture/arts, and business/commerce with hybrid social enterprise, cultural enterprise, and economic enterprise A smart city is a humane city that has multiple opportunities to exploit its human potential and lead a creative life (Albino et al., 2016).

But it also raises some privacy concerns in the society related to the collection, conservation and use of collected data. Therefore, public organisations and private entities that are engaged with smart city projects have to pay special attention to this issue and to create 'smart solution' also to this problem.

Eindhoven is a leading example of developing a smart living concept. They took the bottom-up approach and started by asking citizens to indicate what their frustrations, concerns or dreams are. Subsequently, these social issues have been brought to the attention of potential partners, experts, and designers from businesses, government and knowledge institutes. The next step was to co-create conceptual solutions for these issues and test them in a real situation which was created specifically for this aim called 'living labs'. Other cities also use this approach delimiting certain city area as a test-bed and a city-lab which can be afterwards replicated in other city areas (*Fomento de San Sebastián* (FSS), personal interview, 16.05.2019). These social experiments called 'products' could be implemented at a bigger scope only if they work properly and solve the social issues identified at the beginning of the process (Caragliu, Del Bo & Nijkamp, 2009).

Amsterdam reveals a different approach. Here, a neighbourhood biorefinery, a small-scale treatment unit in which raw materials and energy can be recovered from black wastewater, has been put in place. Wastewater carries raw materials (like plant nutrients) and energy (heat and biogas). Most of these are lost in our current wastewater systems. In practical terms this means that we should keep the different types of wastewater separated to be able to recover energy and minerals efficiently.
Luxembourg is also known for its citizen-focused approach. The leading example is the 'e-City initiative' which transformed the City of Luxembourg by providing internet access to public places and connected mobile devices to a citywide information platform. The main objective of the project was to ensure the integration of each and every layer of the population through proactive approaches towards the citizens' needs and the development of society. In close relation to this project four citizens' training centres have been built since 2004, in collaboration with local associations. The training programmes – for both individuals and groups – allow citizens to obtain their 'internet licence' for free.

Maastricht has constructed a modern system of municipal services for residents and neighbourhoods. Collaboration with residents and institutions and use of their expertise are starting points for planning, particularly within the social domain and where the immediate living environment is concerned. It is believed that it is not only the citizens` opinion that is important but above all their expertise. Within the Maastricht Municipality`s Smart city project several concrete measures are desired and foreseen in the Coalition Agreement. In the first place, the focus is mostly on education and job opportunities. The aim is to intensify the cross-border job placement and increase career opportunities for pupils and students so that they can find not only their first but also their subsequent jobs in their own region/Euroregion. Special attention is given to health and wellbeing of the citizens. It is believed that

what is necessary is to have “private life, work and housing in balance” (Coalition Agreement 2018-2022 Maastricht, Unlimited and Unstrained) as a core value in new health policy, plans, and projects with special attention for preventive healthcare. Encouraging sport, exercise, and recreation as one of the key objectives in the design of public space, for example by installing playground equipment for children and exercise equipment for adults are only a few of the further ideas which are planned to be implemented in future Smart Maastricht.

iii) Smart Governance

Smart governance determines the effectiveness of the implementation of smart city objectives and connects all other domains due to the provision of managerial activities and joint operation.
Smart governance refers to two areas of city development. The first one is the adoption of transparent decision-making and promotion of political participation. This aspect requires an active involvement of different stakeholders - government bodies, companies, NGOs and citizens. Such interaction is based on open dialogue and the framework of communication that allows improving the city together with minimal obstacles. Smart governance in a smart city from this perspective “means collaborating across departments and with communities, helping to promote economic growth and at the most important level making operations and services truly citizen-centric” (Bătăgan, 2011, p. 85). It highlights both internal and external elements of cooperation in the model of smart governance together with desirable results.

The second area is the creation of accessible online services to improve the effectivity of the government and facilitate public services. It includes such policy goals as Information and Communication Technology (ICT) for officials, smart public engagement (for instance, elections), e-consultations and e-data. Examples of this area are special online portals for state services, mobile platforms on the activities in cities, or forums for the immediate communication between citizens and officials. Estonia has a unique program of e-residency that allows entrepreneurs to get access to different public services and launch a start-up, for instance, in Estonia without Estonian citizenship (Republic of Estonia, n.d.). A crucial aspect of smart governance from an ICT viewpoint is also the security issue in terms of protection of sensitive data (and sharing specific databases on city’s progress for the sake of transparency) and surveillance, for instance, CCTV.

There are several models of smart governance: Government to Citizen Model (G2C), Government to Government (G2G), Government to Employee (G2E) or Government to Business Model (G2B). Harmony among them is necessary for effective smart governance. In the case of Maastricht, the most

useful models for developing smart city might be G2C and G2G to analyse the citizens' expectations and needs and to share the experience with other smart cities.

A good example of the practice of Smart Governance is the city of Vienna. The municipality elaborated a comprehensive strategy of smart city that stresses the great importance of e-services for citizens and achieved the number of 85% of digital registrations for various city services (Smart City Vienna, n.d.). The city also has a chat bot and a city app for people's inquiries and an Open Government Database, which aims at offering transparency of the governmental projects. Noteworthy is that the organizational framework allows all the domains to be interconnected under the umbrella of the smart governance focus. Various departments of the municipality are in contact with each other in order to link the projects and strategic plans related to smart city harmoniously and deliver the best result for the citizens, who are the centre of the Smart City Strategy.

In Germany, smart governance focuses on cyber systems and interactive services with a 'label' 4.0, for instance, "Agriculture Administration 4.0" or "Construction Administration 4.0" (Von Lucke, 2015). This is followed by the German e-government law (eGovG) and subsequent smart governance strategies on a national level (National E-Government Strategy, 2015). Cities such as Berlin, Cologne and Frankfurt use the Polyteia platform for smart governance in areas of public communication, operation planning and treasury (Polyteia, 2019).

