UCLouvain

LOUVAIN
School of Management

Louvain School of Management

Assessing the integration of social sustainability in smart city strategies

Analysis of Belgian cities through a standardised framework

Author(s): Pauline de Kerckhove dit van der Varent
Supervisor(s): Carlos Desmet
Academic year 2020-2021

Abstract

Today's society faces many challenges. Both environmental and social, these challenges call for new ways of functioning in our society, especially at the urban level. Demographic and urban growth is leading to a rethinking of the use of resources and space in cities.

As agents of change, cities are at the center of the challenges and concerns of the 21st century. This master thesis studies the social dimension in the smart city strategies of eight Belgian smart cities, a model increasingly advocated by international institutions such as the UN and the EU to achieve the 2030 SGDs and to address urban sustainability challenges. However, due to excessive enthusiasm around technology and the strong focus on environmental challenges, the social implication of smart cities has been neglected. This study therefore fills this gap and through quantitative and qualitative analysis aims at determine to what extent social sustainability is involved and considered by Belgian cities in their transition to smarter and more sustainable cities.

The main conclusion that can be drawn from the literature and practice is that, although city governments are increasingly aware of their leading position in the development of smart, sustainable and inclusive cities, social sustainability and the smart city are recent phenomena that still need to be defined and the lack of currently available measures makes them even more difficult to understand.

As a prelude to this thesis, I would like to thank all those who supported and encouraged me during these months of research and allowed me to be proud of this work.

First of all, I would like to thank my supervisor, Carlos Desmet, for his availability, his precious advice and remarks that contributed to feed my reflection on this inspiring and enriching subject.

I would also like to thank my family and friends for their unwavering support and encouragement, which has been of great help throughout my research and has enabled me to move forward with ever greater determination.

Finally, I would like to express my gratitude to all the interviewees and others who showed great interest in my research, for their time, their help in collecting data and for sharing their knowledge and expertise.

Table of content

List of figures

List of tables

List of appendices

General introduction

Human progress and development have led societies to behave in socially and environmentally unsustainable ways. The progress of human societies, such as industrial revolution, has had huge social and environmental consequences, that have led to growing concerns towards sustainability (Du Pisani, 2006; Steffen et al., 2011).

As agents of change, cities are at the center of these 21st century challenges and concerns and need to find ways to be more sustainable. The smart city, a model increasingly advocated by international institutions such as the UN and the EU to achieve the 2030 SGDs and to address urban sustainability challenges, has gained in popularity and is increasingly used by cities and government to address urban sustainability challenges. However, the over-enthusiasm around technology and the climate emergency we face have sidelined the social implication of smart cities. Social sustainability, as well as the smart city model, is about bringing people together and improving the quality of life for citizens now and in the future. Yet, very little research has been done on the social side of smart city.

In the first place, this study therefore addresses the gap between the different pillars of sustainable development and the importance of putting these pillars on an equal footing. In a second time, this study evaluate the place of social sustainability in smart city strategies. In order to carry on this research we decided to first develop a framework based on identified dimensions of social sustainability. This framework allowed us to collect data and come up with scores in order to evaluate what, and to what extent, was already developed by cities. Secondly, to have a better understanding and representation of the reality in which each cities is evolving, we conducted several interviews to put our quantitative data into perspective and get a more subjective view from experts in the field. In the end, the purpose of this research is mainly to understand the place of social sustainability within cities' transition towards smarter and more sustainable cities. Therefore, the title of this research is as follows:

"Assessing the integration of social sustainability in smart city strategies : Analysis of Belgian cities through a standardised framework"

This work is divided into two distinct parts, firstly a literature review focusing on social sustainability, the smart city and the comprehension of the interaction between these two

concepts, which will allow us to present, at the end of this part, our standardised framework with indicators related to the social sustainability of smart cities.

The second part of this work focuses on a practical approach based on the collection of indicator data, as well as contact with different representatives of the selected Belgian cities. The use of a mixed methodology, both qualitative and quantitative, will allow us to establish a more accurate context of the social reality in which smart cities evolve. Although the aim of this research is not to compare cities with each other, an in-depth analysis of each social aspect will allow us to draw a general conclusion on the state of progress of Belgian smart cities from a social sustainability point of view.

The main limitation of our research is the recent nature of the smart city phenomenon, which implies a low availability of data related to smart city projects, a fresh advancement of the projects within the cities and therefore with little measured impacts, as well as little scientific literature on the implication of this smart city model on the social aspect.

PART I : THEORETICAL REVIEW

1. The sustainability challenge

1.1. Sustainable development: historical roots & definition

The idea of a transition to a more sustainable way of living is nowadays commonly known under the term: sustainable development. Even though this term is not new, it seems to have become one of the driving forces of the 21th century (Du Pisani, 2006).

The concept of sustainable development was first described in 1987 within the Brundtland report published by the World Commission on Environment and Development. In this report, H. Brundtland intended to conceptualize the interconnection between social equity, environmental degradation and economic growth (World Commission on Environment and Development [WCED], 1987). Although the report attempted to provide many solutions to social, environmental and economic challenges, it is more mentioned for its definition of sustainable development (Jarvie, n.d.). Based on Brundtland's report, sustainable development can be defined as a society's condition of economic, social and ecological stability that is sustainable in ways that it can provide basic needs to current and future generation while recognizing the limits of growth. In other words, the objective is to allow economic and social development without compromising the stability of the environment (WCED, 1987).

1.2. The 2030 agenda for sustainable development

In 2015, in order to reach this idea of sustainable development, the 193 members of the United Nation decided to adopt a plan to action: the 2030 agenda for sustainable development. This agenda gathers seventeen interconnected sustainable development goals (SDG), listed in appendix 1 (pp.93), which developed and developing countries should achieve together by 2030 (United Nations, [UN], 2015). Those objectives balance all three dimensions of sustainable development and seek to stimulate changes and actions in the five following critical areas: people, planet, prosperity, peace and partnership (UN, 2015).

The achievement of the 2030 agenda critically relies on the interconnection between the SDGs. Indeed, the 17 goals and their 169 associated targets are interconnected and therefore

indivisible, i.e., they balance each other in a way that, a change in one dimension should have positive impact on another dimensions or targets (UN, 2015).

1.3. Cities and the sustainability challenge

1.3.1. The role of cities in the 17 SDGs

Cities around the world are home for more than half (55%) of the world's population. By 2050, they are expected to grow both in size and number, and this percentage is forecast to reach around 70% (UN, 2018). Besides, although cities only occupy 3% of the world in terms of place, they consume around two-third of the world's energy and are responsible for 70% of world's CO^2 emissions (C40 Cities, 2012). These figures prove that contemporary cities are facing important social and environmental challenges such as urban population growth, resource consumption, greenhouse gas emissions, air and water pollution, social interactions and environmental degradation. These are some of the challenges that lead to massive sustainability problems in terms of health, food security, housing, education, employment, natural resources, etc. (Bibri & Krogstie, 2017a; Randaxhe, 2021). On the other side, cities are also huge actors in the generation of economic growth. According to McKinsey, by 2025, 60% of the global GDP (domestic gross product) will be generated by the world largest cities (Dobbs et al., 2018).

Although urbanization growth is one of the most important trends of the 21st century, as shown in appendix 2 (pp.94), we can notify many differences in urbanization regarding income groups and countries. Indeed, nowadays most of the high-level-income countries already have high levels of urbanization and these regions will only experience slight changes in urbanization. In contrast, the significant increases in urbanization are expected to happen in lower-middle income and low-income countries. Therefore, 90% of the urban growth is expected to happen in Africa and Asia. In the coming decades, the urban population of Africa is likely to triple and the one of Asia to double. More precisely, by 2050, 35% of this growth will happen in China, India and Nigeria. Consequently, by 2050, half of the world's urban population will leave in Africa (52%) and Asia (22%). Therefore, the success of globally reaching sustainable development mostly depends on the management of population growth in those regions, where urbanization is mostly expected. In addition to income, we can also note major differences between cities. Nowadays, most of urban population live in cities with less than 1 million inhabitants, while only 13% of urban population lives in megacities (≥ 10 millions of

inhabitants). As shown in the appendix 3 (pp. 95), by 2030 ten new cities are expected to become megacities nine of which are located in developing countries (UN, 2018). Although these challenges are part of the reality that our world is facing today, this research focuses on relatively medium-sized Belgian cities, which will not face the same challenges as those mentioned above. The choice of this territory is explained below.

1.3.2. Urban sustainability and SDG 11

The challenges faced by societies are unique to the complexity of each. However, as explained in the New Urban Agenda, there is an urgent need to address growing inequalities and environmental degradation in the world as a whole (UN Habitat, 2016a). As part of the problem, cities also appear to have the potential to be part of the solution. A good understanding of the current trends could result in greater efficiency and minimize issues, such as poverty, climate change, inequalities and environmental degradation associated with a continuously growing number of citizens. This belief is translated into the goal 11 of the SDGs which is : "Make cities and human settlements inclusive, safe, resilient and sustainable" (UN, 2015).

The objective of SDG 11 is therefore very connected to the definition of sustainable urban development which is the "…development of cities in ways that provide livable and healthy human environments with enhanced quality of life and well-being in conjunction with decreased demand on resources and less-ended environmental impacts…" (Bibri & Krogstie, 2017b). The idea is to reconnect human being with their living environment by managing cities in an inclusive and sustainable manner (European Commission [EC], 2017).

As explained earlier, the 17 SDGs are interconnected and have the power to influence each other. Here are some examples of the possible interconnections with SDG 11. Well-managed urbanization growth can also contribute to the achievement of SDG 8, which calls for decent jobs and economic growth. On the other hand, cities are centers of innovation and can contribute to the achievement of SDG 9, which is about innovation and infrastructure, which means that we need high quality urban infrastructure. Other goals can find their source in cities, such as SDG 12, which calls for sustainable production and consumption, or SDG 13, which concerns the implementation of the Paris Agreement, as cities are responsible for a large share of GHG emissions (UN, n.d.).

2. The social dimension of sustainable development

2.1. The three pillars theory

As developed before, since the publication of Brundtland report in 1987, sustainable development and sustainability have been at the center of discussions. The concept has always been seen as a "triple bottom line approach" giving the three pillars equal importance and proportion. Moreover, as shown in figure 1, the three pillars influence each other and the combination of economic growth, minimal environmental impact and social inclusion leads to sustainability (Dixon & Woodcraft, 2013).

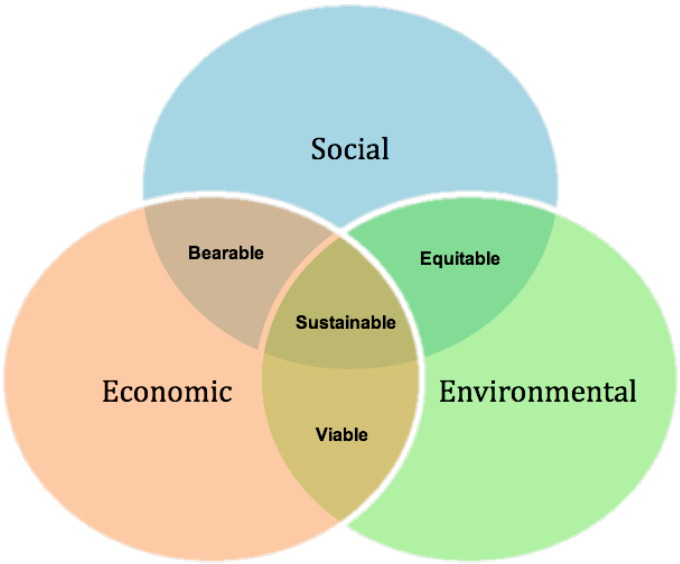


Figure 1 : Triple bottom line (Lowe, 2020)

However, although in this model all three pillars are treated equally, as the current era is dominated by climate change and all environmental and ecological issues, the environmental pillar has gained popularity. In addition, the economic pillar is also integrated alongside the environmental pillar, giving little importance to the social pillar. Much research points to the paucity of academic literature and empirical research on the social pillar, in contrast to the other two, across multiple disciplines (Dixon 2011; Larsen & Jensen, 2019). Furthermore, while the social aspect is sometimes integrated, it is often perceived as a secondary parameter (Larsen & Jensen, 2019).

There are several reasons for the lack of research related to social sustainability. First, the lack of definition and the difficulty in determining which aspects are included within the term "social

sustainability". Second, there is a lack of measurement and evaluation tools to allow for empirical research on this topic (Dixon & Woodcraft, 2013).

However, more and more research sees the social dimension, which was considered a peripheral aspect, as an important primary dimension of sustainability. It is sometimes represented as the glue that brings people together to address environmental problems and enable economic growth (Dixon & Woodcraft, 2013). This is akin to saying that the social dimension is the foundation upon which meaningful environmental change can be built (Dillard et al., 2009).

2.2. Social sustainability: definition

As explained before, the concept of social sustainability is neither theoretically nor practically understood, which are part of the reasons that led to the under investigation of the social dimension (Boström, 2012).

The complexity of defining the social part of sustainability stands in the cross-disciplinary nature of the concept. According to Weingaertner and Moberg, there is no one-size-fits-all definition given that the definitions are most of the time derived according to the discipline or the study perspectives (Weingaertner & Moberg, 2011).

Since the concept is context specific, we decided to use the definition given by the Social Life, as it is based on the importance of social sustainability within a urban development context. We would therefore define social sustainability as:

> *"... a process for creating* ***sustainable, successful places*** *that promote* ***well-being****, by* ***understanding what people need*** *from the places they live and work. Social sustainability combines design of the* ***physical realm*** *with design of the* ***social world*** *–* ***infrastructure*** *to support* ***social and cultural life, social amenities, systems for citizen engagement and space for people and places to evolve****"* (Woodcraft et al., 2011)

Limitation

Although this definition seems coherent and complete, there are a lot of other definitions that take into account many different important aspects such as: quality of life, social inclusion, accessibility to public services and employment, democratic and equitable governance, absence

of inequalities and social discontinuity, good housing, etc. (Dixon & Woodcraft, 2013; Caulfield et al., 2001; Dixon, 2011). Some of these concepts will be further developed in the following sections.

Why it matters

This definition shows that social sustainability is about bringing people together and improving the quality of life for citizens now and in the future. And indeed, issues that affect individuals and communities should be considered as much as economic or environmental issues. Moreover, as explained earlier, people acting together to improve the sustainability of their living space is the best policy for addressing environmental problems. In this regard, to be environmentally sustainable, cities must first be socially sustainable (Caulfield et al., 2001). Therefore, if we want to create more sustainable spaces and cities in the future, there is an urgency to restore the three pillars to equal levels (Dixon, 2011).

Urban development thus has a social role, which is to decrease inequality and ensure that people live and will live in cities that are equitable, inclusive, safe, affordable, and increase the quality of life and well-being of citizens without compromising environmental prosperity (Dixon & Woodcraft, 2013). However, having cities that are welcoming, safe, and inclusive for all people is not so easy to achieve. Indeed, cities around the world still face many inequalities in housing, health, and safety. However, according to the OECD, countries with higher levels of well-being tend to face less inequality, that is, less differentiation between population groups (OECD, 2020). In the following section, we will identify the dimensions of social sustainability and the associated challenges that need to be addressed in order to increase well-being and thus reduce inequality.

2.3. Social sustainability : dimensions

Based on the definition provided, we can already clarify two main dimension of social sustainability which are **well-being** (WB) and individual's **quality of life** (QoL). The concepts of well-being and quality-of-life, although similar, come from two different discipline. On the one hand, WB will be associated to psychology and on the other hand, QoL will come from sociology. However, these concepts are complex to identify and define and most of the time overlap each other. WB would be used when talking about the actual experience of an individual

while QoL will be used to speak of the context and environment of a group (communities or societies) (Gasper, 2010).

According to this comprehension of the two terms, the OECD report on well-being stands that today's well-being is reflected through **income**, **wealth**, **housing**, **work and job quality** while individual's quality of life is reflected through **health**, knowledge and skills, i.e., **education**, **environmental quality**, **safety** and **relationships** i.e., how connected and engaged people are with their community and neighborhood, which we will further develop as "civic engagement" (OECD, 2020). Besides, when it comes to measuring social sustainability, as demonstrated in table 1, research show a shift from "soft" key aspects, which are easier to measure to "hard" key aspects, which makes social sustainability even more challenging to defines and measures (Neamțu, 2012).

Traditional ("soft" key aspects)	**Emerging ("hard" key aspects)**
Basic needs (housing and environmental health)	Demographic change
Education and skills	Social mixing and cohesion
Employment	Sense of place and culture
Equity	Empowerment, participation and access
Human rights and gender	Health and safety
Social justice	Well-being, happiness and quality-of-life

Table 1 : Social sustainability themes (Colantonio, 2009)

We can see that some of the traditional aspects are included in the WB and QoL dimensions defined by the OECD. In addition, some of the emerging aspects can be found in the four dimensions mentioned by the Nobel Prize winner Amartya Sen, which are, quality of life, equality, diversity, social cohesion and democracy and governance (Ricee, 2021).

We decided to cross and combine all these previously mentioned dimensions and to come up with five main dimensions, illustrated in figure 2, that are easier to apply and analyze and that will be used in the following research. These dimensions will first be briefly described below and then analyzed in depth in the following sections.

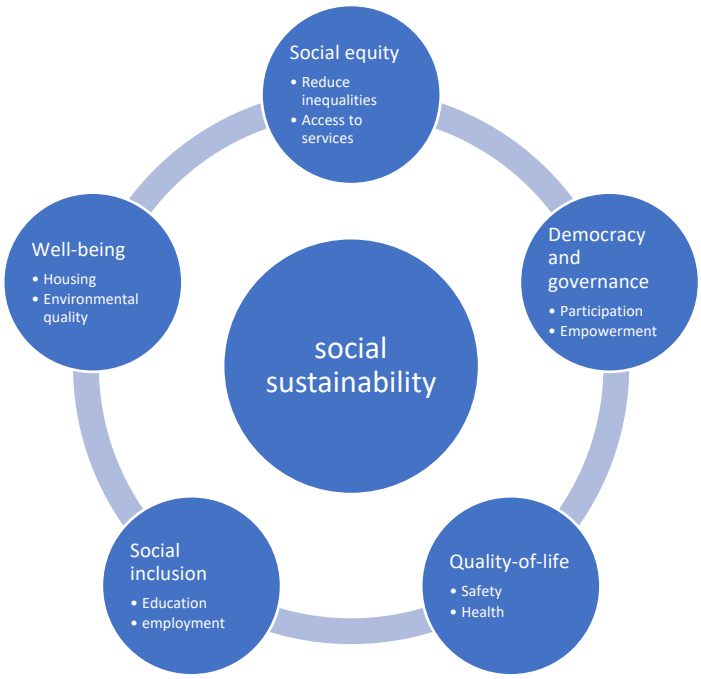


Figure 2 : Dimensions and sub-dimensions of social sustainability (creation of the author)

- **Social equity**

Social equity is not only about reducing inequalities but also about providing equal opportunities to all social and economic groups and enabling all individuals to benefit from the same chances and opportunities (Dempsey et al., 2011).

- **Social cohesion** :

Social inclusion or social cohesion is about engaging different social and economic groups and encouraging them to participate in and contribute to society through systems and structure provided by the community (Dempsey et al., 2011).

- **Quality-of-life** :

According to Amartya Sen, quality-of-life is about ensuring that all basic needs are met to ensure a good quality-of-life for all. While, according to the OECD, quality-of-life is about one's surrounding and what it provides in term **health** and **safety** (OECD, 2020). In this case, the quality of life will be reflected as societal well-being while the well-being dimension will be interpreted as individual well-being (Pacione, 2003).

- **Well-being** :

Although this dimension is not included among the dimensions taken up by Amartya Sen, it was decided to consider it as a dimension in its own right because of its difference from quality of life. Although well-being remains a very broad domain and is rather subjective in its

interpretation. In many research studies, the term "well-being" is represented by the perception that an individual has of the environment that surrounds him or her, whereas quality of life refers to a territory or a community. Therefore, the dimensions of well-being will include the sub-dimensions of **environmental quality** and **housing**, both of which have a direct impact on the perception of well-being of individuals (Macke et al., 2018).

- **Democracy and governance** :

This dimension is about the capacity of a society to provide democratic processes and inclusive and open governance. In this case, democracy and governance will also be linked to the empowerment of citizens, through accessible and open resources in order to increase their engagement and participation in decision making. As explained below, we will talk about collaborative governance (Dempsey et al., 2011).

2.4. The choice of Smart Cities

Many research around Smart Cities point toward the idea that ICT would improve social interactions and help people to easily collaborate and connect, especially in big cities, which will lead to greater quality of life while decreasing environmental degradation. Indeed, according to the ONU, it will practically be impossible to achieve the 17 SDGs by 2030 without the use of appropriate new technologies and innovation (United Nation Conference on Trade and Commerce [UNCTAD]., 2019).