The Maastricht Coalition Agreement (2018) provides a good foundation for developing smart governance as it recognizes the importance of "collaboration with residents and institutions and use of their expertise" (p. 8). It also aims at "investing and innovating in public and government participation" and states that the Municipality is open for experiments on "dialogue, public participation, and cooperation ("co-creation")" (p. 8). It is vital for the city when the European Union was born, so Maastricht can be an example of involvement of the citizens in the city affairs. However, the agreement has no section dedicated to smart governance and peculiarities of interaction between the official bodies and citizens, while other domains are described quite comprehensively. Thus, Maastricht should develop its vision for smart governance more explicitly and elaborate on improvements in the area of communication with citizens and usage of the ICT in the city affairs. This will allow the city to grow as a smart city and raise the effectiveness of other domains, which might benefit the citizens significantly.

iv) Smart Mobility

As mentioned previously, an ever-increasing number of people is living in urban areas, magnifying the demands posed onto the respective mobility infrastructures in these zones. At the same time, the cities are often limited in their possible solutions by space and territory constraints. In order to solve this dilemma, mobility should be as smart as possible. Smart mobility is a term that refers to improving the means of transportation, traffic flow, and the possibility to move freely without causing environmental damage. Implementations are generally aimed at "optimizing existing city infrastructure, services, and urban behaviour through the deployment and utilization of digital networks" (Papa & Lauwers, 2015, p. 544). Different solutions have been proposed to make the city smarter in this regard. These range from solutions that are realistic at the moment and rather easy to implement like bike sharing or the use of mobile phones in combination with apps (Lendák, 2016) or sensors (e.g., Barcelona) to find an open parking spot, to more future-oriented measures such as vehicles with automated driving. One of the predominant views on mobility in the future entails that mobility will switch to be an on-demand service where individuals will change from using their own vehicles to ordering a vehicle when they are in need of one.

When employing these measures, the interests of several actors should be taken into account: public transport companies and organizations, private companies and citizens, public bodies and local governments, and a combination of all of them. Ideally, these means have positive effects on reducing pollution, noise pollution, and transfer costs while improving people's safety and transfer speed (Benevolo, Dameri, & D'Auria, 2016). By nature, these factors can also be utilized to determine the effectiveness of an implemented solution. That is, pre-intervention levels of, for example, pollution or people's safety can be compared to post-intervention levels to determine the impact of a solution.

Nevertheless, there are also risks that have to be considered when speaking about the future use of smart mobility solutions. Maybe the most obvious one is privacy protection: with ever increasing numbers of services heavily relying on data (mining) to provide their services, privacy protection is one of the most pressing issues that have to be resolved to move forward (Ilarri, Stojanovic, & Ray, 2015). Factors relating to governance of smart mobility that should be taken into account include amongst others interventions in the realm of environmental, economic, and social externalities or setting standards and communicating with the public about transport system operation (for an extensive list of governance need for involvement see Docherty, Marsden, and Anable (2018)).

Cities such as Helsinki or Barcelona are frontrunners on the way to implementing smart solutions in the area of smart mobility. Barcelona, a city that is very densely populated and rather narrow and winding,

for example, is using a lot of sensor data and camera footage to facilitate the local traffic flow. Initiatives that have been put into place by the European Capital of Urban Mobility include smart parking, the use of an app called Smou (AppaarkB) and eBici. Smart parking is directed towards studying drivers' behaviour patterns and use the gathered data to increase the user experience of the driver and decreasing the time that has to be invested to find a parking spot. Using the data gathered by 500 sensorized parking spaces, individuals will be notified by an app where to find an open parking spot. Furthermore, possibilities for the integration into car navigation systems are being tested at the moment. Another solution is provided by means of the app *Smou,* which integrates several services in one app. The app enables users to take the time they are parking (similar to the bill-based system for buses in Maastricht) and pay the respective amount of money with their mobile phones Moreover, it can provide the user with a quick overview of the location of the different means of transportation available in one area, even including shared rides, or the next electric recharge station. In this regards the app is the perfect example of an integrated interface to access different data which increases its user experience. The example of Helsinki can give valuable insights in the testing phase of new concepts and ideas. Pilots are first launched in particular city districts before they are, in case of success, employed in the whole city/region. According to Johanna Juselius (personal interview, 05.04.2019) the term smart mobility in Helsinki encompasses several projects. These include mobility as a service (MAAS), the development of automated traffic, car-sharing and an app where citizens can choose the way they want to travel (private or public transport) which have been (partially) implemented.

The 2018 coalition agreement reflects that Maastricht officials already acknowledged the importance of this domain of smart cities. The intention to gradually work towards an emission-free traffic and logistics systems as well as converting parking space within the city into cycling parks, playgrounds, and meeting points is in line with smart mobility objectives. Furthermore, projects like city and rail and the Hasselt-Maastricht tram will increase transfer speed which is one of the outcome measures of smart mobility. Other challenges, such as the parking challenge, might be solved by similar solutions as the ones used e.g. in Barcelona. As our interview partners (Hommes & Kooijman, personal interview, 25.03.2019) stated, Maastricht already possesses potent equipment and technology such as sensors (e.g., traffic lights and ticket machines) and cameras which could be employed to facilitate the mobility of the citizens. Additionally, the use of what has become everyday technology such as smartphones should be taken advantage of. A possible example would be the introduction of an app similar to the ones in Barcelona and Helsinki which would allow citizens to be aware of the mobility options available to them. Ideally, this would also foster the use of public transport and car-sharing options and mitigate the use of private cars. The service could be provided in turn for the provision of general user data.

While thinking about smarter ways to organize Maastricht's future mobility several points should be taken into consideration. One of the most crucial points for attention is privacy concerns. Especially

when a transition towards autonomous driving and MAAS will take place a lot of data will be required, and privacy concerns should be handled in advance. These can be tackled on different levels. On a technological level Butt and Afzaal (2019) propose, amongst others, the use of strong encryption techniques and authenticate smart city sensors each time they are used. On a more general level, the city of Amsterdam has published a manifesto, called TADA, which introduces six principles that intent to foster the responsible use of data. Likewise, New York has developed guidelines for the internet of things (IoT) in order to establish certain standards in this domain. A more extensive list of exemplary solutions employed by other cities regarding privacy can be found in Bass and Sutherland (2018). Another aspect is the necessity to invest in digital infrastructure. Many of the solutions (though not all) depend on the provision of a good technological network. Specifically, providing high-speed internet, at the moment the so-called 5G, all around the city should be a priority as some services are very data-intensive and reliant on this type of infrastructure.

v) Smart Environment

The environment is a component of vital importance to focus on for smart cities. Cities consume between 60-80% of energy worldwide and are responsible for large shares of Greenhouse Gas emissions (UN, 2008). The use of technology can contribute to the achievement of a higher level of sustainability, management of natural resources and the improvement of infrastructures such as waterways and green spaces. Smart Environment is described by attractive natural conditions, pollution, resource management as well as by efforts towards environmental protection (Giffinger et al., 2007). The level of smartness in terms of the environment is commonly assessed by indicators such as ambitiousness of CO2 emission reduction strategy, efficient use of electricity, efficient use of water, green space areas, Greenhouse Gas emission intensity of energy consumption, policies to contain urban sprawl, or proportion of recycled waste.

Under the Coalition Agreement, the city of Maastricht pursues to become a completely waste-free city by 2030. In that sense, it has been shown above in Smart living chapter the example of Amsterdam taking a neighbourhood-oriented approach when tackling with waste management matters. There is not a perfect solution but different ways to address it and each city might have its own way in accordance with its characteristics (*Fomento de San Sebastián* (FSS), personal interview, 16.05.2019). In the field of energy, the focus in Maastricht is on energy saving and a gradual transition to green energy necessary to achieve the target established at a national level by 2050. The province of Limburg within LEKTA (Limburg Energy and Climate Transition Approach) brings an alliance of stakeholders and actors in the province aiming to cooperate to address the goals of the new climate agreement and to hold each other to those goals towards a CO2 neutral Limburg by 2050. In light of this alliance, current colleagues from

our Honours programme have been entrusted with a project which objectives are, among others, researching on the best practices, initiatives or strategies of energy transition involving cooperation from local residents. Therefore, it is highly recommended to have a look at the outcome of this project in order to gain insights into the matter. On the other hand, the city of Maastricht is characterized by a high-quality University system attracting talent from around the world. This special characteristic presents a great opportunity to forge a solid Knowledge-Based Development strategy whereby a continuous interactions of knowledge agents (universities, research institutes, businesses, citizens, etc.) as well as with the knowledge agents of other cities might bring on the table cutting-edge thoughts towards sustainability transition. An interesting example in that regard is the "CityVerve" in Manchester (UK), a consortium led by Manchester City Council including stakeholders such as universities and businesses (Martine Tommis, personal interview, 08.04.2019). Another way to move towards a high level of suitability is through green public procurement. Local authorities, using their purchasing power to choose goods, services and works with a reduced environmental impact, can make an important contribution towards local, regional, national and international sustainability goals. Hence, as enshrined in the Coalition Agreement, tightening up the sustainability objectives within the municipal procurement policy is an important tool to face climate change, resource use and sustainable consumption and production. In that regard, Maastricht contracting authorities can make use of existing guidelines such as the 2016 European Commission titled "Buying green!, a handbook on green public procurement" in order to foster the Smart environment domain.

IV. Funding

First of all, there are two funding sources at the level of a comprehensive general funding agenda controlled by the key European institutions: The European Regional Development Fund (ERDF) that provides financial support on a national or a regional basis and The European Fund for Strategic Investment (EFSI) managed by the European Investment Bank. The ERDF has new strategies for 2014-2020 including Research and Development and Sustainable Economies. It also highlights the importance of a low-carbon economy and is willing to support environmentally-friendly initiatives, especially on the scale of cities. There is a special section on the Southern Netherlands, which is applicable for Maastricht if it wants to address its financial needs for the smart city development. Also, for sure, the Horizon 2020 Research and Innovations Programme must be mentioned, as it provides the biggest funding platform for innovative urban solutions all over Europe. This programme has a special section on the requests for funding (European Commission, n.d. a) with clear guidelines on what is required of cities in order to qualify. So far, the budget of the European projects with a financial contribution from the Horizon 2020 is around 33 million euros.

Secondly, both EU private and public initiatives can attract investors through the European Investment Project Portal (EIPP) (European Commission, n.d. b). It acts as a platform for connecting smart projects and stakeholders, which can bring a lot of benefit to smart city initiators. Basically, it acts similar to a start-up incubator, but at the more professional level and including public bodies, like *Gemeente Maastricht* for example.

Thirdly, there are funding opportunities directly connected to the smart city concept. One of these is the Urban Innovative Actions platform, which is aimed at supporting initiatives that resolve modern urban challenges (Urban Innovative Actions, 2019). The project has regular Calls for Proposals and has already provided financial aid to 55 smart city projects. A similar project is the URBACT supported by the ERDF. Economy, governance, environment and inclusion are in the main scope of the program's supporting areas (Urbact, 2019). It has already helped Maastricht with the Freight TAILS initiative in order to improve the European transportation system preserving the environment without decreasing the effectivity of freight networks.
Different European smart cities have different approaches to funding. Vienna has quite a big share of funding from the city government and the state, while also receiving financial aid from the EU at the level of 25 million euros (Dominic Weiss, personal interview, 01.04.2019).

A similar approach is used by Manchester, which smart city activities are funded by both the EU and UK funding programs. The city also has a social care partnership with Microsoft with the aim of developing technologies for a smart city.

The Mogel neighbourhood in Eibar installed a lift installation and achieved an energy-efficiency improvement to the residential buildings using diverse financing sources, including EU funding through the ZENN project.

In Helsinki, the smart specializations strategy was supported by the money from the European regional development funds, while smart city companies can also use their own budget.

Smart Lighting project of the Municipality of Eindhoven represents a mutually beneficial deal with the consortium of Philips and Heijmans companies, in case of which the funds (several millions of euros) were reserved for the maintenance of street lighting (Heijmans, 2016). This consortium uses the money to maintain the street lighting, while at the same time developing innovative concepts and new features for it, that are desirable in the relevant areas of the city. The Eindhoven University of Technology monitors the whole process.

V. Conclusion

Smart Cities do not come into sight without a Smart City Action Plan which interconnects all the domains discussed above, all the departments of *Gemeente Maastricht* and the different stakeholders of the city. The establishment of a challenging and achievable plan will create a particular vision on Smart City according to the needs of this city. The local DNA of the city, distinctively from the others, should serve as a basis when developing such a vision.

In achieving this vision various opportunities exist to receive additional funding. A major role is played by the European Commission here. Through the European Regional Development Fund and the European Fund for Strategic Investments cities can apply for additional funding for their projects. Furthermore, the European Investment Project Portal provides a promising platform to connect with potential investors or stakeholders that may have remained unnoticed otherwise. Despite the availability of various possibilities for the generation of funding, the task requires a significant amount of time and resources. Most cities applying for such funding opportunities established corresponding departments or have designated employees to focus specifically and only on the exploration of funding strategies and on the actual application process.

As an important remark, smart cities are not just smart because of abundant or excessive use of technology, although we believe that in the majority of cases it can deliver the most effective and sustainable solution. Once a specific vision is agreed upon, it is of utmost importance to develop a common approach to each project that is to be implemented. This approach is meant to serve as guiding points for the successful implementation of any initiative. In our opinion, the following elements are essential here:

1. **Define the objective.**
   → Before one can start considering the specific aspects of the implementation, it is crucial to agree on a project-specific objective. This could take the form of, for example, the establishment of an application to present the availability of parking spots throughout the city centre by using camera surveillance data. Generally, the more concise the objective is, the easier it will be to communicate it and to succeed in the implementation process.