However, many scientists , argued that although the information age will bring a lot of new opportunities to societies, these benefits will also come with ethical dilemmas. Indeed, the understanding of the technological side of smart cities has taken over other important dimensions, such as the social one (Floridi, 2002; Monfaredzadeh & Krueger, 2015; Grossi & Pianezzi, 2017). The most extreme critics point to the reinforcement of inequalities due to the digital divide, the exposure of the most vulnerable populations to the risks of digital exclusion and the inequalities it creates, the priority given to business interests rather than social interests, etc. (Floridi, 2002). Therefore, the intensive use of and investment in ICT challenges the ability of smart cities to equally answer the three pillars of sustainable development, as well as about the place given to citizens in this smart transition and the consideration of social inclusion and citizens' representativeness, given that all part of the population do not have the necessary skills or means needed to effectively participate in this transition (Marsal-Llacuna, 2015).

The smart city phenomenon is emerging in our societies and more and more cities are converging on this concept with the initial goal of improving the quality of life of citizens. However, this objective is not always privileged because as a study conducted in 2017 by the Smart City Institute in Belgian municipalities shows, despite the fact that all municipalities mentioned that the human aspect should be a priority, the majority of them perceive the smart city primarily as a technological challenge and most of the projects first initiated have an environmental purpose. There is therefore an interesting study to be conducted on the smart city phenomenon and the consideration of this human factor within the smart initiatives launched by more and more cities (Desdemoustier & Crutzen, 2017).

3. Smart cities

Despite its popularization over the past decade, the concept of Smart City remains difficult to define. There is no appropriate definition which can be used in a general and comprehensive way, because the meaning constantly differs according to context and country.

In order to find a precise explanation for further research, we will first study the origin of smart cities and then the concept of the "Smart Sustainable City".

3.1. Origin of Smart Cities

Today, ICTs are present in most areas of our lives. As far as urban development is concerned, the use of ICT is seen as a means to better understand how our cities function and how they could be better managed in order to answer a range of questions about the efficiency and health of a city and the quality of life of its citizens. The application of ICT to urban development has given rise to the term 'smart cities'. Initially, the focus was mainly on the use of new technologies to improve the urban environment (Papa et al., 2013).

According to researchers, there are two ways of approaching the concept. The first one is ICT-centered and technologies-oriented, meaning there is a strong focus on the capabilities of technologies to improve our environment (transport, energy, waste management…) while the second one focuses more on people, i.e., on human and social capital (participation, safety…) (Bibri & Krogstie, 2017a).

Even though the concept is challenging to define and most of the time context-dependent, it is possible to identify some factors that are common to each conceptualization of a Smart city. The model of Nam and Pardo, illustrated in figure 3, seems relevant as it identifies three factors as principal components of Smart city (Nam and Pardo, 2011). Those factors are:

- The **technological** factors; the physical infrastructure and the use of technologies.
- The **human** factor which refers to human and social capital.
- The **institutional** dimension referring to the governance, policy and regulations.

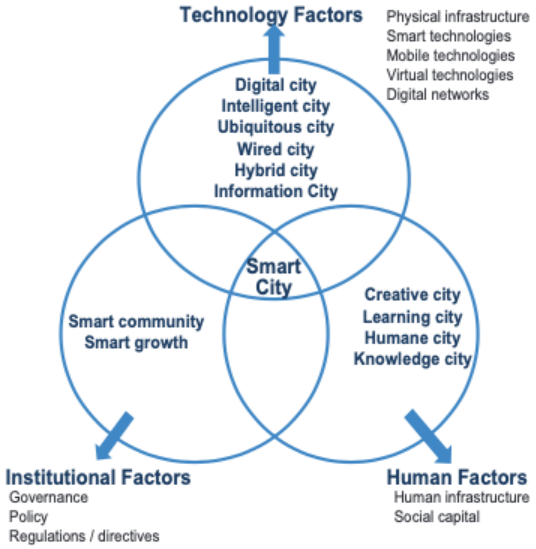


Figure 3 : Components of a Smart City (Nam and Padro, 2011).

3.2. Smart Sustainable Cities

The digital era, starting in the middle of the 20th century, has focused attention on ICT and new technologies. However, we are now increasingly entering an era dominated by climate change and it is time to justify investments in ICTs by linking technological advances to sustainable goals. New technologies are now seen as a tool for cities to achieve the SDGs (Bibri & Krogstie, 2017b; Bifulco et al.,2016).

By applying the concept of sustainable development to an urban context, it is more appropriate to talk about sustainable cities. More specifically, sustainable cities are the development of urban forms whose primary goal is to improve the quality of the environment, social equity and well-being (Bibri & Krogstie, 2017b).

When the use of ICTs is directed towards improving environment, social and economic sustainability, it is therefore more accurate to use the term of "Smart Sustainable Cities". (Kramers et al., 2014; Bibri & Krogstie, 2017b). Although the concept has been increasingly used by different international organizations, we will pursue this thesis using the term "Smart City" for conveniences.

Therefore, to the extent that the model of Nam and Padro, illustrated in figure 3 (pp.13), seems relevant, it misses important aspects of sustainable development. As the Smart City Institute of Liège points out, it would be more accurate to use this model by adding the intention of the Smart City to ensure the sustainability of its territory (Nguyen et al., 2017).

3.3. Definition of Smart Cities

The concept only appeared in 2010's (Al-Nasrawi et al., 2015; Bibri and Krogstie 2017a) and is referred as an intersection between the concepts of urban development (i.e., city), sustainable development and technological development (i.e., smart) (Bibri & Krogstie, 2017b).

Therefore, we decided to rely on the definition of the Smart City Institute of Liège, given that it is the most up-to-date definition that encompasses all the three aspects previously mentioned. According to the Smart City Institute of Liège a smart city is:

> "**… an ecosystem of stakeholders** (local government, citizens, associations, multinational and local companies, universities, research centers, international institutions, etc.) **engaged in a process of sustainable transition** (strategic vision and/or concrete innovative projects) **in a given territory using new technologies** (digital in particular) **as a facilitator to achieve these sustainability objectives** (economic development, social well- being and respect for the environment)." (Nguyen et al., 2017).

3.4. Characteristics of a Smart City

Although the previous definition may seem complete, the concept of Smart City focuses on many other aspects. It therefore seemed appropriate to add the model of Giffinger (Giffinger et al., 2007) to this definition, as it is the most widely used and best-known framework in the field. The Smart City model identifies six distinct dimensions, illustrated in figure 4, on which ICTs can be applied and within which Smart Cities can be developed, assessed and compared. The

six dimensions are the following: economy, environment, people, mobility, governance and living. Each dimension is accompanied by a set of criteria to assess the level of success in that dimension (Bibri & Krogstie, 2017b).

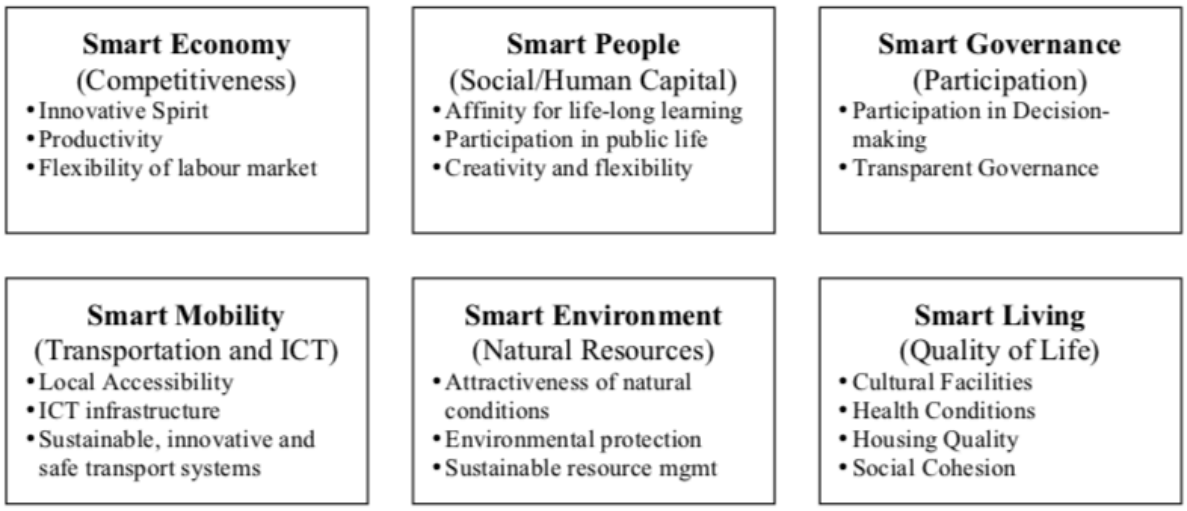


Figure 4 : Six characteristics of the Smart City Model (Giffinger et al., 2007).

- **Smart Economy**

The dimensions of Smart Economy refer to the competitiveness of the city. The city's competitiveness highly depends on the city's capability to innovate, its productivity and the flexibility of the labor market (Nguyen et al., 2017).

- **Smart People**

"Smart people" is about having a fair and inclusive society with educated citizens. It includes the quality of social interactions, cultural awareness, open-minded citizens, the delivering of a high level of education and it also takes into account the level of citizen's participation (Nguyen et al., 2017).

- **Smart Governance**

This dimension focuses more on citizen's participation. Having a Smart governance means having a transparent governance and a system that allows citizens to participate into the decision-making process. In this dimension, ICTs enable citizens to have an easier access to information and data, it can also eliminate communication and collaboration barriers and therefore allows citizens to have a stronger position concerning the management of their cities (Nguyen et al., 2017).

- **Smart Mobility**

Smart Mobility seeks to promote more efficient and sustainable transportation means. It must also include the change in social attitudes regarding transport use and enable citizens to have easier access to sustainable, innovative and safe public transport (Nguyen et al., 2017).

- **Smart Environment**

This dimension aims at the reduction of pollution and GHG emissions, the protection of the environment, the reduction of energy consumption. New technologies allow a sustainable management of resources (water, waste, energy…) (Nguyen et al., 2017).

- **Smart Living**

The last dimension, Smart Living, is concerned with the enhancement of citizens' quality-of-life. It seeks to provide healthy and safe living conditions to all citizens. This dimension is the primary objective of Smart City (Nguyen et al., 2017).

4. *Measurement of Smart Cities*

4.1. Existing frameworks to measure Smart Cities

Although there is an increasing number of frameworks and indicators that allow the comparison and assessment of the evolution of cities towards smart and sustainable cities, the available scientific literature on the application of these frameworks and KPIs is still very scarce. There are mainly two global bodies that assess smart sustainable cities, namely ITU (International Telecommunications Union) and ISO (International Organization for Standardization) (Huovila et al., 2019).

ITU was founded by the United Nations in 1865 with the objective of facilitating international connectivity and ensuring interconnected communication networks for all, in all regions of the world. One of the main aspects of the ITU are its Recommendations. Indeed, the institution has already published more than 4000 recommendations based on all topics related to the use of ICTs. Among the 23 series of recommendations, the ITU-T Y-series is entitled "Global information infrastructure, internet protocol aspects, next-generation networks, Internet of Things and smart cities". Within this series, Recommendations Y.4000 to Y.4999 focus on "Internet of things and smart cities and communities". Among these recommendations, some

focus on the evaluation and assessment of the use of ICT in smart sustainable cities. This is the case, for example, of recommendations **4901**, **4902** and **4903** (ITU, n.d.).

Another initiative, which has been coordinated by the ITU, UNECE and UN-Habitat, along with 14 UN agencies, to achieve SDG 11: "Make cities and human settlements inclusive, safe, resilient and sustainable" is the "**U4SSC**" (United for smart sustainable cities). U4SSC provides a platform for information and knowledge exchange at an international level. The initiative has resulted in the creation of a collection of key performance indicators that allow cities to rely on a standardised data collection method and measure their performance and progress in their transition towards achieving the SDGs and becoming smarter and more sustainable cities (CBD et al., 2017).

As far as ISO is concerned, there is the **ISO 37120** standard, which provides a series of 104 indicators measuring urban services and quality of life, and on the other hand the **ISO 37122** standard, which is derived from ISO 37120 and provides 85 indicators assessing smart cities (ISO, 2019).

Moreover, another framework that assess Smart Cities is the **CITYkeys indicators framework**. This framework set a list of KPIs in order to track and assess the progress of smart cities and smart project initiatives. The framework account for 99 project indicators and 76 city indicators. These indicators are built around five main themes which are people, planet, prosperity, governance and propagation (Bosch et al., 2017).

We can also mention the Organization for Economic Co-operation and Development, **OECD**, which propose a lot of indicators and evidence-based standards in the following areas: environment, governance, Industry and service, science and technology and economical aspect.

As far as Belgium is concerned, every year the **Smart City Institute** measures and reports on the progress of Belgian cities. The latest barometer dates from 2020 and only concerns Walloon municipalities (Randaxhe, 2021), while the latest barometer for cities in Belgium dates from 2018 (Bounazef Vanmarsenille & Desdemoustier, 2018).

The indicators used in our research were therefore selected from among the indicators proposed by these different international frameworks and entities. The methodology for the selection of indicators will be explained later.

4.2. Impact of COVID-19 on Smart Cities

The recent crisis endangered and impacted the livability and health of citizens, which are at the core of Smart cities' objectives. It was therefore a real test for Smart Cities around the world to see whether the use of new technologies would be able to mitigate the impacts (MSCI, 2020). Indeed, other diseases have already affected our societies, but ICTs now offer the opportunity to better manage the spread of diseases.

While some regions, such as Asia, where more vulnerable to the virus due to their density, some of them were already prepared with resiliency plans. This preparedness allowed some cities such as Seoul, Hong-Kong, Taipei and Singapore to manage the crisis in a more effective way (MSCI, 2020). However, it is also important to note the cultural differences between different regions of the world and that some cultures may be more willing to follow such strict rules as those imposed on us during this pandemic.

Worldwide, governments are using the technologies provided by smart cities such as sensors and data to track the effectiveness of social distancing measures. By tracking vehicles and pedestrian movements, citizens movements have been monitored to slow the spread of the disease (World Economic Forum, 2020). While technology is seen here as a solution, it also raises major ethical and privacy issues.

The pandemic could provide a new model of "smart city" more focused on the creation of community. One example of a good practice is happening in Seoul. The city used its approach "citizens as mayors" and provided real time information about COVID-19 situation, including data about patients and last places they visited. This initiative aim at empowering citizens and allow them to take precautionary measures (Baeck & Reynolds, 2020). However, once again, there are issues of individual freedom that would not be welcomed in the same way in all cultures and societies.

An important aspect that has encountered many problems is education. Both in the preparation of the universities and in the knowledge of the students and educators, many gaps and a lack of means, both in knowledge, equipment and connectivity, have been reported.

The pandemic has required many people, institutions and businesses to adapt and adopt new ways of living, working and interacting. Although the pandemic raised the evidence that many countries were not prepared and that our current societies are still not very far in the numeric transition, many technological solutions have emerged and the use of ICT has proven to be beneficial for its efficiency but also for its positive impact on the environment. As a result, it is likely that in the coming years we will see an increase in the use of ICT. Cities have the opportunity to learn from this experience, the main challenge being to ensure that everyone is on board the digital wave.

5. Conclusions of Part I

This first part has allowed us to establish the context of our research and to better understand the two concepts of sustainable smart cities and social sustainability. We have been able to clearly establish the dimensions of these two concepts, which will allow us to build our framework on a clearer basis.

In the next part of this work, which is also part of the literature review, we will link the dimensions of smart city and social sustainability, based on the research done in the first part. This will allow us to establish a framework of indicators for our practical research.

PART II – THE SMART CITY FOR SOCIAL SUSTAINABILITY

1. Introduction

This paper will focus on the social pillar of sustainable development. If we take a closer look Smart City wheel developed by Boyd Cohen, the previously mentioned dimensions of **social sustainability** which are, equity, social inclusion, well-being, quality-of-life and democracy and governance, are closely related to some of the key dimensions of the smart city. These three dimensions are :

- **Smart People**
- **Smart Living**
- **Smart governance**.

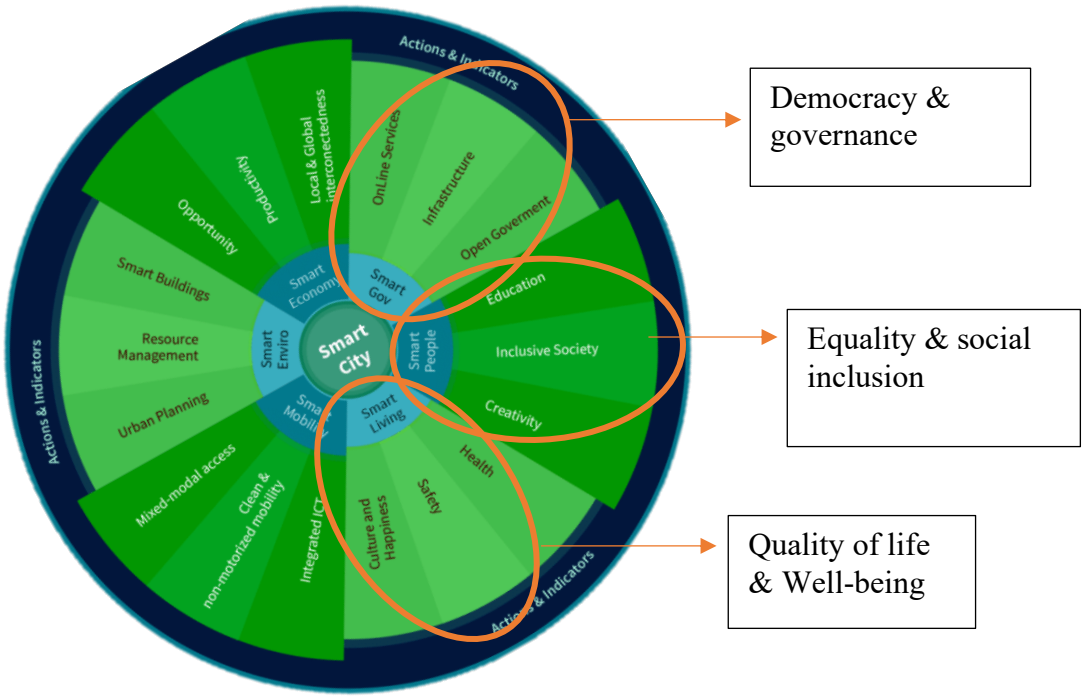


Figure 5 : Boyd Cohen's wheel and the Social dimensions (Soe, 2017).

Indeed, as we can see on figure 5, the smart people dimension is related to equality and social inclusion, smart governance is linked to democracy and governance and smart living to quality-of-life and well-being.

The following section describes each dimension with its respective sub-dimensions and the indicators chosen to represent and measure them. Although the final decision of indicators was

made on a subjective choice, the selection was not randomly picked. The choice of the most suitable indicators was based on previous research that compared different indicators standards for Smart Sustainable cities such as ITU, SDG 11+, ETSI, ISO 37120 and 37122. Among the 413 indicators identified in the study, a first selection has been made on indicators related to urban sustainability with a focus on people (i.e., social sustainability) (Huovila et al., 2019).

The sample of smart indicators is also divided into hard and soft smartness. Hard smartness which relates to tangible assets such as the use of ICT and new technology tools and soft smartness to intangible assets such as human capital, well-being, participation and inclusion, etc. (Huovila et al., 2019). To summarize, the final framework is composed of five dimensions which are, equity, social inclusion, quality-of-life, well-being and democracy and governance, which are themselves divided into 10 sub dimensions all completed with specific indicators. The indicators, listed in table 2, will allow us to measure and compare the social aspects of the selected Smart Cities and to determine the progress of the cities in terms of social inclusion.

Dimensions			Sub-dimensions	Specific indicator	
Smart people	Equity	I_E	ICT access	Household internet access	I_{IA}
				Urban WIFI	I_{UW}
	Social inclusion	I_{SI}	Training	ICT sector employment	I_{ISE}
				Unemployment rate	I_{UR}
				ICT training	I_{IT}
				Education level	I_{EL}
			Creativity	Citizens' creativity	I_{CC}
Smart gov.	Democracy & governance	I_{DG}	Administration	E-guichet	I_{EG}
			Open governance	Datasets available	I_{DS}
			Citizens' participation	Voter turnout	I_{VT}
				Collaborative platform	I_{CP}
Smart Living	Quality-of-life	I_{QoL}	Safety	Security network	I_{SN}
				Smart lighting	I_{SL}
				Crime rate	I_{CR}
				Traffic fatalities	I_{TF}
			Health	Health efficiency	I_{HE}
	Well-being	I_{WB}	Environmental quality	Air quality monitoring system	I_{AQM}
				Concertation of $PM_{2.5}$	I_{PM}
				Green infrastructure	I_{GI}
			Housing	Housing affordability	I_{HA}
				Housing quality	I_{HQ}

Table 2 : Sample of chosen indicators (creation of the author).

2. Smart governance and civic engagement

2.1. Context

For cities to effectively and equitably address the issue of social sustainability, governance is a critical aspect to address. It can be defined as the relationship between decision-making powers, government and institutions, and other actors in the city, which enables the achievement of common goals (Caulfield et al., 2001; Marsal-Llacuna, 2015).

According to numerous research studies, to better improve the quality of life in cities, it is important to adopt a citizen-centered approach and to increase the level of citizen participation in decision-making (Marsal-Llacuna, 2015). In the context of smart cities, collaboration between different actors in society is the most important aspect. Therefore, the implementation of a smart city mostly takes two approaches. On the one hand, a top-down approach, which means that policies and regulations are decided and implemented from the "top", and on the other hand, a bottom-up approach, which means that society should be consulted in the decision-making process (Nguyen et al., 2018). Thus, there is a shift from state-centric governance to a more collaborative governance. Smart governance is determined by the collaboration between the key actors of public authorities, businesses, universities and research centers, and civil society. Citizens should be seen as a source of innovation and creativity in the development of a smart city (Michels & de Graaf, 2017).