2. **Interdepartmental communication (round table).**
   → When the objective is clearly defined, it is important to approach all departments within the municipality to not only gather ideas on how to implement but also to find out about how each

of them could make use of it. Hereby, different applications of the technologies thought of can be detected. Another significant factor that is relevant for all following steps is that only when the different departments actively communicate and collaborate with each other, it is possible to find the most efficient and promising solution.

3. **Select the most sustainable solution.**

   → At this point, the departments within the municipality come to an agreement on how to go through with the implementation of the established objective. Furthermore, it is important to define the needs for the project at hand including how to organize the funding structure, which stakeholders to involve, etc. An important remark to the latter point is that it can prove beneficial to think of potential stakeholders in the broadest sense possible, as this can lead to novel and unexpected combinations.

4. **Involvement/collaboration of stakeholders for a potential solution.**

   → Here, the respective project leaders reach out to external stakeholders that could be value-adding to the project. Maastricht specifically, is in the position to have a strong university, as well as thriving businesses and entrepreneurs within the city limits. Additionally, Maastricht could potentially benefit from its geographic location between Germany and Belgium. The stakeholders chosen to be involved in the respective project represent important sources of input in the forms of knowledge, resources, or even financial means. They can help in refining the solution proposed by the municipality. Consequently, an interplay between the third and fourth outlined points here should be actively encouraged.

5. **Implementation.**

   → When the most adequate solution is agreed upon by all parties involved, the actual implementation takes place. It should be the project leaders´ responsibility to establish a concise plan for it, including specific milestones that shall be achieved in the process.

6. **Monitoring / Assessment.**

   → In order to adequately monitor and assess the progress made throughout the implementation as well as the results achieved afterwards, it is important to develop metrics suitable for each individual project. There are no generally applicable ones available. Nonetheless, a combination of quantitative and qualitative metrics should be applied. They should reflect the financial aspects of the project, but also the consequences for the involved stakeholders as well as the implications the implementation of the project has on the citizens of Maastricht. Performing a thorough assessment of a project allows for detecting aspects that went well and

those that can be improved. These findings should then be included in upcoming projects to establish a routine for continuous improvement.

To round off the report at hand, we would like to emphasize the strong level of interconnectedness between the outlined domains of a smart city. It is only very rarely the case that the advancements in one domain do not affect the others. As a result, municipalities have to realize the need for establishing thorough paths for interdepartmental communication. Only in this way it is possible to not only develop the most efficient solution to a challenge, but also to acknowledge that a certain advancement could serve multiple purposes tapping into other domains as well. Furthermore, it is only for the municipal policymakers to set the priorities for the respective city. These can encompass different domains, but as a starting point should focus only on a single one to ease the transformational processes. Smart Cities are adopting different approaches and implementing a variety of solutions according to their needs. Notwithstanding this, we propose the following ideas for each domain that might serve as an inspiration for the Maastricht urban policy-maker or for the ones in charge of implementing measures concerning Smart City matters:

Domain	Recommendations
Smart Economy	- Encourage and support the development of business clusters. - Focus on achieving a collaborative advantage. - Award leading firms in collaboration or/and sustainability to further increase awareness.
Smart Living	- Smart Parking Systems via Application (App) e.g. for parking availability. - Workshops / Seminars for people (e.g. elders) to inform them how to use new technologies and apps. - Encourage feedback-giving by citizens via App.
Smart Governance	- Using IT technologies for city security and events: CCTV, digital registrations, smart security checks. - Data management policy (security & privacy). - Development of interaction opportunities (virtual & physical) between the government and citizens + government and companies with the help of e.g. mobile apps and/or online platforms.

	- Development of digital public services (registration, passport renewals, procedural matters, question board).
Smart Mobility	- Facilitate developments in technological infrastructure (e.g. 5G). - Transition toward MAAS, including, e.g., car- or bike-sharing - Expansion of smart traffic lights to support traffic flow.
Smart Environment	- Reaching a higher level of sustainability through Green Public Procurement. - Establishing a Knowledge-Based Development strategy towards sustainability transition. - Sustainability as a key pillar in all Smart City domains.

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VII. Annex

1. Interview with Mr. Dominic Weiss (Vienna)

Maastricht, 01.04.2019

1. Please describe your current position.

I'm the Head of the Smart City Agency of the city of Vienna (Urban Innovation). It is legally a private company, but it is owned by the city, so my company is a kind of outsource. We are a team of 8 people. We are a kind of a support unit for the city administration itself, and our tasks include the elaboration of strategic approaches, project implementation, stakeholder management, etc.

2. Do you regard the transformation to a "smarter city" important? Why?

The city of Vienna is, probably, choosing a different view of a smart city than another city. In 2013-2014, when Vienna was choosing the areas of a smart city, we put citizens in the center first of all, but we were searching about a strategy that should guideline Vienna in next 35 years, and smart city concept came just in the same time. Now it is a framework paper which includes many areas, and the core is always people. So, it is important for citizens.

3. Are you currently involved in projects concerning "smart cities"? If so what kind of projects?

Well, this is not so easy to answer for Vienna, as we work mainly on the basis of the framework paper with 55 meta-goals. We include all city departments and a lot of city-owned companies and make projects with them. There are hundreds of projects in health, digitalization, mobility, energy efficiency, and so on.

4. Who is involved in the planning and implementation of projects? (Specific municipal officials, external partners, universities, etc.)

There are a lot of actors involved, including universities. A couple of universities have smart city in their agenda. We are always involved in such activities. We offer the possibility to write a Master's thesis or PhD applying to a smart city. Universities also help us in some scientific projects.

5. Were there specific hurdles that you encountered in this process and how did you overcome them?

Smart city is kind of marketing thing. People should be convinced to do something and develop some enthusiasm. So, the most important thing is to get decision-makers involved, and you have a huge organ structure the most detrimental thing to innovation is silos and silo thinking[1]. To overcome these silos, it is a tremendous challenge, as you deal with different organizational structure (new and old). So, getting people on board and setting up a new effective structure is the hardest problem. These is also an important problem of a big number of people involved in the city activities. Obviously, different stakeholders didn't work together before, and they need to exchange information effectively. To be honest, we act as a platform for this communication, and it is really a governance problem, not budgetary or anything else.

6. How do you assess/measure the success of "smart city" projects?

There is a huge difference between projects and a strategy. There are a lot of projects, and they are monitored and controlled. It is more about numbers, budget, and so on. The crucial point is about implementation and replication, and it is hard to measure. When it comes to the strategy, there are huge processes and many people involved and we see if our goals are achieved. We look very closely and very sharp on that, but it is the task of particular departments. Once in four year there is a monitoring process, how the framework goes, do we have to review or cancel some goals, etc.