2.2. Choice of indicators

2.2.1. Citizens' participation

There are two types of participation within a collaborative governance, direct and indirect. Indirect refers to the mechanism where citizens select representatives who make the decisions for them. On the other hand, we talk about direct participation when citizens are actively engaged in decision-making (Nabatchi, 2012). Through the implementation of participative mechanisms and the association of top-down and bottom-up, Smart cities may be seen as facilitators to increase citizen's participation (Margherita et al., 2021). To measure citizens' indirect participation in the community's life, we will look at the voter turnout, which is a commonly use indicator and is calculated as the ratio of the number of votes cast and the number of voters registered (CBD et al., 2017). However, it is important to take into account the compulsory nature of voting in Belgium, which results in a percentage approaching 90% on

average, which is high compared to other countries where voting is not compulsory and places Belgium as the country with the highest voting rate (Gaudiaut, 2020).

Indicator	Specific Indicator	Definition	Units
I_{VT}	**Voter turnout**	Percentage of the eligible population that voted during the last municipal election	%

Regarding direct participation, although many scholars have emphasized that little research has been done on actual practices of citizen involvement within Smart Cities (Granier & Kudo, 2016), many cities around the world are now focusing on e-governance and inclusion of citizens within government decision (Margherita et al., 2021).

There are many technologies that can be used to empower citizens to engage and actively participate. If used well, these tools will not only allow citizens to be better informed, but also to reach a larger number of citizens. However, it is important to mention that these technological tools can be used in parallel with more traditional, non-technological practices such as neighborhood councils, citizens' meetings, etc. There are a multitude of tools available, but we will only present some of the most interesting ones used in smart cities around the world, as well as those that focus solely on interaction with citizens (and not other actors) (Nguyen et al., 2018). In addition, the following tools are those that act on most levels of the IAP2 spectrum of public participation, which can be found in appendix 4 (pp.96) (IAP2 International Federation, 2018). These levels are inform, consult, involve, collaborate and empower and represent the degree of involvement of citizens. Therefore, it would mean that the tools that act on the most levels are those that integrate citizens the most. On the other hand, tools that act on the last levels run the risk that citizens are not sufficiently informed and therefore only use the ideas of the most educated and aware citizens, thus creating inequalities in citizen representation. It is therefore interesting to see whether a city is active at all levels of IAP2, as the tools can be implemented simultaneously and complement each other.

2.2.2. Open data

Data, generated through the use of various sensors or detectors, is the basis of smart city, mainly because it enables better decision making. Data must therefore be reliable and of high quality. The importance of data is increasingly recognized by cities and is often reflected in the implementation of an "Open data" policy (Ferrara, 2019).

Open data are data generated by public authorities that can be used by different actors in the city such as companies, universities, citizens, etc. The primary goal of open data is to foster innovation and value creation, through the use and sharing of data accessible to all. Sharing more data allows citizens and other city actors to be better informed and thus encourages them to participate more effectively (Ferrara, 2019). An "open data" policy must be considered as a crucial step towards an open governance and more citizens' participation. However, having an open data platform is one thing, but it is also important to look at the information available on the platform. There are several risks regarding the amount and type of data shared. There is a risk that the shared data will fall into disuse because citizens do not know how to use it effectively, which would therefore be a waste of time and money for the city, and there is a risk that important and useful data will not be included in the database. Instead of determining whether or not the city has an open data platform, we therefore decided to look at the number of datasets published, as more information allows for more transparency and triggers more participation (Nguyen et al., 2018).

Indicator	Specific Indicator	Definition	Units
I_{DS}	**Datasets available**	Number of datasets available on the open data platform	#

2.2.3. Collaborative Platform

One of the most used participation tools by cities are collaborative platforms. These platforms allow citizens to interact with public authorities and increase the degree of involvement of citizens in decision making. However, there are different types of collaborative platforms that involve the citizen at different levels. The choice of platform and degree of involvement depends on the context of the city. In our research we will focus on the collaborative platform which takes into account information, consultation and involvement of citizens as well as citizen collaboration. There is first a consultative approach where citizens can develop ideas based on problems they identify and then either the projects are implemented, which is called citizen co-creation, or the projects are not implemented and remain at the proposal stage (Nguyen et al., 2018).

This tool allows a strong collaboration between the citizens and the city but also allows the city to benefit from the collective intelligence of the citizens and thus better target the needs of the population (Nguyen et al., 2018).

Indicator	Specific Indicator	Definition	Units
I_{CP}	**Collaborative platform**	Presence of a collaborative platform	Yes = 1,00 No = 0,01

2.2.4. Administration

Finally, the administration within the city and the management of the numerous administrative demands can be a challenge for the city and the citizens. Obtaining certificates and other documents requires many steps, often poorly explained and time-consuming. To overcome these difficulties, cities can now turn to technology to facilitate the management of administrative procedures and respond more effectively to citizens' needs. E-administration is when new technologies make administration easier, more efficient and more accessible (Oberdorff, 2006).

In recent years, following the launch of the "Digital Agenda for Europe", Belgium and other European countries have been digitalizing essential public services, such as public administration. This policy aims to simplify the administration but also to reduce the costs related to administrative expenses. We are therefore seeing a dematerialization of administrative services and relations with the citizen, putting new technologies at the center of the administration (Brotcorne et al., 2020). From now on, through e-guichets, citizens can have access to a multitude of administrative services online. Although the usefulness of these administrative platforms was proven during the pandemic, when it was difficult to access the administrations, there is a clear risk of marginalization of a part of the population deemed capable of using these online services (Centre d'Informatique pour la Région Bruxelloise [CIRB], 2021a).

Indicator	Specific Indicator	Definition	Units
I_{EG}	**E-guichet**	Presence of an online platform to facilitate administrative tasks	Yes = 1,00 No = 0,01

Limits and challenges

However, many challenges arise when using citizen-centered approaches. First, there is a risk of passive participation, meaning that citizens will passively share their data but not actively participate in decision which are based on the use of these data. Therefore, there is a need to increase citizens' awareness of active participation in the community and in decision making.

Second, there is a risk of lack of knowledge. There is a risk that the level of digital knowledge and familiarity with technological practices will be too low to reach the expected impact. In order to make informed and coherent decision, citizens need to have contextual knowledge and need to be aware of the specific territorial issues. Therefore, there is a need to first educate citizens about the use of ICTs by implementing free training or program to support citizens.

Third, as mentioned before, the access to internet is not ensured for all citizens in many countries and cities around the world. Therefore, such initiatives to involve citizens could marginalized part of the population. Initiatives to ensure the follow up of all citizens were developed in some countries. The city of Belo Horizonte, in Brazil, introduced in 2006 an online voting platform where citizens would have access to transparent information about projects and could interrogate the government through an online forum. To ensure the equal participation and accessibility to all citizens, the city has provided free public Internet voting locations throughout the city (Agence Française du Développement [AFD], 2019).

Another good example is Jamaica. In 2011, the country developed telecentres and Internet access points in libraries to allow all citizens, particularly the ones in low-income areas, to benefit from the development of e-services (AFD, 2019).

3. Smart Living and quality of life

3.1. Context

Smart living includes different features, generally related to the quality of life within a city. It involves innovative and connected solutions aiming at making life easier, more productive, more sustainable and simply happier. The focus of the smart living is on one main objective, to provide a **safe** and **healthy** environment for all. Smart living focuses on integrated health, which is the combination of all health determinants, encompassing social, environmental and economic factors (Kumar, 2020). Integrated health reflects well-being of individuals, communities and population in general (Witt, 2017).

Integrated health is therefore divided into different types of well-being, which can impact one's quality-of-life, such as biophysical, mental, social and ecological well-being. Biophysical WB is directly related to individuals' physical health and can be improved with ICT by delivering smart continuous health services. Mental WB is related to how individuals' think, act and interact within a society. Social WB refers to the extent to which one's feel a sense of belonging and the degree of social inclusion within the city. The last dimensions, ecological WB, does not only refer to the well-being of the planet but also to the relationship between the environment and humans. This relationship could be seen as a circle where humans' actions impact the well-being of the environment, which in turns impact the quality of life of the population (Kumar, 2020).

3.2. Quality-of-life : choice of indicators

3.2.1. Safety

If smart living is linked to the quality of life and the quality of the environment in which we live, it is linked to the feeling of safety that we perceive in a city. According to the OECD, safety is linked to the absence of danger (OECD, 2020). Based on the different frameworks analyzed, we decided to divide this dimension into three sub-dimensions: street safety, road safety and safety systems.

The most representative indicator of street safety is the crime rate. The number of crimes reflects the sense of safety felt by individuals in the city (ITU, n.d.). Crime includes all the offences listed in appendix 5 (pp.97) (Police Fédérale, 2021).

Indicator	Specific Indicator	Definition	Units
I_{CR}	**Crime rate**	Crime rate per 100,000 inhabitants	#/100,000 inhabitants

Regarding road safety, traffic fatalities cost millions of lives each year and have a huge impact on safety. According to WHO traffic fatalities are the leading cause of deaths among youth. We will look at all death, immediate or within the 30 days, caused by traffic injury accidents (Sminkey, 2007).

Indicator	Specific Indicator	Definition	Units
I_{TF}	**Traffic fatalities**	Traffic fatalities per 100,000 inhabitants	#/100,000 inhabitants

Finally, the use of ICT can help prevent certain fatal accidents and increase the feeling of safety in cities. Urban safety is an issue that smart city can address by developing intelligent systems, the so-called "safe city". Here are some examples of functionalities that can be used to increase safety and security: intelligent traffic systems, intelligent surveillance systems, intelligent traffic management systems, etc. However, although data collection is the basis for a safer city, the safe city is not defined by it alone. Indeed, after the collection of data it is important to see whether the city processes and uses this data effectively in real time. Efficient analysis allows for the anticipation and prevention of future incidents, and interconnected data sharing allows for better decision-making and action by the emergency services if necessary. It is therefore clear that a safe city does not stop at the provision of security equipment such as surveillance cameras (Lacinák & Ristvej, 2017). For this reason, we have decided not to use the number of security devices in the city as an indicator, because, although this is an aspect of the safe city, it is not representative of the use that the city makes of it. However, one of the most important elements of the safe city is network connectivity (PwC, 2013). The city will collect data, but it must also ensure connectivity between the different actors and control rooms to ensure effective security management.

Indicator	Specific Indicator	Definition	Units
I_{SN}	**Security network**	Share of data collected through security devices between security representatives and the city	Yes = 1,00 No = 0,01

Besides, given that the feeling of insecurity is related to the quality of surrounding, another ICT based solution that increase the feeling of safety perceived by citizens is smart lighting. However, even though citizens would feel safer in lighten streets, there are no clear evidence that increase lighting actually have an impact on the level of crime (Morrow & Hutton, 2000). Therefore, this indicator will be weighted less than other, as it will increase citizens' feeling of safety, therefore increase their well-being but it does not actually make them safer. Besides, these initiatives most of the time put in place to reduce consumption of energy and safety is more a side effect to it.

Indicator	Specific Indicator	Definition	Units
I_{SL}	**Smart lighting**	Street lighting management using ICT	Yes = 1,00 No = 0,01

3.2.2. Health

Health at city level can be assessed in different ways. In this case, we are interested in the health administration and the organization of health services within the city. On the one hand, a smart indicator which can cover the organization of health services is the number of electronic medical records (e-health). This is a good indicator because e-health records are more than likely to be complete and allow easy access in case of urgent need to access patient information. In this case, the use of ICT allows for better accessibility and therefore faster and more efficient care. Nevertheless, there is a barrier due to confidentiality of data, which is why not everyone automatically allows the sharing of records (ITU, 2016a). However, the number of e-health records is data that is only collected on a regional basis. Therefore, as the territory is not comparable and not representative of each city, we decided not to take this indicator into account.

On the other hand, a lot of research shows that accessible primary health care is a fundamental right for citizens and therefore an important issue for cities to address. One indicator of an accessible and quality health care system is the sufficient number of general practitioners (GP) available in relation to the number of inhabitants. Indeed, the more doctors a city has, the more the demand for health and other care can be met in a short period of time (Van Roy et al., 2017). However, many studies also show a certain concern about the shortage of GPs in Belgium and other countries for many reasons (OECD, 2019a), such as decisions about the number of INAMI numbers available, ageing GPs or preference for other specializations. It is therefore interesting to look at the number of GPs available per municipality and the different actions taken to avoid or remedy this shortage (Van Roy et al., 2017).

Indicator	Specific Indicator	Definition	Units
I_{HE}	**Health system efficiency**	Number physician per 1000 inhabitants	#

3.3. Well-being : choice of indicators

3.3.1. Environmental well-being

According to the OECD, and when comparing the different frameworks (ISO, ITU, SDG11+, ETSI) the environmental quality of a city is characterized by the level of air pollution and the accessibility for citizens to green spaces (OECD, 2020). Other dimensions, such as waste management or water supply are included, however, being much more related to the environmental pillar we decided not to include them within our framework.

3.3.1.1. Air quality

Air pollution has been identified by the WHO as a significant environmental risk to human health. Air pollution can have major impact on health by increasing the risk of stroke, heart disease, lung cancer and respiratory disease. In 2014, exposure to air pollution caused more than seven million premature deaths worldwide and, according to the WHO, 80% of the urban population is exposed to air pollution levels above WHO limits (World Health Organization [WHO], 2018). Countries with the highest level of air pollution exposure are all located in Asia and Africa, the two regions where most of the population live and that expected the highest demographic growth in the coming decade (OECD, 2019b). Consequently, air pollution is considered one of the main environmental risks to health and well-being. Reducing the level of air pollution in cities has therefore been identified as one of the main challenges for sustainable cities.

Air quality is part of the target 11.6. which states : "By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management" (Min, 2018). The indicators chosen is therefore the indicator 11.6.2 and reflects the state of environmental air quality and indirectly measure the exposure of the population to air pollution. The indicator (I_{AQ}) is described as follow :

Indicator	Specific Indicator	Definition	Units
I_{PM}	**Concertation of $PM_{2.5}$**	Annual mean level of fine particles ($PM_{2.5}$) in cities	$\mu g/m^3$

3.3.1.2. Use of ICT

Urbanization growth also come with an increasing level polluting factors such as the use of more vehicles, more waste and energy consumption. Therefore, finding solution to monitor and control air quality is of prime importance for cities. Using ICT solutions, such as sensors for air quality monitoring, can help cities to keep track on air pollution and collect data that can be analyzed to better understand the impact on health and quality-of-life, but it will also allow the city to identify the source of pollution and the bottlenecks where action is needed first to reduce air pollution (ITU 2016a; Environmental Protection Agency [EPA], 2021). The indicator chosen is the following :

Indicator	Specific Indicator	Definition	Units
I_{AQM}	**Air quality monitoring system**	Presence of air quality sensors within the city	Yes = 1,00 No = 0,01

Given the recent emergence of intelligent solutions, the data on the number of air quality sensors installed remains very low. This is why we have chosen to measure the indicator in a binary way, representing whether or not the city has implemented or expressed the will to implement a project concerning the use of technological solutions to improve air quality.

Challenges

Most cities have large and very expensive measuring stations that provide data to measure the air quality. However, to improve the representation of air quality in certain locations, there is a need to have a denser network of measurement points. However, to offer these solutions, cities face another problem which is costs. Sensors are too expensive and cheap sensor are not always seen as the best solution given the low data quality. It is therefore necessary to develop cheaper sensors and to improve the quality of measurement of these cheaper alternatives. Cities should also work closely with experts in the field to get a clearer and more professional view of how to interpret and use the data generated by these sensors (Van Poppel, 2020; CBD et al., 2021, p.24).

3.3.1.3. Green spaces

Regarding the accessibility of green spaces, according to the report assessing green spaces accessibility in European cities from the European commission, green spaces in cities can have various benefits on the health, quality of life and well-being of citizens, but also on the environment, by capturing pollutants (European Commission [EC], 2018). Indeed, the OMS

reports that the accessibility to green spaces increase the feeling of well-being, decreases the stress and increase physical activity (OMS, 2016). This aspect is strongly related to the target 11.7. of the SDG which is "By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities". An open public space is defined as an undeveloped area, i.e., with no building, that is accessible to everyone (United Nations Statistics Division [UNSD], 2021).

Given the poor accessibility of data of the actual share of open public space within cities, as mentioned in the indicator 11.7.1., we decided to use a quite similar indicator representing the share of green infrastructure (GI) in cities, presenting data collected by the European Commission for each of the cities analyzed. The GI represents the share of green space present in the city in relation to other land uses . This indicator is not the most representative because it does not determine whether the population has easy access to these green spaces (Aurambout & Vallecillo, 2016). It does, however, give an overall picture of the share of green space in each city.

Indicator	Specific Indicator	Definition	Units
I_{GI}	**Green infrastructure**	The share of green infrastructure (GI) within a city (all high-quality green spaces and other environmental features relative to other land-uses).	%

Other dimensions are often represented in frameworks to characterize the environmental quality of cities, such as waste management and noise pollution. However, we decided not to look at waste management given that it is much more related to the environmental aspect, rather than the social aspect. On the other side, noise pollution is more related to people and represent a big issue for a lot of cities. Cities are receiving more and more complaints about traffic, neighborhoods and event noise. However, due to the recent nature of these complaints, there is few data on noise level and few policies put in place to counter this issue. We therefore decided not to include this indicator. However, in the future it could be interesting to develop it given that more and more technologies are available to measure the noise level in different part of the city.

3.3.2. Housing

Regarding the quality of housing, looking at the sanitation of household was not that relevant in this case given that, according to the data from UNICED and WHO, 100% of the population

in Belgium use improved water source and improved sanitation facility (WHO & UNICEF, 2015–2020). If we look at the SDGs, the target 11.1. states: "By 2030, ensure access to adequate and safe housing and basic services for all at an affordable cost, and sanitize slum areas". The indicator includes "the share of the population living in dwellings with either leaking roofs, damp walls, floors or foundations, or rot in window frames or floors" (UN Habitat, 2020b). However, the data for this indicator are collected by region and are therefore not available at the municipal level (Burean Fédéral du Plan [BFP], 2003-2020). For this reason, it was decided to select other indicators, less representative but with data available for each municipality, in order to have some representativeness of the city.

Target 11.1. focuses on quality and affordability. Therefore, in order to estimate the quality of the housing supply in each city, we decided to look at the date of construction of the buildings. The age of the properties reflects the general condition and quality of the housing. Indeed, the quality of construction deteriorates over the years and construction standards evolve. The life span of a building is therefore determined by the life span of its structure (foundations and supporting walls). As mentioned in Eurocode 0, the European standard on structure and safety of buildings, the life span of current buildings is about 50 years (ICAB, n.d.). Furthermore, other building components, such as kitchens and bathrooms, have to meet different standards and have to be more flexible than 30 years ago. The indicator will therefore look at the percentage of buildings built before 1970. Obviously, dwellings built a long time ago can still be considered of good quality if they have been properly maintained over the years or if they have been subject to renovation (Swiss Life, 2017).

On the other hand, for affordability, it was decided to look at the supply of social housing accessible to the population. Indeed, in many cities, the demand for social housing often exceeds the supply, which means that many households cannot afford adequate housing. The supply of social housing therefore reflects the possibility for people in precarious situations to find adequate and affordable housing, as mentioned in target 11.1.

Indicator	Specific Indicator	Definition	Units
I_{HA}	**Housing affordability**	Number of social housing for 100 households	#/100 households

Indicator	Specific Indicator	Definition	Units
I_{HQ}	**Housing quality**	Housing quality based on year of construction (before 1970)	%

4. Smart people and equality

4.1. Context

Smart people counts three main dimensions which are inclusion, education and creativity. Social inclusion can be understood as social equity, which addresses issues in many areas encompassing the access to certain services and opportunities for all, without discriminating any social groups (Kumar, 2020). In the context of smart cities, when technologies are involved, we can talk about "digital inclusion" or "e-inclusion ", which is the process by which a society aims to make the digital accessible to all in order to create an inclusive information society. Cities are well aware of the challenges of digital inclusion and the Covid crisis only confirmed and raised awareness of the importance of moving to a digital society for all stakeholders. Digital inclusion gives citizens a better quality-of-life, better job opportunities, better access to information that makes it easier for them to act in the public interest (Mancinelli, 2008).

However, some aspects of the information society raise concerns about issues of access and exclusion. Many social scientists observe the growing number of inequalities within cities with regard to the phenomenon commonly referred to as the 'digital divide', whereby the benefits of digital and ICT are not evenly distributed among the population (Caulfield et al., 2001). Digital divide is on the main source of ethical dilemmas raised by the information age regarding equitable societies. Indeed, since the aim of smart cities is to connect citizens and improve their quality of life through the use of ICT, there is a significant risk of increasing social inequalities if not everyone has the same opportunities or capacities to benefit (Floridi, 2002).