7. How did you organize the funding structure around the transformation to a "smarter city"?

Funding is, of course, a very important issue, but my company is financed mainly by the city administration itself. For the projects themselves, the city is very effective in finding some funds to use. In the future we will focus on private-public partnerships (PPP), and it is a funding concept as well. As an example of the PPP, we have a project with Siemens Technologies and Vienna utility companies such as the Aspern Smart city research making research on urban energy infrastructure. The collaboration with them was successful for 5 years and we prolonged the project for another 5 years as it was successful. 80-100 million euros is going to be put in this project.

8. Did you make use of national or European funding possibilities? If so which ones? How did that process then look like (timeframe, difficulties, etc.)?

During the last 4-5 years we got around 25 million from the EU. The city helping in this, and also there are some projects funded on a national level, from the ministries' side, and we are strongly involved in that.

9. What are specific lessons you learned over time concerning the transformation to a "smarter city" and the management of diverse projects in this matter?

Lesson learned 1 - you have to build a solid basement in the beginning. We made a very good governance structure where every department knows that there is a smart city framework. It gives room for a lot of things after. Many other cities start other way around focusing about some fancy concept, 'a roof', but it is not what they need. Probably, there is no other city in the world like Vienna that does so well in all aspects of smart city. Another lesson learned – we give options, not restrictions. Mobility is one example. Of course, you can make a city tax and say to citizens that if you are rich enough you can ride your car, but no, we always try to give citizens and department options of actions. There are some problems – for instance, waste managers, but there are hundreds of other stakeholders who want to work with us. Rome wasn't built in one day, same with the smart city. You should have a good legal base, solid plan – what do we want to do in 10, 20, 30 years.

10. Is there something you would avoid in the transformation to a "smarter city"?

There are some instruments and policies that are proved to be fruitful, but the management should be in line with many strategies as we are a city of short distances.

*A silo mentality is a reluctance to share information with employees of different divisions in the same company. This attitude is seen as reducing the organization's efficiency and, at worst, contributing to a damaged corporate culture.

2. Interview with Ms. Martine Tommis (Manchester)

Maastricht, 08.04.2019

1. Please describe your current position.

My job title is Principal Resources Programmes Offices at Maastricht City Council. I work as part of a team and I am responsible for bringing in resources to Manchester. We have been working for a long time with numerous programmes from arranging sources including European.

2. Do you regard the transformation to a "smarter city" important? Why?

Yes, looking at the advantages, Smart City brings new opportunities and resources to our city as well as improves suitability of Manchester. It also brings additional resources therefore services can be delivered more efficiently. On the other hand, it provides a better living experience for citizens.

3. Are you currently involved in projects concerning "smart cities"? If so what kind of projects?

I am the project coordinator of Triangulum. It is a Smart City project focused on the "Oxford Road Corridor Manchester", a 2km spine that contains two of the UK's largest universities and one of the largest medical research campuses in Western Europe, it generates nearly €3 billion, which makes up 20% of the city's economic output. Integration of energy, mobility and ICT systems are core infrastructure assets within the "Oxford Road Corridor Manchester".

4. Who is involved in the planning and implementation of projects? (Specific municipal officials, external partners, universities, etc.)

We created "CityVerve", a consortium which is led by Manchester City Council and includes stakeholders such as Siemens (energy company), Clicks and Links, University of Manchester and Manchester Metropolitan University.

5. How did you initiate the change towards becoming "smarter"?

It is not about steps we have taken it is more about continuation. Manchester suffered a big economic declined in the 70's and we have been working for what we called the regeneration. It means we have been looking for ways to create new industries, new jobs and bring economic growth. One of the ways it has been focusing on how we develop the technological sector, attract more knowledge capital and

how the manufacturing sector can be improved. It does not differ from other European cities. In the 90's we looked at how we create digital inclusion, attract digital businesses and how we digitised things.

6. Did you set a specific focus area? If so, which one and why?

We do not have any specific area to focus. We provide more a holistic view trying to cover everything. Technological solutions take an important role. However, if there is a sort of area we focus the most it is sustainability in a broad sense.

7. Is there a sequence of aspects of a "smart city" that you think is best in order to succeed with the implementation?

We do not follow a particular methodology. We try to involve common politicians, city officials, we have strategic goals. All of the work that we do is multi stakeholder which means that we look at who can help us to solve certain issues of our city. Partnership stakeholder-based approach.

8. Were there specific hurdles that you encountered in this process and how did you overcome them?

It is not about problems, it is more about challenges. There are always conflicting goals. There is always a common number of issues, but we try to be creative about the solutions.

9. How did you set up the governance structure for the different projects? Do you stick with a similar structure for each project or is this subject to change depending on certain factors?

The government structure follows the standard project methodology. We have senior responsible owner, then a chairman commander and a project board of managers. It depends on different projects but we normally follow the standard project methodology.

10. How did you organize the funding structure around the transformation to a "smarter city"? (e.g. EU funding, partnering with NGOs, etc.)

We normally either apply for funding to Europe or the UK. Sometimes it just happens. For example, somebody called us this week wanting to do something about wireless charging for his vehicle involving a company which received UK government money and they wanted some people from the municipality to cooperate. Then there is also a Social care partnership which consist of a partnership with Microsoft where they help with developing technologies.

11. Did you make use of national or European funding possibilities? If so which ones? How did that process then look like? (timeframe, difficulties, etc.)

We have participated in a wide number or European projects. There is also the UK innovate funding. These are basically the two main areas we focus in terms of funding.

12. What are specific lessons you learned over time concerning the transformation to a "smarter city" and the management of diverse projects in this matter?

Triangulum project serves as a good example. We always learn basically about organization, agenda coordination. Also managing and reporting structure. Understanding which technology we are dealing with.

13. What do you regard as essential for the successful implementation of "smart city" projects?
Most importantly, having a use case. Knowing what you want to do.
14. How do you assess/measure the success of "smart city" projects?

Influencing our political leaders. Having engaged political leaders is important. On the other hand, citizen's opinion matters.

15. Is there something you would avoid in the transformation to a "smarter city"?
One of the things we always avoid is chasing the money just because the opportunity is there. Thinking in the long term, about the future. Another thing we try to avoid is the lack of engagement. We always want to be engaged with the city and the technology.

3. Interview with San Sebastian, Spain (FSS)

Maastricht, 16.05.2019

1. Please describe your current position.

Fomento de San Sebastián (FSS) is the local public society dedicated to the economic and social development and promotion of the city of San Sebastian-Donostia (Spain), through innovation, knowledge generation and transformation, networking, and project fostering and management, all under sustainability criteria. Fomento San Sebastian has a Smart Strategy and Sector Specialisation area which

is aimed at fostering smart transformation in all aspects of the city including to the local technological companies.