Although the digital divide is more present in developing countries, developed countries also face it through differences between urban and rural settlement and socioeconomic status. The Digital Inclusion Barometer, published by the "Fondation Roi Baudouin", identifies three degrees of digital divide. Firstly, inequalities linked to **access**, also known as the first-degree divide, which concerns not only access to digital equipment (computer, telephone, tablet) but also access to an internet connection. The second level divide concerns **digital skills**. Inequalities related to digital skills prevent a part of the population from benefiting from the tools made available, which are supposed to facilitate their lifestyle. However, as mentioned in

the report, citizens' skills developed more rapidly during the COVID crisis due to the exceptional and urgent need to use digital services. The last degree of the digital divide concerns **essential services**. Some inequalities may emerge at the level of social integration due to the practical and increasingly present character of certain services, sometimes considered as essential, such as those related to health care (e-health), administrative procedures (e-administration or e-banking) or consumption (e-commerce) (Brotcorne et al., 2020).

According to the barometer, inequalities related to the digital divide particularly affects low-income households, people with a low level of education, isolated people, especially women, and the elderly. There is therefore not only an income and education divide but also a generational and gender divide. It is thus essential to take into account all the population and all the groups potentially at risk of digital exclusion (Brotcorne et al., 2020).

4.2. Choice of indicators

4.2.1. Internet access

It was decided to use indicators related to each degree presented above. The first being related to the access to internet. Indeed, internet is not yet available everywhere. The statistics of 2021 show that only 59.5% of the world population was connected, meaning that there is still a lot of space for internet growth around the world. The most disconnected countries are in Asia and Africa (Statista, 2021). Therefore, measuring the proportion of households with access to the internet will allow us to assess the ability of the population to access and benefit from the smart tools available to them.

Indicator	Specific Indicator	Definition	Units
I_{IA}	**Internet access**	Proportion of household with Internet access	%

Due to lack of data, this indicator was measured based on regional data. Therefore, the percentage might not be representative of each specific cities but gives a broad information on the regional situation. However, as presented in the barometer of social inclusion, the situation in Belgium is relatively positive compared to other European countries (Brotcorne et al., 2020).

Moreover, some cities provide a free urban WIFI. The availability of WIFI in public areas allow citizens of a city to have greater access to the internet and therefore to available smart services. Such initiatives will increase citizens' use of e-service and therefore allow them to increase their participation in decision making processes.

Indicator	Specific Indicator	Definition	Units
I_{UW}	**Urban WIFI**	Number of free public WIFI hotspots available in the city per km^2	$\#/km^2$

4.2.2. Education & training

Furthermore, the second degree is related **lack of knowledge** concerning the use of ICTs, i.e., digital skills. Indeed, **education** regarding new technologies is not equal among demographic factors such as age, sex, income and level of education. However, it is important to mention that a large part of the population, even those considered to be at no risk, have poor digital skills. The skills gap is therefore a problem that affects the entire population, even if the so-called at-risk groups remain the most vulnerable (Brotcorne et al., 2020).

Therefore, investing in digital education and increasing the availability of digital training could help to reduce the gap that is widening as our societies become more digital. Given the vulnerability of people with low levels of education, the first indicator studied will be the level of education and the second will look at the availability of training to improve the digital skills of the population.

Indicator	Specific Indicator	Definition	Units
I_{EL}	**Education level**	Share of the population with a higher education degree	%

Indicator	Specific Indicator	Definition	Units
I_{IT}	**ICT training**	Availability of training to improve ICT skills	Yes = 1,00 No = 0,01

4.2.3. Employment

Jobseekers are also very vulnerable and in Belgium 44% of them have low digital skills. Therefore, in order to get an idea of how many people are looking for work, we will look at the unemployment rate in the city (Brotcorne et al., 2020).

Indicator	Specific Indicator	Definition	Units
I_{ER}	**Unemployment rate**	Share of the total city labor force that is unemployed	%

On the other hand, as the smart city model is based on the intensive use of ICT, it is essential for cities undertaking such a project to have a sufficient ICT workforce to be able to carry out the research and implementation of technological solutions. A representative indicator will therefore be the share of people employed in the ICT sector (CBD et al., 2017).

Indicator	Specific Indicator	Definition	Units
I_{ISE}	**ICT sector employment**	Share of the total city labor force working in the ICT sector	%

4.2.4. Citizens' creativity

The last dimension of smart people is creativity. Smart citizens are citizens that are actively involved in public life and find innovative ideas and solutions to improve city's sustainability (Kumar, 2020). To assess the creativity of citizens we decided to look at the extent to which the city provide the necessary support to citizens to be actively involved in decision-making.

According to the Smart City Institute, the two participative tools that allow citizens to not only participate but also be in charge of project and take the final decision, which represent the last degree of the IAP2 spectrum, are the living lab and the participatory budget (Nguyen et al., 2018).

Living Labs are innovation centers created by the city for citizens where real collaboration can take place. These places offer shared workspaces that encourage meetings between citizens and innovation through the exchange of ideas in order to respond to potential problems in the city. There are different places that respond to different problems, societal, entrepreneurial,

commercial, etc. The living lab is the one that best represents the integration of citizens in the decision-making process that directly concerns them (Nguyen et al., 2018).

Secondly, the participatory budget. Unlike the living lab, this practice is not very recent, since it was born at the end of the 1980s. The fact that it is not so recent allows us to have more hindsight on the initiative and also to evaluate the impact that certain initiatives have had, unlike the living lab which is a fairly recent practice and therefore not yet very well evaluated (Ganuza et al., 2015). Therefore, it is a practice that is already well adopted by many municipalities and thanks to new technologies this practice is increasingly easy to implement because they improve communication with the citizen. The participatory budget aims at granting a part of the public budget to citizens to implement projects proposed and voted by them. This practice therefore not only improves the relationship between the municipality and the citizens, but also allows for a better targeting of the citizens' needs and for tailor-made decisions that suit them. However, for this to work there is a need to raise awareness of the use of these practices and to communicate to a diverse audience, to avoid that decision-making and budgeting is only given to a small part of the population. Indeed, according to the smart city institute report, there is a stronger mobilization of citizens with a higher level of education (Nguyen et al., 2018).

As the choice of the participatory tool depends not only on the challenges of the city but also on its budget and structure, some cities implement both practices and others prefer only one or none. Furthermore, given the recent nature of the laboratories, the impact that the implementation of these has on the city and its citizens is still unknown and difficult to assess (Hossain et al., 2018). For this reason, we have decided not to take into account in the indicators the setting up of laboratories but only the setting up of participatory budgets, which is a relatively simple practice to implement and has been used for several years. However, the labs developed by some cities will be explained and developed in part three.

Indicator	Specific Indicator	Definition	Units
I_{CC}	**Citizens' creativity**	Active Interaction with citizens through the implementation of participatory budget	Yes = 1,00 No = 0,01

PART III – Methodology

The first two parts have identified the dimensions related to social sustainability in smart cities and the indicators that can be used to partially measure how cities integrate social dimensions into their smart city strategies. This second part will explain the territory that will be examined, the methodology that will be used to quantify the data collected and to establish the final scores, as well as the explanation of the interventions of the interviewees.

1. Choice of Belgian territory

For this research, we decided to analyze Belgium territory. As explained before, megacities are not representatives of the majority of cities and cities in developing countries are expected to encounter a lot of changes in the upcoming years. Therefore, it seemed more interesting to look at a well-developed and stable territory such as Belgium. However, some limitations due to the size of the territory will be mentioned later (pp.39). In order to conduct an extensive research and to have the best representation of the country, we selected a range of several Belgian Cities, from each region, with dissimilar territorial characteristics.

We selected our sample according to the size of the city and the wealth index. First, the size criterion will allow us to distinguish between large (≥200,000 inhabitants), medium (≥100,000 inhabitants) and small (<100,000 inhabitants) cities. Secondly, the wealth index, which is the ratio between the average per capita income of the city and the average per capita income in Belgium. The wealth index in Belgium is equal to 100, which means that cities with an index of more than 100 have an average per capita income above the Belgian average. This criterion will allow us to identify the purchasing power of the inhabitants of each city and therefore the capacity of the inhabitants to access different services (IBSA, 2011).

Our sample of cities is therefore composed of eight municipalities distributed between the Flemish region, the Walloon region and the region of Brussels, as shown in table 3. We decided to select this sample based on the diversity and dissimilarity between the cities. However, an important limitation to mention is that the selected cities are not representative of cities in general, due to the small size of the field studied. Therefore, the statistical conclusions drawn from the analysis of the data collected cannot be replicated for all types of cities.

Size/**Index of Wealth**	**<100**	**≥100**
Small (< 100.000)	Mons	
Medium (≥100.000)	Brussels / Liège / Namur	Bruges
Large (≥200.000)	Antwerp / Charleroi	Ghent

Table 3 : Sample of selected cities

2. Context in Belgian municipalities

According to the Smart City Institute's 2018 barometer, which is a study of 123 Belgian municipalities spread across the three regions (61 in the Walloon region, 4 in the Brussels region and 58 in the Flemish region), although for most municipalities digitalization is the first goal associated with the term smart city, 59% of them believe that the smart city can improve citizen participation and include the community more and 57% believe that it can improve the quality of life of citizens. However, these trends are not evenly distributed across the three regions. The Brussels region is entirely focused on improving the quality of life through a smart city approach, Wallonia mainly associates it with the "brand image of the city", while Flanders is mainly concerned with the digitalization of the city (Bounazef Vanmarsenille & Desdemoustier, 2018). However, the 2020 barometer of the Smart City Institute, which only studies Walloon municipalities, states that the trend has changed for Walloon municipalities and that the smart city is no longer associated with the brand image but with citizen participation and the improvement of the quality of life (Randaxhe, 2021).

In terms of the progress of their smart transition, Belgian cities rate themselves on average at 3.64/10, which is still very low but understandable given that most of them (69%) declare to have initiated smart projects since 2016. Besides, most of the municipalities put forward the human factor in terms of importance, compared to the institutional and technological factor. However, in terms of awareness raising, the majority of the actions to raise awareness are aimed at communal stakeholders and not, or very little, at citizens (Bounazef Vanmarsenille & Desdemoustier, 2018).

In terms of the dimensions of the smart city, the priorities differ depending on the region. In Flanders, priority is given to smart governance, followed by smart environment and smart mobility. In Brussels, the priority is smart environment followed by smart people and smart living and finally in Wallonia it is quite similar to Flanders with first smart governance followed

by smart environment and smart living. The result is similar at the level of the provinces, and we can observe a strong trend for the smart environment dimension (Bounazef Vanmarsenille & Desdemoustier, 2018).

Finally, when setting up smart city projects, the first obstacle that stands out the most is the lack of budget. Indeed, half of the municipalities believe that they lack the funding to implement projects. According to the report, the cities claim that the municipalities' own funds finance 65% of smart city projects, followed by regional funds which finance 35% and finally European subsidies, 23%. What is interesting is that there is a marked difference between the regions. Indeed, all provinces in the Flemish region use European subsidies, unlike the Walloon region where none of the provinces use them but rather regional subsidies (Bounazef Vanmarsenille & Desdemoustier, 2018). The second obstacle is the lack of expertise needed to develop projects. Moreover, according to the 2020 report based solely on Walloon municipalities, 56% of them said it was difficult to implement a smart city strategy, mainly because they encountered several problems in involving the different stakeholders, namely government, citizens and businesses, and because of the lack of budget. Their inability to actively involve citizens prevents them from clearly identifying projects and new technologies to implement and makes the smart city approach difficult to undertake (Randaxhe, 2021).

To conclude, for Belgian municipalities, the technological aspect is less and less linked to the smart city, whereas the theme of governance seems to be taking up more and more space among the priorities to be achieved. Moreover, bottom-up initiatives are more and more present in order to include and engage the citizen in an inclusive and dynamic decision making. However, there are still few measures on the impact of the projects, and the state of progress is still preliminary (Bounazef Vanmarsenille & Desdemoustier, 2018).

3. Methodology of research

In order to have a more complete and synergetic understanding of the social situation within the sample of cities, a mixed method will be used. A mixed method refers to a technique whereby both quantitative and qualitative data are simultaneously analyzed within the same study (Shorten & Smith, 2017).

In this case, the quantitative data collected through indicators will be mixed with qualitative data collected during interviews with representatives of the cities analyzed. Therefore, the

qualitative data are collected through semi-structured interviews that are built on the results of the quantitative phase. The use of this method was decided since it seemed that the extent to which smart cities integrate the social pillars cannot be answered by qualitatively or quantitatively research alone. This method will allow to have a better understanding of the situation within Belgian municipalities as well as building connections or contradictions between the data collected through indicators and the actual vision of the city regarding its smart strategy.

4. Quantitative research

This phase allows us to collect measurable data in order to have an objective assessment of the social situation in Belgian Smart Cities. Based on the literature review developed during the first and second part, a quantitative analysis will allow to assess the issue of social sustainability without falling into subjectivity.

4.1. Methodology of calculation

The methodology used can be divided into three main steps :

1. The collection of data for each indicator and each city
2. The normalization of indicators
3. The weighting and aggregation of indicators

4.1.1. Normalization of indicators

The selected and studied indicators are listed in Table 2 (p.21). Some identified indicators are based on binary measurements while other are based on very different measurement units. There is a need to obtain indicators that are comparable and therefore independent of their specific unit of measurements. To do so, we will use the normalization method which will rescale the dataset so that each value falls between 0 and 1. In this case, for simplicity, in order to reduce the number of decimal places while keeping a certain precision, we will multiply by 10 to have a scale from 0 to 10 (Garau et al., 2015). The data collected for each indicator can be seen in Table 8 in appendix 10 (p.103).

Normalization method was chosen as it is the most appropriate method to prevent one variable from being overly influential and bring all variables to the same range. Due to the lack of

definition and research on social sustainability, we considered all variables of being as important (Garau et al., 2015). The formula used to do so is the following :

$$X_{norm} = \left(\frac{X - X_{min}}{X_{max} - X_{min}}\right) * 10$$

where:

- x_{norm} = normalized indicator
- x = indicator
- x_{min} = minimum value of the indicator
- x_{max} = maximum value of the indicator.

The normalized value of each indicator will be reported as shown in table 4, which shows an example for the variable Democracy and governance. All the other variables are calculated in the same way and are presented in the appendix 6 (pp.98).

Cities	Democracy and governance $I_{DG} = [(I_{EG} + I_{CP} + I_{VT} + I_{DS}) / 4]$				
	I_{EG}	I_{CP}	I_{VT}	I_{DS}	**I_{DG}**
Brussels	10,0	10,0	4,9	10,0	**8,7**
Antwerp	10,0	0,0	6,8	8,6	**6,3**
Gent	10,0	10,0	10,0	2,2	**8,1**
Charleroi	10,0	0,0	2,2	0,0	**3,0**
Liège	10,0	10,0	0,5	0,9	**5,3**
Bruges	10,0	10,0	9,2	1,7	**7,7**
Mons	10,0	0,0	0,0	0,4	**2,6**
Namur	10,0	0,0	2,2	3,1	**3,8**

Table 4 : Example of the standardised indicator I_{DG}

4.1.2. The weighting and aggregation of indicators

The weighting of indicators within a framework reflects the importance of each variable and their contribution to the performance of the city. However, due to lack of studies and definition of social sustainability, as previously mentioned, equal weighting will be used. This weighting method gives the same importance to all variables in a portfolio. Besides, based on the research , it is the most appropriate when there are no empirical evidence of differences in indicators weight. It is the easiest and most commonly used method within sustainability indices. Indeed,

according to this research, among the 96 sustainability indices reviews (such as Human Development Index or Living Planet Index), almost half of it (46,88%) used equal weighting (Gan et al., 2017).

On the other side, aggregation of indicators reflects the substitutability of the dimensions. Depending on the method used, it reflects whether the dimensions can compensate or substitute each other. Most commonly used method are additive aggregation method, such as arithmetic mean and multiplicative aggregation method, such as geometric mean. On the one hand, the weighted arithmetic mean uses additive functions to sum up all standardised values of the indicators and is used when there is some interchangeability between indicators of the same dimension. On the other hand, the geometric mean uses multiplicative functions and limits the substitutability between dimensions in order to prevent low-scoring indicators from being offset by high-scoring indicators (Gan et al., 2017).

According to the previous mentioned research, 86,46% of reviewed sustainability indices use an additive method. However, it is common to use both aggregation methods. In this case, the use of both methods assumes that within the same dimension there is substitutability between the indicators, but that on the contrary there is no substitutability between the dimensions (Mazziotta et al., 2010). Indeed, within a dimension, for example "democracy and governance", an indicator with a very low score can be compensated by an indicator with a very high score, which prevents the city from being penalized on the basis of a single indicator for a single dimension. Moreover, some indicators are measured in a binary way, in case the geometric method was used and a city would not present this indicator, a score of zero would strongly penalize this city. Conversely, to calculate the overall score, it would be more logical to use a geometric method to reflect the strong and weak dimensions of each city. Therefore, within the same dimensions the indicators were obtained through arithmetic method using the following formula :

$$X = \frac{(X_1 + X_2 + \cdots + X_n)}{n}$$

The overall score for each city was obtained through geometric method using the following formula :

$$X = (X_1 * X_2 * \ldots * X_n)^{\frac{1}{n}}$$

5. Qualitative analysis

As explained, qualitative data is collected through semi-structured interviews that build on the results of the quantitative phase. These interventions allow us not to draw conclusions based solely on the quantitative data and contribute to a better understanding of the reality in which cities evolve. Moreover, as the smart city phenomenon is recent, cities are still in the process of development and many actions are still to be put in place. It therefore seemed important to have the opinion of experts in order to contextualize our quantitative research (Romelaer, 2005).
`

In order to carry out this qualitative research we chose a semi-structured interview. This is not only one of the most frequently used types of interviews, but also the one that is most suitable for our research, as it allows more flexibility in the questions asked according to the reality of the territory studied. We therefore prepared a short, rather broad set of questions beforehand, based on the collection of indicators. Then, as we went along, other questions were added according to the information provided. In total, 7 interviews were conducted for a total of 225 minutes and extra emails were exchange. The exhaustive list can be found in appendix 7 (pp.99) and the transcripts of each interviews and email can be found in appendix 11 (pp.109). The interactions served mainly as a support for the qualitative research and the information provided in these interviews allowed for a more precise understanding of the subject and context specific to each city.

However, there were some limitations in conducting these interviews. First of all, the COVID crisis did not allow us to meet the actors in person, which took away some of the spontaneity of the interaction and the fluidity of the exchange. In addition, the recent floods in Wallonia prevented us from interviewing two stakeholders, one from Liège and one from Namur. However, e-mail exchanges were carried out and provided some answers and clarifications, which were not, however, as rich as an interview would have been.. Finally, the position and therefore the level of knowledge of each stakeholder, as well as the subjectivity that may come into play during these interviews, may alter the information gathered.

PART IV – Analysis of the results

In the following section, we will examine all dimensions. Firstly, we will analyze in detail the scores obtained by the cities and secondly, we will try to relate these results to the city's strategy. This will allow us to better understand the context and the situation in which the city is evolving. In the end, we will be able to better compare cities and regions on the basis of the context related to the different indicators and on the basis of a better representation of the reality of the city. The analysis in the following section is based on the structural plan of the cities and the actions communicated by them, as well as on interviews with representatives of the cities in the field of the smart city.

1. Cities' strategies

The strategy adopted by a city is specific to that city, specific to its challenges, its size and social mix. Since 2018, all municipalities, provinces and CPAS in Wallonia have been obliged to draw up a 'Plan stratégique transversal' (**PST**), which sets out the city's priority actions in order to establish a common vision of the objectives to be achieved. Often the PST takes up the objectives established in the city project and translates them into concrete and measurable actions over time (Wallonie, 2021). Flanders also requires its municipalities to draw up a 'Beleids- en beheerscyclus' (**BBC**), which also includes the various policy aspects of the city (mobility, culture, youth, urban space, etc.) and the actions to be taken and the evaluation of these.

The table below represents the number of strategic objectives (S.O.) established by each city, divided in operational objectives (O.O.) as well as the number of priority actions (P.A.) accompanying these objectives.

	Brussels	**Liège**	**Mons**	**Namur**	**Charleroi**
S.O.	6	5	14	37	7
P.A.	n.d.	137	200	132	262
Objective n°1	A city of **proximity.**	Fighting **poverty** and **social inequality**.	An exemplary **administration** in terms of transparency, **citizen participation** and ecological transition.	To be a city that **involves** its **citizens**.	An **inclusive** city.

	Ghent	Bruges	Antwerp
S.O.	5	20	7
P.A.	n.d.	515	599
Objective n°1	Working on **spatial** and **societal challenges**.	Bruges, **hospitable** and **friendly**.	**Livable** and **mobile** city.

It can be observed that the objectives that the cities declare first are mostly related to citizen proximity, citizen engagement and inclusion and quality of life. This is interesting because it shows that cities are increasingly willing to act on this social and human aspect and that the environmental aspect is only mentioned at a later stage. The cities' strategic plans include actions that run from 2019 to 2024. At this stage, it is therefore still difficult to assess the impact of some actions as many are not yet fully implemented. This study therefore proposes a rather avant-garde approach and it would be interesting to assess at a later stage to what extent the cities have succeeded in implementing their objectives.

2. Detailed analysis of the results

The application of the previously mentioned methodology has allowed to come up with global score to evaluate the social sustainability of the cities. The table 5 shows the result obtain through the calculation of the different indicators and standardised with the application of the formula. The cities are grouped by region and ranked in order of result, from highest to lowest.