2. Do you regard the transformation to a "smarter city" important? Why?

Sure. Fomento San Sebastian´s considers the smart transformation of the city strategic in order to transform the city to include new technologies and innovations, with the objective to promote sustainability and efficiency of the city in all aspects such as energy, economic, etc. positioning the city in the new digital era by the extensive use of ICT and technology.

3. Are you currently involved in projects concerning "smart cities"? If so what kind of projects?

Yes, Fomento San Sebastian has long history of Smart City projects deployment. These projects are structured differently, following some of them a bottom-up approach and others a top-down approach instead. Additionally, some of the projects are run locally, where just local partners take part, others, are bigger structures where several cities and companies of different countries work together. This diversity allows FSS to manage several smart city projects at the same time, which even they all follow the ultimate goal to evolve into a smart city, the path to get it is different.

At this time, several smart city projects have already been implemented in the city and they are now over, others, are currently ongoing. This has already positioned the city in the front row of the smart cities. Then again, in parallel, new smart city initiatives and projects are being defined that will be developed in the following years.

These projects are based on implementing several smart solutions and running different smart initiatives in the city counting with the collaboration of all the possible agents that can be involved in these city transformations, such as, technological companies, municipal departments, local commerces, citizenship, etc.

In general, the Smart City projects are framed in specific districts, streets or areas. Some implementations cover the whole city scope, but in general, the strategy we follow for project implementations are focused on particular areas with the objective to have greater impact on that particular environment which may get all people around more actively involved on those projects. Additionally, having a delimited approach allow us to use the city environment as a test-bed and a city--lab in an easy manner which can be afterwards, replicated in other city areas.

4. Who is involved in the planning and implementation of projects? (Specific municipal officials, external partners, universities, etc.)

Smart City strategy of the city of San Sebastian is led by Fomento San Sebastián. However, the planification process as well as the implementation of the projects is done together with all the actors that may be involved in the initiatives. This includes different municipal departments (environment, mobility, maintenance and urban service, ICT department, etc.), local technological companies which can provide innovative solutions and technology being able to test them in real environments, and citizenship and local business that can benefit from the technological solutions and can improve the efficiency in the several areas where the smart topic can actuate (energy, mobility, economy, environment, etc.). this public-private collaboration model has been particularly emphasized in a pioneering project called SmartKalea (*see more information in question number 5*), where it has been awarded in 2017 by CNIS for the public-private collaboration.

Particularly, since 2014 led by FSS, there was developed the San Sebastian Smart City Plan 2016-2020 which established a strategic line with shared objectives and defines a public Action Plan for the period 2016-2020 through which the city will effectively plan and implement its development projects in the urban field under an integrating and Smart perspective.

This Smart Plan is the result of the development of the European Steep project, led by Fomento de San Sebastián along with San Sebastian City Council's Department for the Environment, which has been carried out within the Smart Cities call of the European Union's Seventh Framework Programme. The objective of Steep has been the development of a comprehensive Sustainability Plan in each member city (San Sebastian, Bristol and Florence). The results obtained from the project have been the Smart Plan for the municipality as well as the development of an Action Plan for Vega del Urumea and the local agents have been directly involved in the definition of the main lines of work in the Smart field. Specifically, the plan was elaborated collectively, led by FSS, where 187 people of 96 different public and private entities (such as Municipal Departments, companies, Research Centres, Universities, Sectorial Associations, Civil Associations, etc.) took part.

5. How did you initiate the change towards becoming "smarter"?

Fomento San Sebastian has always been committed to foster and boost sustainability, efficiency and innovation in the city of San Sebastian and collaboration with local companies to involve them in the city transformation. Previously to the Smart City Plan 2016-2020 definition FSS has been leading and driving the transformation of the city's socio-economic model, promoting the development of emerging sectors through the consolidation of the local clustering model. FSS has set-up the Smart Cluster integrating different entities covering the entire value chain: Research Corporations, Training Centers,

Associations, Financial and Sectorial Institutions and local Companies in the smart field. It aims to find synergies that allow members to be an active part of the evolution and progress in the materialization of the city's smart strategy. The fields of renewable energies, energy efficiency and ICT stand out among others. In this way, FSS supports these business sectors in its transformation, through a cohesive organization that works through economically sustainable projects and capitalizes and transfers the knowledge generated. In this context, during 2014 FSS initiated the Donostia Smart City strategic project of the city for the promotion of social, economic and environmental sustainability, coordinating the public and private entities in its deployment.

The city of Donostia – San Sebastian, coordinated by FSS, has deployed projects and initiatives (some of them co funded by the European Commission) related to the transformation into a Smart City, among which:

SmartKalea is Fomento San Sebastian's Innovative initiative to establish a public-private collaboration model that integrates the different agents that coexist in a city environment from a smart perspective. The pioneering project is based on different implementations to test and validate a comprehensive model for its expansion to other geographical areas.
More information of the project can be checked in the following webpage:

http://www.fomentosansebastian.eus/smartkalea/en/

REPLICATE (H2020 2015): REnaissance of PLaces with Intelligent Citizens And Technology. Led by San Sebastian city and with FSS leading the management of the project, the main objective of REPLICATE project is the development and validation in three lighthouse cities (San Sebastián - Spain, Florence – Italy and Bristol – UK) of a sustainable City Business Model to enhance the transition process to a smart city in the areas of the energy efficiency, sustainable mobility and ICT/Infrastructure, in order to accelerate the deployment of innovative technologies, organisational and economic solutions to significantly increase resource and energy efficiency, improve the sustainability of urban transport and drastically reduce greenhouse gas emissions in urban areas.
More information of the project can be checked in the following webpage:

https://replicate-project.eu/

Other initiatives that has been deployed in the city led by FSS:
Installation of Renewable Energies in the city: Photovoltaic panels (28 installations for a total of 1MW) and wind turbines (2 installations).

Bioclimatic buildings: Bioclimatic architecture in new buildings (PIA building, Talent-House, UBA House or Enertic Bioclimatic Center). Buildings close to zero emissions. Consolidation of local smart cluster (renewables energies and energy efficiency, ICT, etc.). The Enertic Building is the main hub for the cluster providing services, training, and auditorium facilities, meeting rooms, etc. to the companies of the cluster. i-Sare Micro-grid project, located in Enertic building and managed by a consortium of public-private entities.

District Heating project design and deployment in Urumea Riverside District. The service is owned by the municipality through FSS.