Cities	Social smartness $I_{SS} = [(I_{EG} + I_{DS} + I_{VT} + I_{CP})^{\wedge(1/5)}]$					
	I_E	I_{SI}	I_{DG}	I_{QoL}	I_{WB}	**I_{SS}**
Bruges	5,4	7,7	7,9	7,5	7,7	**7,2**
Brussels	10,0	7,7	4,3	4,8	8,7	**6,7**
Ghent	5,7	8,9	7,5	4,3	8,1	**6,6**
Antwerp	5,4	7,3	6,4	6,5	6,3	**6,3**
Namur	5,2	7,6	5,9	5,3	3,8	**5,4**
Liège	5,0	3,8	4,3	3,0	5,3	**4,2**
Mons	5,5	6,1	3,3	4,2	2,6	**4,1**
Charleroi	5,1	4,0	4,8	3,4	3,0	**4,0**

Table 5 : Synthetic indicator of the social smartness of cities

The results from the indicators show that cities from the Flemish region and Brussels rank higher achieving a relatively high score (>5) in almost all dimensions, while cities from Wallonia obtain the lowest overall scores with most of them achieving average or low scores in all of the dimensions.

2.1. Equity

In the field of the smart city, ensuring that all citizens have equal opportunities means ensuring that all citizens are connected. Some cities are not yet lucky enough to be able to say that all citizens are connected and taking part in the digital transition. Before analyzing the results, it is important to consider some limitations. Statistical data on the digital inclusion of households in Belgium is only provided at a regional level. Although the percentage are rather similar, the Walloon region has the lowest percentage (89%), compared to Flanders (92%) and Brussels (90%). In the calculations, the data is put on a scale of 0 to 1, which would have an unfair impact on Walloon cities. Therefore, as the percentages are very close and the average digital inclusion in Belgium is 89.7% (SPF Economie, 2020b), we decided to give the same percentage to all cities (90%), which leads to the same scores for all cities for this indicator.

Situation in Belgium

On a European level, Belgium scores quite good. Based on the Digital Economy and Society Index (DESI) score, in 2020 Belgium was ranked 9th among the 28 European countries analyzed, which is two places higher than in 2019. According to the report, Belgium's strengths lie in its fixed and mobile network infrastructure, which covers a large part of the territory and thus allows around 90% of the population to have access to the Internet, while the European average is 85.85%. Moreover, 4G is available on 100% of the Belgian territory (SPF Economie, 2020a). However, according to the digital inclusion barometer published in 2020 by the Fondation Roi Baudouin, 40% of the Belgian population is still at risk of digital exclusion. This percentage particularly affects people with low incomes and low levels of education (Brotcorne et al., 2020).

2.1.1. Inclusive society

Inclusive society : (I_{IC}+I_{UW})/2

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
10,0	5,4	5,7	5,1	5,0	5,4	5,5	5,2

As the results show, in terms of digital inclusion, the City of **Charleroi** and **Liège** score the lowest. As **Charleroi** is also the city with the lowest level of education, one can logically deduce that it is the city where the risk of social exclusion is the highest, which would explain why the city puts more emphasis on the fight against the digital divide. Indeed, the digital divide still affects many people and in particular in the city of Charleroi around 80,000 people are at

risk of digital exclusion out of 200,000 inhabitants. According to Eric Goffart, alderman for digital development in Charleroi, the risk of the digital transition is that people with digital difficulties will find themselves in a situation of complete social disengagement, a situation that may be even more serious than it is today . This is why the city has recently decided to implement a three-part strategic plan for digital inclusion and wants to position itself as a leader in the field of digital inclusion in the coming years. Out of the three components of the plan, the most important is training and support, the second is connectivity and the third is the provision of digital tools. Although Charleroi's priority is to train the population in the use of digital tools and services, the city places great importance on citizen connectivity. For instance, Charleroi maintains a partnership with Proximus in order to extend the optical fiber as much as possible on the territory and to enable households and companies to have a good connection. Charleroi is the city where Proximus is the most advanced in the installation of optical fiber, which is not the case in the rest of Wallonia where, as the barometer indicates, there are still many areas with no or little network. In addition, the city wishes to make a free urban WIFI network available to citizens by equipping the strategic points in the city over the entire territory, with priority given to places frequented by young people. This WIFI also aims to give some buildings a new purpose and a new attractiveness. This is why the city also wishes to make devices (computers, smartphones, tablets...) available to citizens. Thus, by going to these public places, citizens have access to devices, a good connection and people available to help them in their digital processes (E. Goffart, interview, June 16, 2021).

In contrast, the city of **Liège** has decided to stop its free urban WIFI, which can explain why the score is so low. According to the city, the budget was too high for the use that was made of it. In addition, citizens say that they have enough 4G to surf the internet and that the connection to the city's WIFI is slow and not always efficient (K. Jaminon, e-mail, July 22, 2021). In order to reach a higher level of performance the city would have to invest more than the 80.000 euro per year. According to experts of the Walloon region, 4G technology has made great strides, so investment in outdoor WIFI is less justified than investment in indoor WIFI and this is what the city of **Liege** intends to do. There is therefore a disparity between the two cities, subsidized by the same entity, which are adopting completely opposite solutions; one is extending its urban WIFI network while the other is stopping it completely. Although Liège's decision is motivated by various arguments and supported by various experts in the Walloon region, the city of Charleroi still wants to try the experiment in the hope of obtaining different results from Liège.

The city is planning a three-year test and will then decide whether or not to extend it (RTBF, 2019).

For the city of **Namur**, the 19 WIFI points are made available as part of the Creative Wallonia initiative which aims to improve creativity and innovation in Wallonia. As a result, the WIFI is subsidized by the Walloon region. The project also provides 72 Wi-Fi access points in the cities of **Mons** and 49 in **Liège**, before the city withdrew from the project. As far as the city of **Charleroi** is concerned, the first three years will be covered by the Walloon region and the city will then have to decide whether to bear the costs itself by extending the urban WIFI or not (Compère, 2018).

The city of **Bruges,** on the other hand, has chosen a middle ground and established clear criteria for which public buildings free WIFI will be installed. Part of the WIFI budget will be financed by the WIFI4EU European action to provide free WIFI in as many European cities as possible (Stad Brugge, 2020). Several Belgian municipalities have benefited from this initiative, as shown in appendix 8 (pp.102).

Brussels takes the first place as it is the city with the highest number of free WIFI hotspots per km2. However, it is important to note that the digital divide is a policy that is managed at the level of the Brussels Capital Region. Initially, the city of Brussels had its own WIFI, then it was decided that it would be more efficient to entrust it to the region in order to have only one operator. Wifi.brussels is therefore the network that covers a total of 221 locations, in outdoor public spaces, inside some public buildings and in all metro stations for a total of 867 hotspots mainly gathered in the center, as shown in the appendix 9 (pp.103). In particular, the city of Brussels has the most connections in the region due to the number of busy metro stations (CIRB, 2021b).

2.2. Social inclusion

2.2.1. Education

Education level (I_{EL})

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
7,5	4,8	10,0	0,0	6,3	7,6	6,1	7,8

Unemployment rate (I_{UR})

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
1,2	6,7	8,1	0,0	0,8	10,0	2,4	5,5

As far as education is concerned, there is a correlation between the level of education, employment and the level of digital skills. As mentioned in the Digital Inclusion Barometer, 54% of people with a low level of education have a low level of digital skills compared to only 13% of people with a higher education and among jobseekers, 44% have low digital skills, 39% have never looked for a job online and in Flanders 18.5% do not have an e-mail address. This is quite alarming given that many jobs offers and applications are currently made via the internet. People looking for work or with a low level of education are therefore at risk of digital exclusion (Brotcorne et al., 2020).

According to the “Information Society Barometer”, regarding digital literacy, Belgium is slightly above the European average. Around 61% of the population declare to have basic competences, which is 3% higher than European average. On the other side, 23% of the population feels that they are not able to use digital tools in their daily lives due to a lack of skills. This lack of skills stems from various reasons, including lack of time, lack of specification of what skills to learn and lack of digital training provision (SPF Economie, 2020a).

Ghent has a high overall score with the highest level of education and the second lowest unemployment rate, after Bruges. This result is logical given the correlation between the unemployment rate and the level of education. Indeed, according to the World Bank, people with a tertiary degree are more employable, resulting in lower unemployment rate, promote long-term growth and increase citizen participation, which is true in the case of Ghent, which also ranks first in terms of indirect citizen participation. Furthermore, in terms of digital inclusion, the City of Ghent has set up the "Digitaal Talent Ghent" programme. This programme aims to improve the digital skills of citizens and municipal employees. To this end, the city has set up 25 Digipoints that provide free access to computer equipment, assistance in answering digital-related questions and coaching to help citizens with digital difficulties (configuring devices, using applications, using electronic services, etc.). The assistants at the Digipoints are either volunteers or social service workers (Stad Gent, 2020). The city also provides training for the assistants so that they can better help citizens. This is the same "train the trainer" idea that the city of Charleroi also uses.

On the other hand, **Charleroi** is the city with the highest unemployment rate and the lowest level of education, therefore it might be the city with the largest audience at risk of digital exclusion. This might explain why Charleroi is primarily focus on issues of digital exclusion. As a continuation of the explanation of its action plan, the city's priority is to train people. To achieve this, the city adopts a "train the trainer" approach. The logic behind this approach is that vulnerable groups are in theory easily identified but in practice difficult to reach because they are often excluded from society. The city has therefore decided to train digital helpers in the administrative and associative world, two worlds that are in direct contact with this more marginal group of people in society and therefore more at risk. A second goal of training the population in digital skills is to increase employment in the ICT field (Ville de Charleroi, 2020a). According to E. Goffart, the city of Charleroi was built on coal and manual trades, which are no longer competitive elements for the city. This is also reflected in the fact that Charleroi has the lowest score for the share of the population working in ICT. A digital transition is also taking place at the level of employment and Charleroi hopes to create vocations among its citizens and thus make the city more competitive at the Belgian and European level (E. Goffart, interview, June 16, 2021).

The city of **Brussels** joins the vision of Charleroi and Ghent in terms of support. Indeed, as part of the "Plan d'appropriation numérique" of the Brussels Capital Region approved in February 2021, more and more EPNs (Digital Public Spaces) have been developed and are present throughout the city and the region. These spaces not only provide digital tools and an Internet connection but also offer training in the use of these tools and in computing. The EPN label was created in 2019 by the Brussels-Capital region and allows certain places to be officially recognized as EPNs according to precise criteria such as the number of training sessions offered, the presence of qualified staff and helpers, the equipment available, etc. (CIRB & easy.brussels, 2021). The region currently has 18 EPNs spread throughout the territory, including 8 in the city of Brussels (Caban, 2021).

According to several city representatives there is a general belief that the digital divide is mainly generational. However, it is observed that for many young people, even if the use of ICT is more instinctive, undertaking administrative procedures or using other digitalized public services is not so simple.

It is therefore clear that all cities have become aware of the urgent need to train and educate citizens in the use of new technologies. Therefore, as far as training is concerned, all cities offer, in one way or another, training to improve the knowledge and use of new technologies. However, the cities do not always focus on the same public. This is the case, for example, in Liège and Mons. On the one hand, **Liège** offers an introductory course in robotics and automation for children, a more future-oriented approach (Ville de Liège, 2019). On the other hand, in the strategic plan of **Mons**, only the elderly are targeted by the desire to increase the number of training courses in new technologies. Indeed, the city of Mons has set up 5 free ICT training modules and offers information sessions aimed at the elderly called "Ville Amie des aînés". The city also wants to call on young people to help the older generations in the use of digital tools, a vision more turned towards the "past". Mons also proposes to collect digital tools in order to make them available to those who need them most (Ville de Mons, 2019).

ICT sector employment (I_{ICE})

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
10,0	4,9	6,2	0,0	1,9	1,0	1,8	4,9

In terms of **ICT employment**, Brussels has the highest percentage and a slight trend can be seen in the Flemish region, excepted for Bruges. For the Walloon region, one of the themes of the Digital Wallonia programme is digital skills. The « UpSkills Wallonia » programme tries to respond to the shortage of qualified profiles by developing digital skills. However, the project is very recent and will only be tested in the course of 2021, so the impacts and spin-offs will only be visible later (Balancier, 2021). The **Brussels Capital Region** has also established an e-inclusion plan starting in 2021 with targets for 2024. Quite similar to **Charleroi's** ambition, the aim of this plan includes 4 axes, raising the awareness of the Brussels population to the use of digital technology, making the necessary digital tools available, training citizens and accompanying society towards a digital transformation for all. Indeed, according to F. Maingain, alderman for the smart city of the city of **Brussels**, the city has identified a significant number of job opportunities in the digital field which represent a sustainable source of employment for Brussels (F. Maingain, interview, June 29, 2021). Given the high unemployment rate in Brussels, the city's ambition is to develop this economy by creating an ecosystem between digital start-ups and digital training for citizens, in order to give them access to these jobs. Which seems to be working well, given that Brussels is in first place with the highest rate of ICT employment (CIRB & easy.brussels, 2021).

2.2.2. Creativity

As explained before, only the implementation of a participatory budget was taken into account in the calculation of the indicators. This practice is widely used by many cities and in Belgium, all the cities analyzed have set up a participatory budget, the amount and use of which varies from city to city.

Some cities started several years ago. For example, the city of **Antwerp** has been making a budget of 1.4 million euros available to citizens since 2014. Each city also has a different process. In general, there is the same guideline for each city with a multi-stage process consisting of the call for projects, the selection of projects by the citizens, the voting of the citizens on the remaining projects and the implementation of the projects. However, the conditions of participation, the level of involvement of the city and the proposal of basic themes vary from city to city. For example, in **Antwerp** the process takes 2 years and is divided into 5 well-defined steps. The first step is the selection of themes. In the case of Antwerp, the city proposes 8 domains containing a total of 67 pre-selected themes to the citizens who then select the ones they are most interested in and finally select 12 themes. The budget is then divided between these 12 themes, according to the citizens' choice. Step three is the proposal of projects. All citizens can propose projects related to the selected themes, these proposals are then sorted on the basis of coherence with the city's vision and the city's competences to execute the project. The citizens will then be able to select from among the selected projects those that will be implemented with the budget. Every year the city of Antwerp carries out more than a hundred projects. Although new technologies facilitate the organization of participatory budgets, they existed long before their appearance. The city therefore usually organizes offline meetings in all districts of Antwerp, so that citizens can meet and exchange ideas. Besides that, new technologies now allow people who cannot travel to participate online and thus also have an impact on the decision making (Burger Begroting, 2021).

In the case of **Ghent**, the city plays an active role in the decision making and development of the themes. Indeed, the city works together with experts to present the first ideas but also to advise the citizens who submitted a project. In addition, in the final stage, which consists of voting on the projects to be implemented, the citizens' votes are worth 70% of the final score and the city's vote 30%. The weight of the city's decision is therefore important in this case (Vlaanderen, 2018).

Moreover, at the level of Walloon cities, the "Proximity" project has been set up in 2019 with the support of the region. This project proposes a 4-step solution to municipalities in order to raise funds and actively engage citizens in participation with the aim of creating a collaborative ecosystem between municipalities, their citizens, companies and associations towards the goal of ecological and solidarity-based transition. “Proximity” not only allows the organization of meetings between these different actors but also proposes a call for projects to citizens where the proposed and selected projects will benefit from financial support and a one-year accompaniment that will ensure the good development of the project. The project currently involves 9 municipalities, including the city of **Namur**, **Mons** and **Charleroi**. The budgets granted by these three cities vary between 69.000€ for Charleroi and 330.000€ for Namur and were launched in 2020 for Namur and Charleroi and 2021 for Mons, with a budget of 135.000€. For the three cities, the proposed projects must revolve around the themes of the environment, the living environment and social dimensions. For its first year, **Mons** has received in June 2021 about thirty project proposals and is currently selecting the selected projects. In 2020, with a previously lower budget of €50,000, **Charleroi** implemented 6 citizen projects, while in **Namur**, the city received 79 project proposals and selected 64 of them, which were submitted to more than 17,000 votes and selected 22 projects that will be implemented. The difference in the number of projects selected can be explained by the significant difference in the budget allocated by the cities. **Namur** has a much higher budget and is able to carry out more projects. Moreover, the conditions are not the same in each city, for example in **Charleroi** each project can receive a maximum of 10.000€, for **Mons** the budget is divided between projects below 5.000€ and those above. The city of **Namur** allocates the budget according to the expenses, whether they are ordinary or extraordinary, which are defined by experts within the municipal administration. When the projects are voted, the budget of each envelope (ordinary and extraordinary) is distributed between the projects in order to use the whole amount, but no maximum budget per project is mentioned, so it is possible that some projects are not finally retained if the budget is not sufficient (Proximity, n.d.).

As for the city of **Liège**, it is not part of the "Proximity" project but the city declares in its 2025 strategic plan to release a participatory budget of one million euros. However, nothing is mentioned about the previous or current use of this budget. The city has put in place calls for projects, notably via the "Réinventons Liege" platform, but no budget is mentioned. For this reason, due to lack of information and confirmation from the city, we have assigned a zero score to the city of Liege (Ville de Liège, 2019).

The city of **Brussels** adopts a slightly different approach which is built up in 6 stages. These six stages also include the stages adopted by other cities, such as the call for projects, the citizens' vote and the final decision. However, following the call for projects, the city organizes the "Festival des Projets". For one day, the ideas selected by the jury are presented and submitted to co-creation workshops between the representative of the idea and the concerned representatives of the city in order to assess the feasibility and relevance of the selected projects. This stage also allows for the improvement of the project proposals before they are submitted to the citizens' vote (Ville de Bruxelles, n.d.).

As for the lab, some cities have developed initiatives, notably the cities of Liège, Namur and Brussels. The city of **Namur** has set up "Le Nid", a co-creation place that will allow, from September 2021, to involve citizens and other actors of the city in a collaboration towards a more sustainable and intelligent city (Ville de Namur, 2020). In 2016, the city of **Liège** organized the first "Labville" meeting. This city laboratory was born in 2014 with the primary aim of facilitating exchanges between the city and the University of Liège on different themes such as urban planning and social and territorial development and also plans to engage citizens by encouraging the proposal of initiatives and cooperation (Ville de Liège, 2017). These two cities therefore offer living labs, which are part of these hybrid places offering new working and collaboration methods where innovation is at the center of the discussion. Among these places, we also find the FabLab, a place that provides people with the necessary tools to make and design innovative tools or projects. Collaboration is also a priority here, but more focused on sharing manual and manufacturing knowledge. **All cities** we analyze have a FabLab, often in partnership with universities, are making tools such as 3D printers, digital milling machines or laser cutters available to citizens and businesses to enable everyone to bring their projects to life.

2.3. Democracy and governance

2.3.1. Citizens' participation

Voter turnout (I_{VT})

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
4,9	6,8	10,0	2,2	0,5	9,2	0,0	2,2

Collaborative platform (I_{CP})

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
YES	NO	YES	NO	YES	YES	NO	NO

With regard to the indirect participation of citizens, it can be seen that the Walloon municipalities show a low score compared to the Flemish municipalities and Brussels. Regarding direct citizens' participation, most of the time all cities recognized the positive impact of ICT in increasing and supporting citizens' participation. However, not all of them implemented a collaborative platform, which, as we explain in the literature review, is one of the most studied and widespread participatory tools in smart cities because it allows a direct dialogue between the citizen and the city. It is also important to mention that cities underlined the use ICT is only seen as a support for citizen participation and not as a substitute tool. Some cities are at the beginning, like the city of **Brussels,** which is launching its platform, others are actively using their platform, like the city of **Liège** which has already had around 983 project proposals or the city of **Ghent** with more than 234 proposals.

If we look at the relationship between participation rates and the presence of a collaborative platform, to see if it would influence citizen engagement, it is interesting to note that no clear correlation emerges. Indeed, although we can observe a slight tendency that cities with a high participation rate are often cities that have a collaborative platform in place, and this can be explained by the fact that the presence of a platform allows citizens to get involved and increases the sense of belonging and therefore the commitment of citizens, this statement does not emerge for all cities. It is also interesting to note that for cities with a platform, the number of projects submitted is not representative of the participation rate. On the one hand, the city of **Liège** has the highest number of projects submitted but the second lowest participation rate. On the other hand, **Bruges** has one of the highest participation rates and yet the city mentions that between 2017 and today, no major projects have been proposed. However, the city has implemented many initiatives such as the 'neighborhood tour' organized in 2019 where the mayor and aldermen met with citizens in 24 neighborhood to find out more about their needs and ideas, which could explain the higher participation rate (De toekomst van Brugge, 2020).

Another interesting city to look at is **Antwerp**. After Ghent and Bruges, both of which have a participatory platform, Antwerp has a relatively high participation rate. However, the city does not have a participatory platform and this is a well-considered choice. When implementing a participatory platform, the city becomes co-responsible for the projects. According to R. Stoop,

head of department for strategic coordination of the city of Antwerp, the risk is that by giving too much freedom to citizens to identify problems and propose potential solutions, the city has to hold itself accountable for being able to respond to these needs and implement these projects, which may not always be the case. As a result, there is a risk of loss of government credibility and citizen confidence. The city of Antwerp is therefore in the middle of the road: on the one hand the desire to involve citizens more, on the other hand the fear of putting too much pressure on the citizens and not responding properly to their expectations. This is why the city is not a fan of collaborative platforms and prefers to take a top-down approach when it comes to implementing projects related to new technologies (R. Stoop, interview, July 01, 2021). It could be said that, on the contrary of Liège, Brussels or Bruges, Antwerp limits citizens' participation to a consultative level. The government keeps control on the implementation and decision but there is also a consultation part where the city distributes surveys to better understand citizens' needs and appreciation and then built project proposal on what they identified through these surveys.

Although B. Rosseau, head of the data information unit of the Ghent City Council, agrees to the fact that care should be taken when including citizens in this participation process, Ghent has already implemented many participatory tools such as a participatory platform, a participatory budget, a living lab and crowdsourcing. However, B. Rosseau says that the city is well aware that these will never replace "traditional" face-to-face participation. According to him, it is simply a matter of using and taking advantage of what is available and appropriate, depending on the context (B. Rosseau, interview, July 6, 2021).

Other cities, like **Charleroi**, have not yet implemented a collaborative platform. Although this is in Charleroi's future plans, the city has decided to first make sure of the return on investment and according to E. Goffart, this would be done through education (E. Goffart, interview, June 16, 2021). Charleroi wants all citizens to have the knowledge and training to actively use this platform once it is launched. On the contrary, the city of **Liège** is already active with its participatory platform "Reinventons Liège". Through this initiative the city allowed its citizens to submit project ideas for 100 days. The process took place in three phases, first a call for projects, followed by a vote and a selection of priority projects. Out of 983 proposed projects, the city selected 77 priority actions divided into 7 themes (Ville de Liège, n.d.-a).

Challenges

Several challenges were identified by the cities. According to R. Stoop, for **Antwerp** the two main challenges are, firstly, the difficulty of identifying and implementing the right projects. This was the case, for example, of an experimental smart lighting project that was not very effective because it was not appreciated by the citizens. Secondly, the size of the city also plays a role (R. Stoop, interview, July 01, 2021). The larger the city, the more difficult it is to involve all citizens. F. Maingain, for the city of **Brussels,** also emphasizes the difficulty of having a participatory audience that is representative of the population. It was found that it is often the groups with the highest socio-economic incomes that actively participate in decision-making, leaving a large proportion of citizens unrepresented and not taking into account the interests of the whole population (F. Maingain, interview, June 29, 2021). B. Rosseau, for the city of **Ghent**, also mentions this gap within the different social-economic groups and says that in his opinion digital will not be able to remedy it but it is a question of reaching out to these marginalized publics and including them directly in participation. Furthermore, although digital is not seen as a fully complete solution, there are many advantages to supporting participation via digital, while being careful not to create an additional barrier for some people (B. Rosseau, interview, July 6, 2021). In general, the ideal objective of the cities remains the use of a maximum of different channels, including this digital one, to reach all the citizens and try to have the widest possible participation by trying to take into account all the citizens.

Another challenge mentioned by several cities is the capacity to participate. Both in terms of knowledge and digital media. E. Goffart, for **Charleroi,** rather talks about the lack of training of citizens, who do not have the necessary knowledge to use this platform in an optimal way (E. Goffart, interview, June 16, 2021), and F. Maingain, for **Brussels**, rather talks about the lack of material capacity, such as access to an internet or to devices (smartphones, computers) (F. Maingain, interview, June 29, 2021).

Other tools

Obviously, as mentioned before, although we focus here on collaborative platforms, other participatory tools exist. Some cities have implemented them. For example, several years ago, the city of **Ghent** set up a crowdsourcing platform called "My digital idea for Ghent". However, according to B. Rosseau, none of the projects implemented by the city come from this crowdsourcing. So there is no real use for the city of Ghent to implement projects directly.

However, the city uses this tool to see which projects get the most attention and in a way it allows them to see the priorities given by the citizens (B. Rosseau, interview, July 6, 2021). The city of **Bruges** has developed a gamification system, which consists of involving citizens through playful elements linked to real situations. In this case, the application encouraged citizens to use low-polluting means of transport for their journey to school or the office and to invite their friends or colleagues to do the same. This creates a fun environment, while providing real solutions.

2.3.2. Open governance

Datasets available (I_{DS})

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
10	8,6	2,2	0,0	0,9	1,7	0,4	3,1

When it comes to open data, all cities acknowledge the importance and many benefits of sharing data. However, as we can see with the scores, some cities share more data than others. Moreover, the cities of **Charleroi** and **Mons** share the least data and are also the only two that do not have a city-specific Open Data platform. Indeed, Charleroi and Mons datasets are available on the ODBW (Open Data Brussels Wallonia). **Brussels** and **Antwerp** are the cities that share the most data on their platforms. With just over 500 datasets each they are far ahead of the third city, Namur, which shares just under 200 datasets.

Currently, the data shared by the city of **Brussels** is data generated by the city's smart city unit. According to F. Maingain, the current challenge is to automate the sharing of data in order to make the current platform a goldmine that can be exploited by all the city's actors (F. Maingain, interview, June 29, 2021). In addition, the open data platform offers many possibilities, different ways to visualize the data, it is possible to download the data in different formats and the platform offers services that facilitate the creation of smartphone applications from the data.. After the city of Brussels, the city of **Antwerp** publishes the second largest amount of data with the same possibilities as the Brussels platform. On the contrary, the city of **Bruges** publishes a relatively large offer of datasets but uses a different platform than the other cities. Indeed, in general, the platforms of all cities, with the exception of Antwerp and Bruges, have the same structure. However, the Bruges platform is not very convenient to use because the data is not as well explained as on the other platforms, nor is it represented in different formats, such as tables or a map, which makes it not very intuitive to use. For the city of **Ghent**, according to B.

Rosseau, mobility is a priority, so most of the data shared on the open data portal is related to mobility (B. Rosseau, interview, July 6, 2021).

On the other hand, the city of **Charleroi** does not yet have its own platform, but there is currently a discussion to set up a global open data strategy. Moreover, according to E. Goffart the low number of published data (5 datasets are currently accessible on the ODBW) can be explained by the fact that the city is very cautious and does not want to publish data that do not make sense. The city takes a close look at the reliability of the data and the purpose and relevance behind the publication of the data (E. Goffart, interview, June 16, 2021). This reluctance on the part of the city of Charleroi does not come from nowhere because, as identified in the smart city institute report, one of the generally identified obstacles to the use of open data is the risk that the data will not be used due to a lack of interest or usefulness, which also results in a loss of time for the city (Nguyen et al., 2018).

The city of **Namur** already puts a large amount of data online and aims to further expand the number of accessible datasets in order to facilitate further interaction between the city and its citizens (Ville de Namur, 2019).

2.3.3. Administration

In terms of e-administration, it is noted that all cities have an e-guichet available for citizens to facilitate their administrative procedures. The e-guichet proved to be an essential tool during the COVID-19 pandemic.

According to the 2020 Digital Inclusion Barometer, the use of e-government is similar in the three Belgian regions and amounts to about 64%. However, large inequalities in terms of income and education level are noticed in relation to the use of e-government services. For the level of education, among the population with a high level of education, 78% use e-government against only 33% for those with a low level of education. For income, 74% of high-income individuals use e-government compared to 44% of low-income individuals (Brotcorne et al., 2020).

One of the main reasons is the lack of awareness of the complexity of administrative procedures. Indeed, many cities note that digital skills are not always as high as one might expect. Many people can manage with simple use of technology, but not all of them are able to complete

administrative procedures online. Beyond the digitization of the administration, there is therefore a great deal of work to be done to avoid entering a digital world where only people capable of using online tools can benefit from the services made available (Brotcorne et al., 2020).

This was the case in **Antwerp**, for example. Indeed, according to R. Stoop, for the last 10-15 years the city has been busy with the digitalization of their administration, with the positive result that today there is no more paper in Antwerp, everything is digitalized. Although this was very beneficial during the COVID-19 pandemic, the city has recently realized the inequalities generated by this digitalization. That is why the city elected a new chief digital officer a year ago and instead of focusing on digitalization, the city is now focusing on the citizen and making the administration easier to use (R. Stoop, interview, July 01, 2021).

2.4. Quality-of-Life

2.4.1. Safety

Street safety & Road safety ($(I_{SS}+I_{RS})/2$)

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
3,4	9,2	8,2	6,1	5,3	8,3	4,1	7,3

Again, a trend can be observed in the cities of the Flemish region, which are the three cities with the highest score, implying that these are the cities with the lowest numbers of crime and road fatalities, in proportion to the number of inhabitant.

All cities state in their PST that they want to become safer cities and keep their citizens safe. The city of **Liège** has 221 safety-related projects, mainly aimed at improving road safety and increasing police presence in the city's neighborhoods. Projects range from establishing a pedestrian zone in the city's center, to introducing a 30km/h zone in as many neighborhoods as possible by 2025, to creating a road safety cell, to installing intelligent surveillance cameras, etc. (Ville de Liège, 2019). The city of **Charleroi** plans to integrate more road safety awareness in the teaching, in partnership with the police, as well as the reinforcement of the 30km/h zones, etc. (Ville de Charleroi, 2019).

Regarding the exchange of information between the city and the security services, the indicator was not included in the final calculation due to the lack of information provided by the police

cells of the municipalities. However, some points are worth mentioning. Firstly, only two of the cities reported actually exchanging information between the police and the city for its own use (smart city, low emission zone, etc.). The region of **Brussels** has set up a regional platform for video protection that allows the sharing of information from the different surveillance cameras to the concerned actors. Thus, these images benefit all actors, and allows a more efficient use of data that contributes to the well-being of Brussels citizens (CIRB, 2015). Also for the city of **Antwerp**, the cameras are used by the police but some are also used by the city for certain information related to the competences of the city such as low emission zones or in the framework of the smart city (Antwerp local police, e-mail, July 07, 2021) . As for the city of **Bruges**, the data from the surveillance cameras are shared with the police zones of other municipalities, such as **Ghent**, but the data are not shared with the city (Duyck L., e-mail, July 08, 2021

As for the cities of Liège, Charleroi, Mons and Namur, no data is exchanged between the police and the city, although this is in their future ambitions.

Smart lighting

In terms of smart lighting projects, as explained above, the correlation between sufficient street lighting and safety is not proven. However, it is interesting to see that, although the objectives are different, all cities have implemented a smart lighting project. Some cities are only doing it with a mainly ecological objective, with the replacement of streetlights by LED lamps which consume less energy, others are adding sensors in these same streetlights in order to make a more smart and global use of them.

In **Brussels**, the intelligent management of public lighting is managed by the region, which wishes to position itself at the forefront of this technology. In partnership with Sibelga, the region has decided to replace and install a total of 12,000 intelligent public lighting systems by the end of 2021 and a total of 25% of the lighting stock will be intelligent by 2023. The main aim of this approach is to reduce energy consumption by 20% and to reduce CO2 production by 2035 (Brussels Smart City, 2021). In addition, Sibelga also states various advantages that have a direct impact on the quality of life of citizens, such as the reduction in the intensity of lights placed near homes and an increase in the feeling of safety thanks to better lit streets. In addition, the intelligent sensors allow problems (e.g. breakdowns) to be reported in real time,

which allows for rapid intervention (Sibelga, 2020). Sibelga has also carried out a test of intelligent lighting between February and April 2021 in the “Bois de la Cambre”, a key entrance to Brussels, which generates a lot of car and pedestrian traffic. This experiment showed that intelligent lighting placed at strategic locations (e.g. where traffic is variable) allows energy savings while ensuring comfort and a feeling of security for citizens (Sibelga, 2021).

At the level of the **Walloon region**, the Walloon Governmental Decree of 14 September 2017 indicates the switch to LEDs for communal public lighting. The financing of the replacement of the 585,000 light points will not be at the expense of the communes and will be done over a period of 10 years from 2020. It is therefore not possible to see any return on investment yet, but this work will result in lower energy consumption and the replacement of luminaires with more efficient technology (Gouvernement Wallon, 2017). As of 30 June 2021, for the municipalities managed by the public lighting operator ORES, 14.3% of **Charleroi's** public lighting had been replaced by LED lighting and the municipality plans to reach 28.7% by the end of 2022, **Namur** is more advanced with 41.3% of the luminaires replaced and a target of 74.3% by the end of 2022. **Mons** is between the two with 28.9% of LED lighting installed and 48.7% planned by the end of 2022 (ORES, 2021). As for the city of **Liège**, the province is managed by the public operator RESA, which has set itself the objective of replacing the entire public lighting stock in 6 years, instead of the 10 years indicated in the government decree (Resa, 2021).

Other projects are underway or have been completed by the municipalities. For example, the intelligent lighting equipment of the citadel of **Namur**, work finished in May 2020. In addition to reducing energy consumption, this project aims to increase safety on the paths leading to the citadel as well as to increase the usefulness of the luminaires equipped with smart technology such as sensors, allowing the intensity of lighting to be reduced in case of low passage, meters and cameras (Le Nid, 2021).

The **Flemish government** is also investing in sustainable lighting on regional roads by 2024, with the replacement of 75,000 LED points. Other financial support is also granted if it concerns investment in energy saving (Vlaanderen, n.d.). Besides that, Flemish cities have also developed other smart lighting projects, including the city of **Antwerp**. The city has realized a smart lighting project in the Antwerp smart zone. The project, which aimed to increase the safety and amenity of the city, consisted of equipping a crossroads and a basketball court with

smart lighting in order to illuminate them only when they were used. These smart lights were also equipped with pollution and noise sensors and smart cameras. This allowed for certain actions such as, when the cameras detected a pedestrian, the lighting was turned on to maximum brightness, when the weather sensors predicted bad weather, the lighting was turned on to allow for better visibility, etc. A project that took up many of the ambitions of the use of intelligent lighting, including the ambition expressed by the Brussels region for the coming years (Van Batenburg, n.d.). However, according to R. Stoop, the project was not so well received by the citizens, who found the lighting variation disturbing (R. Stoop, interview, July 01, 2021). This once again proves the need to take into account the expectations of citizens and to work with them.

2.4.2. Health

Health efficiency (I_{HE})

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
5,2	2,3	8,5	2,0	1,6	10,00	0,0	3,9

Accessibility to care is an obvious issue for the cities and it is essential that the city has a sufficient number of doctors to ensure the continuity of primary care for which general practitioner (GP) are one of the main actors. In the OECD report on the performance of health systems, one indicator is the number of doctors per 1000 inhabitants. It can be seen that since 2000 there has been an increase in the number of doctors in all OECD countries. However, the report indicates that the number of doctors has not increased in some countries, notably Belgium. Not only does Belgium have a lower number of doctors per 1000 inhabitants than the OECD average, but also the number of doctors per 1000 inhabitants in Belgium has only increased from 2.8 to 3.1 between 2000 and 2017. To summarize, in 2017 the average number of practicing doctors per 1000 inhabitants was 3.1 in Belgium and 3.5 for the OECD average (ranging from 0.3 to 6.1) However, this report includes all doctors, including all those who are licensed to practice, i.e. also those who do not practice or no longer practice and also people practicing in the health field (researcher, professor, etc.), which overestimates the results (OECD, 2019a). If we look only at the number of general practitioners, we speak of a shortage when there are less than 0,9 doctors per 1000 inhabitants (Missinne & Luyten, 2018). The table below shows the number of GPs per 1000 inhabitants for each commune.

Number of GP per 1000 inhabitants

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
1,19	0,96	1,45	0,94	0,91	1,57	0,78	1,09

As we can see, the cities of **Bruges** and **Ghent** are the two cities with the higher supply of GP. Although few of the cities presented are considered to be in shortage, most cities in the Walloon region are close to it. Indeed, **Namur** is the only Walloon city to have more than one (1.09) GP per 1000 inhabitants. Most of Belgian cities are at risk of a shortage and some actions have been taken. For instance, since 2006, the regions, both Wallonia-Brussels and Flanders, have put in place a series of financial measures (bonuses, subsidies, etc.) called IMPULSEO, to encourage the practice of GP and to encourage them to settle in areas of shortage in order to ensure a good access to health care in Belgium (Van Roy et al., 2017). Since the 6th state reform in 2014, this competence is assigned to the federal states, which would explains why in the strategic plans of the cities there is no action regarding the increase or training of more GPs (INAMI, 2017)

2.5. Well-being

2.5.1. Housing

Housing affordability (I_{HA})

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
4,6	4,9	10,0	5,7	0,0	1,8	1,7	0,7

Housing quality (I_{HQ})

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
3,5	5,3	7,0	0,3	0,0	10,0	4,2	8,6

In terms of SDG 11.1, the share of the population living in inadequate housing, i.e., housing with leaks, damp foundations or rotting windows and floors, varies between regions. The percentages are as follows: 24.7% for the Brussels region, 20.1% for the Walloon region and 13.4% in the Flemish region (BFP, 2003-2020). There is a significant difference between Flanders and the other two regions. As we do not have this data at the level of the municipalities, we will analyze below the different housing plans put in place in the cities.

In terms of social housing provision, almost all cities state in their strategic plan that they wish to become an inclusive and sustainable city by promoting access to quality housing that is accessible to all. Objective number 4 of the city of **Charleroi** concerns the promotion of and

access to quality housing for all, with the aim of improving the quality of life and energy consumption. Indeed, given that around 84% of housings were built before 1970 and more than 71% of housings in the city center were built before 1945, housing is ageing and consumes a lot of energy. Moreover, housing construction is not high, 10 dwellings per 10,000 inhabitants in 2014 and 2015, which means that the current accessible housings are very old (Ville de Charleroi, 2019). According to the PAEDC (Plan d'Actions en faveur de l'Énergie Durable et du Climat) of Charleroi, the sector that emits the most CO2 is housing, with 37% of the emissions in 2006, which is explained by the high population density and the age of the buildings (Botman & Deconinck, 2017). The city has also mentioned in its PAECD a showcase project for the renovation and construction of low-energy housing, however, no report has been made on the progress of this project which is due to take place between March 2018 and December 2021.

With regard to energy consumption, the city of **Namur** is also planning, from 2022, a budget of €65,000 per year to renovate buildings occupied by people in precarious situations, which is not much compared to other budget allocated by the city in its PST and also compared, for instance, to the citizens budget of 330.000€ (Ville de Namur, 2019).

For **Liège**, priority action number 10 of its strategic plan mentions "Promoting access to housing for all". In order to make housing more accessible, Liège's plan is to join forces with the AIS (Agence Immobilière Sociale) to convince private owners to rent out their homes and then rent them out at more accessible prices. Indeed, Liege is the city that offers the least possibilities in terms of social housing with only 6.15 social housing units per 100 households (Ville de Liège, 2019).

Mons is the third city, after Liège and Namur, with the lowest supply of social housing. However, the seventh strategic objective states that Mons wants to be a city that promotes quality housing for all. With 24 priority actions for this objective, Mons wants to increase its supply of social housing for the vulnerable public by 2024 (Ville de Mons, 2019).

For **Brussels**, in view of the demographic growth and the ageing of the buildings, around 78% of housings were built before 1970, housing is the second most important concern after unemployment. Indeed, the city is experiencing an exodus of households, due to the price of housing, which has been rising steadily since 1990. As a result, the city is committed to

increasing the number of housing units and renovating existing buildings to provide quality housing. Indeed, the City of Brussels, together with its CPAS (Centre Public d'Action Sociale), has decided to establish the "Plan logement 2019-2024". The objective of this plan is to build approximately 296 housing units, mainly meeting the specific needs of a precarious public (people on low incomes, single women, elderly people, etc.) as well as an environmental emergency (low energy consumption housing, etc.). A global budget of 57.660.000€ is planned and the works will start in 2022 (CPAS, 2019).

At the level of the **Flemish region**, the BSO (Bijzonder sociaal objectief) was introduced in 2009, which is a binding objective assigned to each Flemish municipality in order to increase the supply of social housing between 2009 and 2025. The target is imposed by the region and then it is up to the municipality to implement the necessary actions to reach this target. When the municipality commits itself to reach this target, the Flemish Region commits itself to finance the social housing (Wonen Vlaanderen, n.d.).

The city of **Ghent** is quite high in the ranking with the highest supply of social housing. Indeed, in Flanders, Ghent is the second municipality, after Genk, with the highest percentage of social housing. With around 11% of social housing, the social housing offer is almost the double of the average in Flanders. However, the percentage of housing built before 1970 amounts for 70% and indeed, about 51% of private rental housing does not comply with the Flemish Housing Code (VMSW, 2021). Social housing in Ghent is not new and only one third is considered to be of 'good quality', which means that a large proportion should be replaced or renovated. Moreover, demand far exceeds supply and at the time of the last report there were 7,800 households waiting for social housing. In its 2030 plan, the city of Ghent commits itself to building 11,000 new housing units, some of which will be affordable housing (social housing and others) to meet the demand of the population in precarious situations (Stad Gent, 2018).

The city of **Bruges** has, compared to other cities, a lower rate of buildings dating from before 1970. In fact, according to the city's action plan, the fight against dilapidated buildings is a priority. Moreover, the city wishes to encourage its students to stay in Bruges. In order to do so, the city has set up several actions, such as the development of "housing quality labels" for student housing or allowing students to occupy student housing for up to three years after their studies. Regarding the BSO, the target for Bruges was 861 additional social housing units and in 2017 Bruges achieved a total supply of 1070 social housing units, i.e., 209 additional units

to the target. According to the BSO, cities that have reached their target can enter into an agreement with the Flemish Region to provide additional housing. The city therefore plans to build 700 additional housing units and intends to conclude the agreement with the Flemish Region to finance part of this project (Damen et al., 2021).