6. Did you set a specific focus area? If so, which one and why?

The smart topic integrates a wide range of thematic in it such as, energy efficiency, sustainable mobility, ICTs, Infrastructures, environment, open participation, etc. The smart concept covers all these topics and it that sense, the city of San Sebastián, through Fomento San Sebastian is building a Smart City taking into account all these pillars to carry out the transformation in a holistic and integral approach.

7. Is there a sequence of aspects of a "smart city" that you think is best in order to succeed with the implementation?

Each city has its own particularities and specific characteristic, having a unique background. To understand this context is essential to make a proper sequence for the transition towards a smart city. In general, to have a previous planification for the strategy to follow in this transition, before starting with the implementation phase may be a good way to consider opportunities and difficulties that will arise on the transition process. Additionally, starting for small initiatives and going bigger is a very good option not to invest in huge infrastructure in a city level.

8. Were there specific hurdles that you encountered in this process and how did you overcome them?

Transition towards a smart city entails to overcome different obstacles along the whole process. For one hand, managing all the actors that take part on the implementation of the projects, considering their different interests and work for establishing a common approach. For the other hand, technical aspects in terms of technology, solutions and city infrastructures force to change and adapt planned strategy to circumstances.

9. How did you set up the governance structure for the different projects? Do you stick with a similar structure for each project or is this subject to change depending on certain factors?

Governance of the project is defined at the launch of each of the projects. Depending on the typology of the projects FSS coordinates the whole project or just, the pilot to be done in the city of San Sebastian (for example, in the cases of European funded projects FSS can act as leading entity or as a partner leading city implementations). However, each project will have different partners and stakeholders so different governance structures are set-up for the project following-up. Moreover, depending the smart topics that are analysed in the project different task group leaders can be defined to carry out the coordination of those initiatives.

10. How did you organize the funding structure around the transformation to a "smarter city"? (e.g. EU funding, partnering with NGOs, etc.)

Many of the smart city projects that we put in place in the city are co-funded by European, national or regional level institutions. FSS is very active on presenting several project proposals to be funded such as FP7, Horizon 2020, Interreg, etc. This economic aid allows us to carry out really ambitious projects that are strategic for the smart transformation of the city. A good example of this, is the lighthouse European project REPLICATE (H2020 programme) that is led by FSS.
However, not all the funding for these projects is covered by external entities, also FSS and municipality assume part of it, but also, technological companies and final beneficiaries as local businesses put their resources for the project.

11. Did you make use of national or European funding possibilities? If so which ones? How did that process then look like? (timeframe, difficulties, etc.)

Following with the information provided in the previous question, the European funded projects allow us to implement innovative solutions that with just own funding cannot be covered. This involves having a proper internal structure to apply for these funding programmes, where adding value project proposals need to be defined, heterogeneous consortia must be established and international cities need to be joined to achieve a common goal. When proposals are accepted, project management need to be set up and close following up need to be done to overcome to the tight deadlines project may have and solve all the problems that will arise.

12. What are specific lessons you learned over time concerning the transformation to a "smarter city" and the management of diverse projects in this matter?

It is important to have a close following up of the projects to be agile in the problem resolution and make a continuous follow up in order to meet deadlines, goals or milestones.
It is important as well, to measure the impacts that have been achieved. This means in general to set up tools for the monitoring of the solutions and initiatives that have been done and evaluate the results obtained.

Additionally, it is not easy to come across all the different and opposed interests that all the stakeholders can have. Moreover, implementation phase of the solution will very probably meet problems that will need to be solved. Having an agile and flexible process for solving these issues is important to obtain solutions and continue in the transition towards a smart city.

13. What do you regard as essential for the successful implementation of "smart city" projects?

It is crucial to take into account all the aspects that are involved in this type of projects, this means that when defining the project, all the economic, technical, environmental, social, urban, etc. aspects need to be considered and analysed to assure its feasibility.

14. How do you assess/measure the success of "smart city" projects?

Several methods are used for the measuring of these projects. In general, many solutions are data-based so if using data as an asset different measures and KPIs can be defined to test the implemented solutions. Having measures and feedback of the solutions it is important to assess the solutions and validate them, or to detect improvements that may be done. When the success of a particular initiative or solution can easily be evaluated, it can serve to replicate it or scaled it up afterwards, in a city context or a different area.

As an example, in the SmartKalea project that we are developing, data coming for different sources such as energy consumption, public lighting consumption, water consumption, pedestrian mobility, etc. is monitored and published in the project webpage in daily basis. For one hand, with this data several KPIs are measured to evaluate the efficiency of the solution installed (for example: efficiency improvement when shifting public lighting into intelligent lighting). From the other hand, this information is public, and therefore, socialized amongst de society, so they can access and understand this information.
http://www.fomentosansebastian.eus/smartkalea/en/monitoring

15. Is there something you would avoid in the transformation to a "smarter city"?

It is difficult to detect something that should be avoided in the transformation to a Smarter City since all the cities, solutions, initiatives, socio-economic context, etc. is different and unique in each city, so what is wrong in one place it may be a good solution for other.

4. Interview with Ms. Nathalie Dumarey (VVSG)

Maastricht, 18.03.2019

1. Current Position:

Employee at the association of cities and municipalities in the Flanders region in Belgium. She is working as an advisor to municipalities in the field of "smart city"-developments. Furthermore, the association offers different services such as trainings for civil servants and offer advice on collaborations between different municipalities.

2. What is a smart city to you?

A smart city is an open one that is actively looking for innovative solutions in the fields of mobility, climate change, sustainability, with the general idea in mind to improve the life of the citizens. The use of different technologies is surely one of the key factors for such solutions, but it is also not the only one. At the basis, all needed partners have to be included actively, to secure a successful implementation of a project.

3. Is it necessary for cities to become smarter?

Yes. With the increasing digital transformation in all aspects of peoples´ lives, the expectations towards municipalities change as well. Inhabitants tend to expect their municipalities to not just be easily accessible, but also to provide cutting-edge services on demand.

4. What are the key factors to make a smart city initiative successful?

Before one should even think about the specifics of a project, it is of utmost importance to agree on a vision that everyone involved can agree upon. When that is present, all involved parties are on the same page and can commit to the project without any doubts. Furthermore, for a successful implementation a strong leadership style is required. This leader has amongst others the responsibility of coordinating the collaboration between different stakeholders during the projects.

5. Are collaborations with external parties valuable? If so, which ones?

Generally, the involvement of external stakeholders can be very beneficial for sourcing different expertise and for making the implementation of a project successful. Partners can include academic institutes such as universities together with local businesses and industries, but also individual citizens can prove very valuable. Nonetheless, it is especially difficult for smaller cities to find appropriate partners.