Furthermore, an interesting point to raise is that the city of **Charleroi** has a large number of precarious neighborhoods, with very old and uncomfortable housing, poor environmental quality and a high rate of unoccupied buildings. E. Goffart, is the Alderman for digital development but also the Alderman for public works, states that many urban projects need to be undertaken before investing in smart projects, using new technologies (E. Goffart, interview, June 16, 2021).

2.5.2. Air quality

Concentration of $PM_{2.5}$ (I_{PM})

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
0,0	2,9	4,3	8,6	10,0	5,7	8,6	8,6

The average annual mean of $PM_{2.5}$ in 2020 in Belgium was 12,7 µg/m^{-3} while the air quality standards for protecting health set by WHO said that it should not exceed 10 µg/m^{-3} per year (European Environment Agency [EEA], 2020). According to the data collected by the ISSeP (Institut scientific du service public),Brussels environment and VM (Vlaamse Milieumaatschappij), all cities except Liege have a value greater than or equal to 10 µg/m^{-3} per year. Another way to look at air quality would be to look at the air quality index for each city referenced on the "World Air Quality Index" website which uses official data issued by each country's Environmental Protection Agency (EPA) using professional monitoring equipment in over 132 countries. By looking at this index the ranking could be different. However, the data referenced are daily. As air quality is highly dependent on meteorological conditions, it is not useful to take daily data, which will not be representative of the annual average air quality.

Regarding the implementation of air quality monitoring system, it appears that only three cities implemented or clearly mentioned a plan to implement something in the years to come. Compared to the established ranking, Brussels and Antwerp are respectively in last and before last position, which explains with the fact that these two cities have put in place actions to improve air quality. In June 2020, the city of **Antwerp** declared being part of the European

‘sensEURcity’ project, which is a project implemented in three cities : Antwerp, Oslo and Zagreb, which aim at understanding and solving the gap between the use of cheap sensor systems and the reliability of data collected. As part of this project, additional air quality sensors will be installed in different locations in Antwerp. However, due to the recent nature of the project, the number of sensors and actual impact are still unknown (Van Poppel, 2020).

In **Brussels**, a group of citizens created InfluencAir, which is a collaboration of citizens aiming at measuring and mapping air pollution levels in the city of Brussels by building a cheap and reliable sensor network hosted by participating citizens and organizations. However, even though the affordability of sensors have been proven, the reliability of measurements is still checked and not proven yet (InfluencAir, n.d.). Another initiative, Curieuzenair, was recently carried out in **Brussels-Capital region** to measure the concentration of nitrogen dioxide (NO2), mainly emitted by vehicles, and thus mapping air pollution at more than 3000 sites in the region. The final aim is to provide the region with data to optimize the control and solutions implemented with regard to air quality (Bruckner, 2021).

Although behind the Walloon region, for the Flemish region, **Bruges** ranks first in terms of air quality and this is to be expected as the city has been paying special attention to air quality since 2006. The city has taken various measures to limit the emission of fine particles, such as equipping public buses with particle filters, avoiding the passage of buses through the city center, investing in the city's bicycle policy and finally, since 2008, the city Lab has been measuring PM10 and PM2.5 particle emissions. To date, around 60 sites have been examined, which has enabled the city to considerably improve the air quality and to establish that all sites comply with the European directive with regard to particle levels. Besides, the city also developed a solution to measure ultra-fine dust, which can be very hazardous for the health. In March 2021, the city called for volunteers to ride the measuring bikes. These volunteers will have to ride their bikes around the city to allow the bike to collect data on particle emissions. This has already allowed the city to detect certain areas with strong level of pollution, especially in the city center, mainly due to traffic (Stad Brugge, 2017). Several projects concerning air quality and the placement of sensors have been proposed on the participatory platform of the city of **Liège**, but none of them presents a launch date or a progress situation beyond the project proposal.

2.5.3. Green infrastructure

Green infrastructure (I_{GI})

Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
6,0	9,2	0,0	2,4	4,9	10,0	6,7	8,8

According to the OECD "Better life Index", in 2012 , around 93% of the population in European countries have access to green spaces such as parks, forest or other green areas in a distance of 10 minute's walking from home. Belgium is slightly over the European average and ranks quite high with an average score of 94,9%. However, the accessibility to more green spaces remains a priority for cities. Moreover, great inequalities can be perceived in the distribution of these green spaces. Indeed, in some cities, some neighborhoods will benefit from several green spaces, allowing the population easy access to them, while others will have none in their vicinity (OECD, 2020).

This is the case, for example, in **Charleroi** where the lack of green spaces was mentioned as one of the obstacles to living in Charleroi. Indeed, the accessibility to green space is not evenly distributed over the territory and the main parks are mainly present in the south of the city. Only 22 districts out of 55, i.e., less than half, have good access to a green space (Ville de Charleroi, 2020b). The objective four of the Charleroi's strategic plan focuses on increasing the presence of green space in the city. One of the priority actions includes the development of a network of green spaces in order to allow all inhabitants to benefit from a green space close to their home (approximately 500 meters) (Ville de Charleroi, 2019).

This is also the case for the city of **Liege**. Although the city has a number of green spaces, three quarters of them are located in the Sart-Tilman domain. As a result, there is little green space left in the rest of the city. This is why the city of Liège has decided to establish an action plan in 17 districts of the city in order to improve the quality of life of the inhabitants. This plan includes four main actions involving the improvement of existing spaces, the creation of new spaces as well as new accesses to the existing spaces and finally ensuring that these spaces are accessible by "soft" means of transport, i.e., by bicycle, on foot, etc. (Ville de Liège, n.d.-b).

The city of **Ghent** scores the lowest with only 10% of green infrastructure. Again, green spaces are not evenly distributed across the neighborhoods. On the one hand, the city of Ghent has five large green poles of more than 100 hectares, but although these are almost in every corner of the city, they are only on the outskirts of the city (Stad Gent, 2014). In 2015, a neighborhood

park within 400 meters was accessible to 42% of the population and the spaces in the cities were considered too small in relation to the number of inhabitants (Stad Gent, 2018). Furthermore, according to a study conducted by the city on the satisfaction of residents with the proximity of green spaces, the results differ between neighborhoods, with residents of central neighborhoods being more satisfied than residents of non-central neighborhoods. Besides, due to the lack of green spaces, the city has experienced significant heat waves, which are supposed to decrease due to the presence of green spaces. The city of Ghent has set up a green action plan with a long-term vision and objectives for 2030. The city wants to create an interconnected network of green spaces, including parks and forests that are of high quality, have enough space for the inhabitants ($100m^2$ per inhabitant for the major centers and $10m^2$ for the neighborhood parks) and are sufficiently accessible (accessible at less than 5 km for the major centers and less than 400 meters for the neighborhood parks) (Stad Gent, n.d.).

This desire to create a connected network of green spaces has been realized by the city of **Bruges**. Indeed, all urban parks and gardens are connected by safe green corridors, which are also equipped with playground equipment in order to create a real green network through the city. Another initiative taken by the city is to privilege underground parking in order to favor outdoor locations for the construction of parcs (Stad Brugge, 2019).

To sum up, as we can see from the figure 6, the large cities (>200,000 inhabitants) have quite low scores regarding environmental quality, combining I_{AQ} (air quality) and I_{GI} (green infrastructure). Among the small and medium-sized cities, we can see that the most populated of them (>150,000 inhabitants), i.e., Brussels and Liege, also score low. Therefore, we might say that there is a correlation between the number of inhabitants within a city and the impact it has on environmental quality. In this case, the fewer inhabitants a city has, the better the environmental quality.

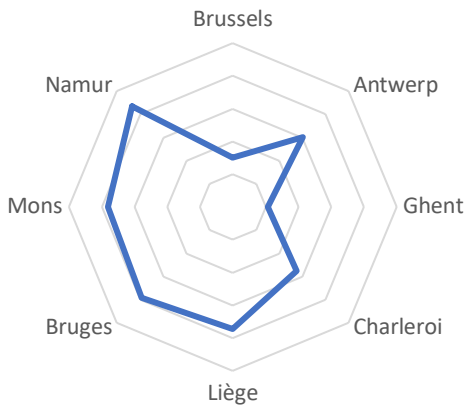
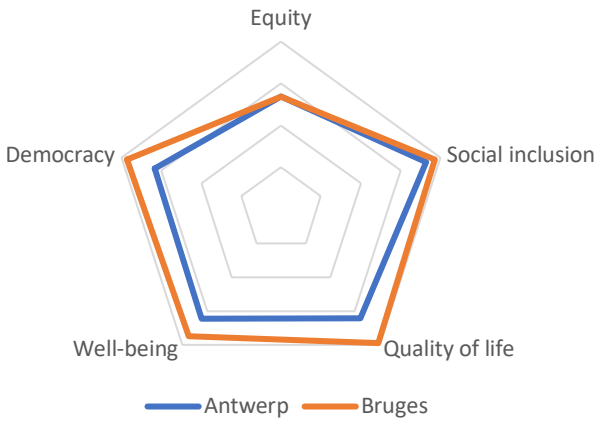


Figure 6 : Environmental quality ($(I_{AQ}+I_{GI})/2$)

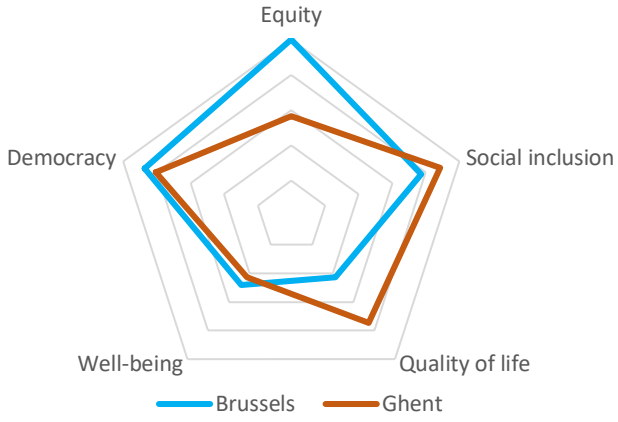
3. Conclusion part II

Finally, we will use radar diagrams to identify the strengths and weaknesses that make up the scores of each city, as well as to facilitate the interpretation of the indicators.

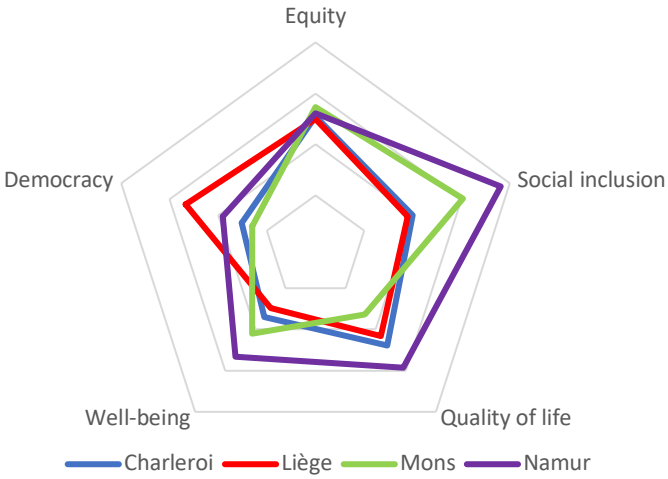
At the city level, we can see that the cities of **Antwerp** and **Bruges** do not have any scores below or equal to 5 and show fairly consistent performance in all dimensions. However, the city of Antwerp only ranks fourth in terms of overall scores. This can be explained by the fact that although the city scores consistently in all categories, the scores are almost never higher than 6, except for the social inclusion score.



On the other hand, the city of **Brussels** has a fairly high overall score but has low scores (>5) in two dimensions, namely quality of life and well-being, compensated by a high score in equity and democracy, which allows it to be ranked in second place. This is also the case for **Ghent**, which scores relatively low in terms of well-being and equity but compensates for this by performing well in other areas.



Finally, the municipalities in the Walloon region all have an overall score below 5, except for **Namur** which has a slightly higher score (5.52) and only scores low in one category, democracy. The other cities, namely **Mons**, **Liège** and **Charleroi**, show low performance in 3 of the 5 dimensions. All of them score higher than five in the equity dimension, which is largely supported by the region through the digital Wallonia programme.



It is also interesting to look at the scores obtained in matrix form, in order to have a better representation of the performance of each city in the different dimensions. The table 6 shows in red the scores strictly below 5, in yellow the scores between 5 and 7 and in green the scores higher or equal to 7. At the dimensional level, the dimension of well-being has the lowest scores, with five out of eight cities scoring below 5, while the dimension of social inclusion has the highest number of high scores, with five out of eight cities scoring above 7. The matrix also clearly shows that Flemish municipalities perform well on average in all dimensions, unlike Walloon municipalities.

	Equity	Social inclusion	Quality of life	Well-being	Democracy
Brussels					
Antwerp					
Ghent					
Charleroi					
Liège					
Bruges					
Mons					
Namur					

Table 6 : Matrix of the overall scores for each dimension

4. General conclusion

In conclusion, it is certain that Belgian cities have begun the transition to more intelligent and sustainable cities. Numerous projects are being expressed and others are already being implemented, as can be seen from the cross-cutting strategic programmes set up by the cities. However, the current lack of means to measure and evaluate the real impact and spin-off of these projects does not allow us to affirm that the cities of tomorrow will be as inclusive and supportive as they hope to be. Indeed, while the ambitions of the cities are reflected in their TSPs, which include interesting and original ideas, the lack of data and evidence is a major weakness of the cities' strategies.

Moreover, although cities are increasingly willing to undertake smart city initiatives, the lack of skills is a brake on the concrete implementation of this phenomenon, which is sometimes still vague and misunderstood. One of the major challenges therefore seems to be to ensure that all the city's actors have the necessary skills to follow this transition. There seems to be a growing awareness among cities that the smart city is more about a profound and sustainable societal transition and not just about putting in place a few gadgets or applications that will quickly become obsolete.

This is also reflected in the intention of cities to increase and facilitate interaction with citizens. The cities are aware that in order to tackle the challenges of tomorrow, all actors must be involved, and especially the citizens, a key player in the territory. However, the difficulty of addressing these actors and including all groups, even marginalized ones, is a problem for all cities without exception. The desire to become a territory where collaboration is at the center of decision-making is not lacking, but the implementation does not seem to be easy. Another obstacle is the lack of budget. Projects developed with little impact and little evidence of return on investment make cities wary of investing a large budget in certain smart solutions.

PART V – CONCLUSION

1. Purpose of this research

This master thesis studies the social dimension in the smart city strategies of eight Belgian smart cities, a model increasingly advocated by international institutions such as the UN and the EU to achieve the 2030 SGDs and to begin a transition to more sustainable and intelligent cities. In order to analyze this topic, a series of indicators were selected, mainly based on the U4SSC, a European initiative coordinated by ITU, UNECE and UN-habitat, but also on standards developed by ISO, OECD, ETSI and SDG11+. Data has been collected to complete these indicators and come up with a score which was then challenged and discussed through 7 interviews lasting a total of 225 minutes, with the aim of assessing the social aspect and the initiatives taken in the smart city strategies of the cities and establishing links between the different directions taken by the cities and regions.

2. Limitation and further research

Having carried out this work for one academic year, our report has some limitations that should be highlighted.

First of all, one of the limitations that we consider to be the most important, as it was probably the most constraining during our research, is the recent nature of the concept. Indeed, cities are only beginning to appropriate this term, which is difficult to define in theory, and initiatives are only beginning to emerge or are planned for the coming years. Consequently, it is still very difficult to diagnose and perceive a real impact of the implementation of these initiatives. Many of the projects that have been studied have recently, or not yet, been launched. As a result, no progress or impact has yet been measured. However, in the course of our research we found that there are many projects and ideas for the coming years and that the ambition of the cities is high. For future research, it would be interesting to establish a time balance of the evolution of the situation. Have the projects stated in the strategic plans of the cities been implemented? What are the social effects of these projects? To what extent do cities continue to include citizens in decision-making? The present work can therefore be seen as a work in progress.

This first obstacle leads us to the second limitation, which is the lack of information and accessibility to data specific to municipalities. Indeed, few data collections have already been carried out on the Belgian territory due to the lack of information and access to data specific to municipalities. Most of the data available on Belgian or regional statistical websites are generally data issued at regional or provincial level. Indeed, the availability of data varies by topic and year, as statistics on cities are only provided on a voluntary basis, as there is no European legislation governing their collection. Therefore, data collection was very difficult and time consuming, not only to find the data from the municipalities, but also when the data was not published and it was necessary to wait for a response from the municipalities themselves. Some indicators were therefore measured in a binary way, i.e. whether or not such and such practices were in place. In the future, perhaps more precise information will be shared and it will therefore be interesting to calculate these indicators in a non-binary way in order to have a better representation of the evolution of the city.

Furthermore, in relation to this previous limitation, given the non-mandatory nature of data sharing, some of the data used are not recent and therefore may not reflect the current reality of the city. In each case, the most recent data available has been used.

Besides, as explained above, social sustainability is still an undefined subject and still causes many misunderstandings among different researchers and scientists. Moreover, as explained, the smart city is also a recent field which is still poorly defined and, above all, poorly understood. Therefore, one of the limitations of this work is the complexity of combining the two subjects. The combination of the two led us to choose a series of indicators, however, due to the limited research done on the link between the smart city and social sustainability, the choice of indicators was mainly made on subjective decisions.

Moreover, as explained above, our research territory is limited to Belgium. Although the selection of cities allows us to have a fairly global view of the Belgian territory, it remains a small territory and perhaps not a very representative one of the social reality and challenges of cities in general.

Finally, our work is based on one of the pillars of sustainable development, the social pillar. However, a smart city approach must focus on all the pillars and transversally integrate all the components of the city. Our approach may therefore seem limited because it focuses on the

social aspect and does not take into account other aspects such as mobility or the economy. However, the aim of this research is also to assess the place of human capital in the city, in a world which is becoming increasingly environmentally oriented.