6. Who should take the lead role in collaborations with external partners?

In any case, the local municipality should take the lead in the implementation of a project. The reason for this is that external partners tend to have different goals in mind such as making a profit or gaining exposure

7. How should a municipality start the development process to becoming a "smarter" city?

As each city has its unique characteristics and corresponding strengths and weaknesses, it is hard to identify one specific solution. There is no one-size-fits-all approach to becoming smarter". In any case the focus should be on the local challenges and problems. Also, cities do not just become "smart" because they use certain technologies, but rather because they find innovative solutions to the local problems.

Another aspect is the availability of resources and the realization of the need to becoming "smarter". There are three types of cities: Pioneer cities, intermediate cities, and beginner cities. Only in pioneer cities are enough resources available and the there is a clear vision for becoming a "smart" city. Beginner cities in contrast tend to have numerous challenges, but neither the resources nor the priority to become a "smart" city. In intermediate cities there is a vision in place, but the required resources are not or only insufficiently available.

8. Are there specific funding opportunities available?

The EU offers some funding possibilities, but these are often tied to very specific requirements. Furthermore, the majority of cities do not have the personnel available to solely work on learning about funding possibilities and managing existing funds for "smart city" developments. Usually only the largest cities afford to have specific personnel for these matters.

9. What should a municipality avoid in the process of becoming "smarter"?

It will not work out successfully when a municipality "just" starts with some projects. A clear vision is absolutely essential for the success. When that is in place, the surrounding municipalities or the broader geographic region can be taken into consideration to assist in the process. Furthermore, collaborations across municipalities can be very promising, as resources and knowledge can be shared.

5. Interview with Ms. Johanna Juselius (Helsinki)

Maastricht, 05.04.2019

1. Please describe your current position.

Senior advisor on Eu affairs at the Helsinki council. Responsible to write the smart specialization strategy for the region. We look at a regional level what are the innovation potential that we have for the coming period, and then we are choosing particular areas that we want to focus on in our strategy.

2. Do you regard the transformation to a "smarter city" important? Why?

Smart city is something that has been developed in our region for few years now and it has been seen as important in city, regional and national strategies. Is rolled out in many different fields in our region.

3. Are you currently involved in projects concerning "smart cities"? If so what kind of projects?

Mobility is something that they are focusing on many years, with the term "smart mobility". In our case it includes mobility as a service and the development of automated traffic but also car-sharing. Since the region consist of 26 different municipalities, we need to look the infrastructure. Therefore, when we are looking in our infrastructure for mobility, we need to take in consideration the future of the traffic. Moreover, in 2016 the Helsinki region transport authority made history of urban mobility by releasing all its data for all private companies so as to use them in order to start developing services. Therefore, this would allow the use of private and public transport to collect data in one application, where citizens can choose the way they want to travel (private or public transport). That's one way that our legislative authorities have taken a big step towards an eco-system. An eco-system that we can develop smart

mobility further. As for the automotive driving our authorities have enable the development by testing them in public (pilot studies).

4. Who is involved in the planning and implementation of projects? (Specific municipal officials, external partners, universities, etc.)

We do have an open elaborate system in Finland, as it is not very bureaucratic society. Therefore, we find it very easy to collaborate between the private/public and we involve the citizens as well. In terms of smart city, the strategic goals are all similar. It is part of one big development. We make plans for the regions and below that is the municipalities, where cities themselves are making their own strategies. However, every 2-3 weeks we have a meeting where the regional council with the city leaders discuss these strategies, so that we can have an idea on which way we are going as well as to discuss negotiations and co-operations.

Moreover, we are making a lot of developing by using pilots. In a particular city district in Helsinki which has been developed as a smart city district, we developed a waste management collection where citizens provide data on how and when the bins are been emptied. Additionally, with the aid of artificial intelligence, you also get the information from bins whether are full or the temperatures are too high. By having the feedback from the people that are living in the area it becomes also very meaningful for them because it's part of their daily lives that these services work (high citizen engagement).

5. Were there specific hurdles that you encountered in this process and how did you overcome them?

In terms of people who are working in regional development or city development, I could say that smart city it very quickly formed into technical description. So, the idea of a smart city is to build a networked where everything is digitally connected and then to create services on top of that. Sometimes may have resistance from people who want to think about ideas such as cooperation and the human aspect of living in a city. So definitely the smart city has been receiving some resistance in terms of instigating more and more that the person has to been taken into consideration (to make it more human-focused).

6. How do you assess/measure the success of "smart city" projects?

We are at the moment thinking of what are the instigators that we will put in place in terms of measuring the success and it is complex. This cannot be measured by the traditional indicators which is more jobs and GDP growth, I think it must also include impact more widely, in terms of citizen and engagement. How many people are involved and what kind of connections they have with each other. Those can be

a better way to measure the success rather than measure financial figures, because this involves the quality of daily life. It is more about the people. So, it's not just smart city. Smart city is integrated in the whole kind of philosophy on doing things smartly by making the most of the technologies available, in order to create livable and sustainable environments.

7. How did you organize the funding structure around the transformation to a "smarter city"?

We have a collaboration with different stakeholders, and this is where universities are important because they provide a lot of research into the area at the moment. Also, a lot of students can be used in these projects. Moreover, cities are the most obvious partners as well as companies themselves provide their own funding.

8. Did you make use of national or European funding possibilities? If so which ones? How did that process then look like (timeframe, difficulties, etc.)?

The smart specializations strategy is funding by the ER, which comes from the European union (funds for regional development). A lot of the EU funding has the possibilities for smart development and smart initiatives and looks like will have even more in the future.

9. What are specific lessons you learned over time concerning the transformation to a "smarter city" and the management of diverse projects in this matter?

Firstly, you have to start with what you have. If you have a city with very old infrastructure and strong identity you have to start in working on how you can integrate that and that can be a challenge. But what can be challenging in smart city is that some people can have a different view. What has to be done is to work with what you have and give more flexibility to the term. For instance, if you are not a city and you are a region, then you should not limit yourself in the concept of a smart city.

When we began the work was very new, so you have to prepared that is going to take a lot of time to introduce the new concept. You have to ensure that is not something that is going to be just for now, but it will also be here in the future. Furthermore, you have to collect information from other cities, so as to gain an idea form their work. Thus, your city can come up with new ideas and can benefit from possible collaborations. Furthermore, smart city is a 'trendy' word. Therefore, it is very useful to look at the term academically, and how it is shaped. Make use of what has been done and support your case.

Moreover, you have to build a strategy that you are committed in order to engage all the different political parties it may be a long process and it takes a lot of convincing. If you have reasonable players, local players that they can do it, the commitment is stronger.