Bibliography

Agence Française du Développement. (2019, March 20). *L'élaboration numérique d'un budget participatif.* Retrieved from AFD: http://smartcity-guide.afd.fr/l-elaboration-numerique-d-un-budget-participatif.html?lang=fr

Al-Nasrawi, S., Adams, C., & El-Zaart, A. (2015). A Conceptual Multidimensional Model for Assessing Smart Sustainable Cities. *Journal of Information Systems and Technology Management*, *12*(3), 541–558. doi : 10.4301/s1807-17752015000300003

Aurambout, J., & Vallecillo, S. (2016). *UDP - Share of green infrastructure, 2010 - 2050*. European Commission - Joint Research Centre (JRC) [Dataset]. Retrieved from European Commission: https://data.jrc.ec.europa.eu/dataset/jrc-luisa-udp-shareofgreen-reference-2016

Baeck, P., & Reynolds, S. (2020, April 24). *Smart cities during COVID-19*. Retrieved from Nesta: https://www.nesta.org.uk/blog/smart-cities-during-covid-19/

Balancier, P. (2021, February 1). *UpSkills Wallonia. Répondre à la pénurie de profils qualifiés*. Retrieved from Digital Wallonia: https://www.digitalwallonia.be/fr/publications/upskills-wallonia#top

Bibri, S. E., & Krogstie, J. (2017a). On the social shaping dimensions of smart sustainable cities: A study in science, technology, and society. *Sustainable Cities and Society*, *29*, 219–246. doi :10.1016/j.scs.2016.11.004

Bibri, S. E., & Krogstie, J. (2017b). Smart sustainable cities of the future : An extensive interdisciplinary literature review. *Sustainable Cities and Society*, *31*, 183-212. doi :10.1016/j.scs.2017.02.016

Bifulco, F., Tregua, M., Amitrano, C. C., & D'Auria, A. (2016). ICT and sustainability in smart cities management. *International Journal of Public Sector Management*, *29*(2), 132–147. doi :10.1108/IJPSM-07-2015-0132

Bosch, P., Jongeneel, S., Rovers, V., Neumann, H. M., Airaksinen, M., & Huovila, A. (2017). *CITYkeys indicators for smart city projects and smart cities*. Retrieved from CITYkeys: https://nws.eurocities.eu/MediaShell/media/CITYkeystheindicators.pdf

Boström, M. (2012). A missing pillar ? Challenges in theorizing and practicing social sustainability : introduction to the special issue. *Sustainability : Science, Practice and Policy*, *8*(1), 3-14. doi :10.1080/15487733.2012.11908080

Botman, E., & Deconinck, C. (2017, August). *Plan d'Actions en faveur de l'Energie Durable et du Climat (PAEDC) - Ville de Charleroi*. Retrieved from Ville de Charleroi: https://mycovenant.eumayors.eu/storage/web/mc_covenant/documents/8/4TjrseZh53OV4g2MR3XAj87CKvyMTLqv.pdf

Bounazef Vanmarsenille, D., & Desdemoustier, J. (2018, June). *Stratégies et projets Smart City en Belgique : Baromètre belge 2018.* Retrieved from Smart City Institute:

https://orbi.uliege.be/bitstream/2268/225024/1/Barometre%20Belge%202018%20Smart%20Cities%20FR.pdf

Brotcorne, P., UCLouvain, CIRTES, Centre Interdisciplinaire de Recherche Travail, & Fondation Roi Baudouin. (2020, June). *Baromètre de l'inclusion numérique 2020*. Retrieved from Fondation Roi Baudouin: https://www.kbs-frb.be/fr/~/media/Files/Bib/Publications/PUB_3734_BarometreInclusionDigitale_2020_NEW.pdf

Bruckner, A. (2021, May 22). *"Curieuzenair" : la qualité de l'air à Bruxelles au cœur d'une recherche inédite de science participative*. Retrieved from BX1: https://bx1.be/categories/news/curieuzenair-la-qualite-de-lair-a-bruxelles-au-coeur-dune-recherche-inedite-de-science-participative/

Brussels Smart City. (2021, April 8). *Un éclairage public intelligent permettra de réduire de 20 % la consommation d'électricité de Bruxelles d'ici 2035.* Retrieved from Brussels Smart City: https://smartcity.brussels/news-847-un-eclairage-public-intelligent-permettra-de-reduire-de-20-la-consommation-d-electricite-de-bruxelles-d-ici-2035

Bureau Fédéral du Plan [BFP]. (2003–2020). *Logement inadéquat* [Dataset]. Retrieved from indicators.be: https://indicators.be/fr/i/G11_IDW/Logement_inad%C3%A9quat

Burger Begroting. (2021). *Kies nu je favoriete projecten!* Retrieved from Burger Begroting: https://2020-2021.burgerbegroting.be

C40 Cities. (2012). *Why cities? Ending climate change begins in the city.* Retrieved from C4O Cities: https://www.c40.org/why_cities

Caban. (2021). *Caban - Collectif des Acteurs Bruxellois de l'Accessibilité Numérique*. Retrieved from Caban: https://caban.be/?lang=fr

Caulfield, J., Polèse, M., & Stren, R. (2001). The Social Sustainability of Cities: Diversity and the Management of Change. *Canadian Public Policy / Analyse de Politiques*, *27*(3), 381. doi: 10.2307/3552480

CBD, ECLAC, FAO, ITU, UNDP, UNECA, UNECE, UNESCO, UN Environment, UNEP-FI, UNFCCC, UN-Habitat, UNIDO, UNU-EGOV, UN-Women, & WMO. (2017). *Collection methodology for key performance indicators for smart sustainable cities*. https://www.itu.int/en/publications/Documents/tsb/2017-U4SSC-Collection-Methodology/mobile/index.html

CBD, ECLAC, FAO, ITU, UNDP, UNECA, UNECE, UNESCO, UNEP, UNFCCCC, UN-Habitat, UNIDO, UNOP, UNU-EGOV, UN-Women, & WMO. (2021). *Simple ways to be smart*. Retrieved from ITU: https://www.itu.int/en/publications/Documents/tsb/2021-U4SSC-Simple-ways-to-be-smart/index.html#p=88

Centre d'Informatique pour la Région Bruxelloise [CIRB]. (2015, July 14). *Inauguration de la plate-forme régionale de mutualisation des images de vidéoprotection.* Retrieved from cirb.brussels : https://cirb.brussels/fr/quoi-de-neuf/actualites/inauguration-de-la-plate-forme-regionale-de-mutualisation-des-images-de-videoprotection

Centre d'Informatique pour la Région Bruxelloise [CIRB] & easy.brussels. (2021). *Plan d'appropriation numérique 2021–2024 - Pour la Région de Bruxelles-Capitale*. https://cirb.brussels/fr/quoi-de-neuf/publications/cahiers/ndeg40-plan-dappropriation-numerique-1

Centre d'Informatique pour la Région Bruxelloise [CIRB] (2021a, March 2). *Record pour IRISbox en 2020 : 327.000 demandes effectuées sur la plateforme en ligne* [Press release]. https://cirb.brussels/fr/quoi-de-neuf/publications/communiques-de-presse/2021/record-pour-irisbox-en-2020-02-03.2021

Centre d'Informatique pour la Région Bruxelloise [CIRB] (2021b, March 3). *Wifi.brussels séduit de plus en plus* [Press release]. https://cirb.brussels/fr/quoi-de-neuf/publications/communiques-de-presse/2021/wifi-brussels-seduit-de-plus-en-plus-03-03.2021

Colantonio, A. (2009). *Social sustainability: a review and critique of traditional versus emerging themes and assessment methods*. Retrieved from The London School of Economics and Political Science: http://eprints.lse.ac.uk/35867/1/Colantonio_Social_sustainability_review_2009.pdf

Compère, P. (2018, March 29). *Les projets Digital Cities et le Wi-Fil urbain*. Retrieved from Digital Wallonia: https://www.digitalwallonia.be/fr/publications/projets-digital-cities

CPAS de la ville de Bruxelles [CPAS]. (2019, October). *Plan logement 2019–2024*. Retrieved from Ville de Bruxelles: https://www.bruxelles.be/plan-logements-du-cpas-2019-2024

Damen, S., van den Broeck, K., & Winters, S. (2021). *Woonbeleidsplan Brugge*. Retrieved from KU Leuven HIVA: https://www.brugge.be/woonbeleidsplan-stad-brugge

De toekomst van Brugge. (2020, February 24). *Projecten*. Retrieved from De toekomst van Brugge: https://www.detoekomstvanbrugge.be/nl/projecten

Dempsey, N., Bramley, G., Power, S., & Brown, C. (2011). The social dimension of sustainable development: Defining urban social sustainability. *Sustainable Development*, *19*(5), 289–300. doi: 10.1002/sd.417

Desdemoustier, J., & Crutzen, N. (2017). *Etat des lieux sur la dynamique « Smart City » en Belgique : Un baromètre quantitatif*. Retrieved from Smart City Institute : https://orbi.uliege.be/bitstream/2268/220415/1/Smart%20City%20Barometer%202017%20-%20FR.pdf

Dillard, J., Dujon, V., & King, M. C. (2009). *Understanding the Social Dimension of Sustainability.* New York: Routledge. doi: 10.4324/9780203892978

Dixon, T. (2011). Putting the S Word in Sustainability - Can we be more Social ? *The Berkley group*. doi: 10.13140/RG.2.2.12242.96965

Dixon, T., & Woodcraft, S. (2013). Creating strong communities—measuring social sustainability in new housing development. *Town & Country Planning, 82*(11), 473–480. Online https://www.researchgate.net/publication/320895251

Dobbs, R., Smit, S., Remes, J., Manyika, J., Roxburgh, C., & Restrepo, A. (2018, April 27). *Urban world: Mapping the economic power of cities*. Retrieved from McKinsey & Company: https://www.mckinsey.com/featured-insights/urbanization/urban-world-mapping-the-economic-power-of-cities

Du Pisani, J. A. (2006). Sustainable development – historical roots of the concept. *Environmental Sciences*, *3*(2), 83–96. doi: 10.1080/15693430600688831

Environmental Protection Agency [EPA]. (2021, August 2). *Managing Air Quality - Ambient Air Monitoring*. Retrieved from US EPA: https://www.epa.gov/air-quality-management-process/managing-air-quality-ambient-air-monitoring

European Commission [EC]. (2017). *European Green Capital*. Retrieved from European Commission: https://ec.europa.eu/environment/europeangreencapital/europeangreenleaf/2016-european-green-leaf-applicant-cities/index.html

European Commission [EC]. (2018, January). *A walk to the park ? Assessing access to green areas in Europe's cities*. Retrieved from European Commission: https://ec.europa.eu/regional_policy/sources/docgener/work/2018_01_green_urban_area.pdf

European Environment Agency [EEA]. (2020). *Air quality in Europe - 2020 report*. Retrieved from European Environment Agency: https://www.eea.europa.eu/publications/air-quality-in-europe-2020-report/at_download/file

Ferrara, C. (2019, September). *Nos territoires face aux données et à leur gouvernance*. Retrieved from Smart City Institute : https://guidesmartcity.be

Finco, A., & Nijkamp, P. (2001). Pathways to urban sustainability. *Journal of Environmental Policy & Planning*, *3*(4), 289–302. doi: 10.1002/jepp.94

Floridi, L. (2002). Information Ethics - An Environmental Approach to the Digital Divide. *SSRN Electronic Journal*, *9*(1), 39–45. doi: 10.2139/ssrn.3848486

Futurocité. (2017, November). *Smart Governance : comment mieux interagir avec les citoyens ?* Retrieved from Smart City Institute : https://www.futurocite.be/app/uploads/2017/11/01-FUTUROCITE-Introduction.pdf

Gan, X., Fernandez, I. C., Guo, J., Wilson, M., Zhao, Y., Zhou, B., & Wu, J. (2017). When to use what: Methods for weighting and aggregating sustainability indicators. *Ecological Indicators*, *81*, 491–502. doi: 10.1016/j.ecolind.2017.05.068

Ganuza, E., Francés, F., & Garibay, D. (2015). Le défi participatif : délibération et inclusion démocratique dans les budgets participatifs. *Participations*, *11*(1), 167–190. doi: 10.3917/parti.011.0167

Garau, C., Masala, F., & Pinna, F. (2015). Benchmarking Smart Urban Mobility: A Study on Italian Cities. *Computational Science and Its Applications*, 612–623. doi: 10.1007/978-3-319-21407-8_43

Gasper, D. (2010). Understanding the diversity of conceptions of well-being and quality of life. *The Journal of Socio-Economics*, *39*(3), 351–360. doi: 10.1016/j.socec.2009.11.006

Gaudiaut, T. (2020, November 4). *Participation électorale : où vote-t-on le plus ?* Retrieved from Statista: https://fr.statista.com/infographie/23386/taux-de-participation-electorale-par-pays/

Giffinger, R., Kalasek, R., Fertner, C., & Pichler, N. (2007, January). *Smart cities - Ranking of European medium-sized cities*. Online https://www.researchgate.net/publication/261367640_Smart_cities_-_Ranking_of_European_medium-sized_cities#fullTextFileContent

Gouvernement Wallon. (2017, September 14). *Communication du Gouvernement wallon de ce jeudi 14 septembre 2017 | Gouvernement wallon* [Press release]. https://gouvernement.wallonie.be/home/presse/publications/communication-du-gouvernement-wallon-de-ce-jeudi-14-septembre-2017.publicationfull.html

Granier, B., & Kudo, H. (2016). How are citizens involved in smart cities? Analysing citizen participation in Japanese ``Smart Communities''. *Information Polity*, *21*(1), 61–76. Doi: 10.3233/ip-150367

Grossi, G., & Pianezzi, D. (2017). Smart cities: Utopia or neoliberal ideology? *Cities*, *69*, 79–85. Doi: 10.1016/j.cities.2017.07.012

Hossain, M., Leminen, S., & Westerlund, M. (2018). A Systematic Review of Living Lab Literature. *SSRN Electronic Journal*, *213*, 976–988. Doi: 10.2139/ssrn.3307055

Huovila, A., Bosch, P., & Airaksinen, M. (2019). Comparative analysis of standardized indicators for Smart sustainable cities: What indicators and standards to use and when? *Cities*, *89*, 141–153. Doi: 10.1016/j.cities.2019.01.029

IAP2 International Federation. (2018). *IAP2 Spectrum of Public Participation*. Retrieved from International Association for Public Particiaption: https://iap2.org.au/wp-content/uploads/2020/01/2018_IAP2_Spectrum.pdf

IBSA. (2011). *Indice de richesse*. Retrieved from IBSA: http://ds3.ds.static.rtbf.be/article/pdf/indice-de-richesse-1348465597.pdf

ICAB. (n.d.). *Eurocode 0 - definition des charges*. Retrieved from ICAB - Eurocodes : https://www.eurocode1.com/fr/eurocode0.html

INAMI. (2017, June 10). *Impulseo*. Retrieved from INAMI : https://www.inami.fgov.be/fr/professionnels/sante/medecins/impulseo/Pages/default.aspx#%E2%80%8BCompétence_des_entités_fédérées_à_partir_de_2015

Innovation and Networks Executive Agency [INEA]. (2019). *The map of WiFi4EU winners | Shaping Europe's digital future*. Retrieved from European Commission: https://digital-strategy.ec.europa.eu/en/news/map-wifi4eu-winners

InfluencAir. (n.d.). *About InfluencAir*. Retrieved from https://influencair.be/about/

ISO. (2019). *ISO 37122:2019(en) Sustainable cities and communities - Indicators for smart cities*. Retrieved from ISO: https://www.iso.org/obp/ui/#iso:std:iso:37122:ed-1:v1:en

ITU. (2016a, June). *Recommendation ITU-T Y.4901/L.1601 : Key performance indicators related to the use of information and communication technology in smart sustainable cities*. Retrieved from ITU: https://handle.itu.int

ITU. (2016b, October). *Recommendation ITU-T Y.4903/L.1603 : Key performance indicators for smart Evaluation and assessment sustainable cities to assess the achievement of sustainable development goals*. Retrieved from ITU: http://handle.itu.int/

ITU (n.d.). *ITU-T Recommendation serie structure*. Retrieved from ITU : https://www.itu.int/en/ITU-T/publications/Pages/structure.aspx

Jarvie, M. E. (n.d.). *Brundtland Report | publication by World Commission on Environment and Development*. Retrieved from Encyclopedia Britannica : https://www.britannica.com/topic/Brundtland-Report

Kramers, A., Höjer, M., Lövehagen, N., & Wangel, J. (2014). Smart sustainable cities – Exploring ICT solutions for reduced energy use in cities. *Environmental Modelling & Software*, *56*, 52–62. doi: 10.1016/j.envsoft.2013.12.019

Kumar, T. V. M. (2020). *Smart Living for Smart Cities: Case Studies (Advances in 21st Century Human Settlements)* (1st ed. 2020 ed.). Springer. doi: 10.1007/978-981-15-4603-7_1

Lacinák, M., & Ristvej, J. (2017). Smart City, Safety and Security. *Procedia Engineering*, *192*, 522–527. doi: 10.1016/j.proeng.2017.06.090

Larsen, N. B., & Jensen, L. B. (2019). Current work on social sustainability in the built environment. *IOP Conference Series : Earth and Environmental Science*, *225*. doi: 10.1088/1755-1315/225/1/012063

Le Nid. (2021, February 5). *Balisage lumineux intelligent des cheminements piétons de la Citadelle*. Retrieved from Le Nid : https://www.le-nid.be/les-projets/balisage-lumineux-intelligent-des-cheminements-pietons-de-la-citadelle

Lowe, L. (2020, September 2). *The Three Pillars of Sustainability Explained*. Retrieved from Future Fitouts: https://www.futurefitouts.com.au/three-pillars-of-sustainability-explained/

Macke, J., Casagrande, R. M., Sarate, J. A. R., & Silva, K. A. (2018). Smart city and quality of life: Citizens' perception in a Brazilian case study. *Journal of Cleaner Production*, *182*, 717–726. doi: 10.1016/j.jclepro.2018.02.078

Mancinelli, E. (2008a). *e-Inclusion in the Information Society*. http://lincompany.kz/pdf/Hungary/NETIS_Course_Book_English2008.pdf#page=171

Margherita, E., Esposito, G., Escobar, S., & Crutzen, N. (2021, January). *Exploring the Smart City Adoption Process: Evidence from the Belgian urban context*. Online https://www.researchgate.net/publication/348487007_Exploring_the_Smart_City_Adoption_Process_Evidence_from_the_Belgian_urban_context

Marsal-Llacuna, M. L. (2015). City Indicators on Social Sustainability as Standardization Technologies for Smarter (Citizen-Centered) Governance of Cities. *Social Indicators Research*, *128*(3), 1193–1216. doi: 10.1007/s11205-015-1075-6

Mazziotta, C., Mazziotta, M., Pareto, A., & Vidoli, F. (2010). La sintesi di indicatori territoriali di dotazione infrastrutturale: metodi di costruzione e procedure di ponderazione a confronto. *RIVISTA DI ECONOMIA E STATISTICA DEL TERRITORIO*, *1*, 7–33. doi: 10.3280/rest2010-001002

Michels, A., & de Graaf, L. (2017). Examining citizen participation: local participatory policymaking and democracy revisited. *Local Government Studies*, *43*(6), 875–881. doi: 10.1080/03003930.2017.1365712

Min, Z. Y. (2018, September 14). *Indicator 11.6.2 - E-Handbook on SDG Indicators - UN Statistics Wiki*. Retrieved from UN Statistics: https://unstats.un.org/wiki/display/SDGeHandbook/Indicator+11.6.2

Missinne, S., & Luyten, S. (2018). *Les médecins généralistes en Région bruxelloise : qui sont-ils, où pratiquent-ils et où se situent les potentielles pénuries ?* Observatoire de la Santé et du Social. Retrieved from Commission Communautaire Commune : https://didiergosuin.brussels/sites/default/files/documents-articles/20180507_les_medecins_generalistes_en_region_bruxelloise_qui_sont-ils_ou_pratiquent-ils_et_ou_se_situent_les_potentielles_penuries.pdf

Monfaredzadeh, T., & Krueger, R. (2015). Investigating Social Factors of Sustainability in a Smart City. *Procedia Engineering*, *118*, 1112–1118. doi: 10.1016/j.proeng.2015.08.452

Morrow, E., & Hutton, S. (2000, April). *The Chicago Alley Lighting Project: Final Evaluation Report*. Online https://www.darksky.org/wp-content/uploads/2014/09/Chicago-Alley-Lighting-Project.pdf

MSCI. (2020). *Post-Pandemic Reflections: Smart Cities. COVID-19 and its potential impact on the new ecosystem*. Retrieved from MSCI: https://www.msci.com/documents/1296102/18941732/ThematicIndex-SmartCities-Post-COVID-cbr-en.pdf/5b4df1b8-64d1-240c-eae3-f40eb36afbbf

Nabatchi, T. (2012). Putting the “Public” Back in Public Values Research: Designing Participation to Identify and Respond to Values. *Public Administration Review*, no. doi: 10.1111/j.1540-6210.2011.02544.x

Nam, T., & Pardo, T. A. (2011). Conceptualizing smart city with dimensions of technology, people, and institutions. *Proceedings of the 12th Annual International Digital Government Research Conference on Digital Government Innovation in Challenging Times*, 282–291. doi: 10.1145/2037556.2037602

Namur Capitale. (2018, March 29). *WIFI Digital Cities de Namur*. Retrieved from Namur Capitale: https://data.namur.be/explore/dataset/namur-points-acces-wifi/custom/

Neamțu, B. (2012). Measuring the Social Sustainability of Urban Communities: The Role of Local Authorities. *Transylvanian Review of Administrative Sciences*, *37*, 112–127. Online https://rtsa.ro/tras/index.php/tras/article/viewFile/75/71

Nguyen, C., Bleus, H., & van Bockhaven, J. (2017, September). *Le guide pratique de la Smart City*. Retrieved from Smart City Institute: https://www.guidesmartcity.be

Nguyen, C., Bleus, H., & van Bockhaven, J. (2018, September). *Comment rendre le citoyen acteur de son territoire ?* Retrieved from Smart City Institute. https://orbi.uliege.be/bitstream/2268/229265/1/smart-city-le-guide-pratique-tome-2.pdf

Oberdorff, H. (2006). L’administration électronique ou l’e-administration. *Recherches et Prévisions*, *86*(1), 9–18. doi: 10.3406/caf.2006.2247

OECD. (2019a). *Panorama de la santé 2019 : Les indicateurs de l’OCDE - Médecins (nombre total).* Retrieved from OECD iLibrary : https://www.oecd-ilibrary.org/sites/d50086e7-fr/index.html?itemId=/content/component/d50086e7-fr

OECD. (2019b). *Air pollution exposure.* Retrieved from OECD Data: https://data.oecd.org/air/air-pollution-exposure.htm

OECD. (2020). *How’s Life? 2020 : Measuring Well-being*. Retrieved from OECD iLibrary : https://www.oecd-ilibrary.org/sites/9870c393-en/1/1/index.html?itemId=/content/publication/9870c393-en&_csp_=fab41822851fa020ad60bb57bb82180a&itemIGO=oecd&itemContentType=book

ORES. (2021, June 30). *On passe au LED.* Retrieved from ORES : https://extranet.ores.be/fr/information/e-lumin

Organisation mondiale de la santé [OMS]. (2016, November 2). *Selon un rapport de l’OMS, les espaces verts urbains apportent de multiples bienfaits à la santé.* Retrieved from OMS Europe: https://www.euro.who.int/fr/health-topics/environment-and-health/pages/news/news/2016/11/who-report-shows-urban-green-spaces-deliver-multiple-health-benefits

Pacione, M. (2003). Urban environmental quality and human wellbeing—a social geographical perspective. *Landscape and Urban Planning*, *65*(1–2), 19–30. doi: 10.1016/s0169-2046(02)00234-7

Papa, R., Gargiulo, C., & Galderisi, A. (2013). Towards an Urban Planners' Perspective on Smart City. *Tema Journal of Land Use, Mobility and Environment*, *6*, 5–17. doi: 10.6092/1970-9870/1536

Police Fédérale. (2021, April 23). *Statistiques policières de criminalité*. Retrieved from Police Fédérale: http://www.stat.policefederale.be/statistiquescriminalite/rapports/

Proximity. (n.d.). *Proximity*. Retrieved from Proximity Belgium: https://proximitybelgium.be/static/notre-histoire-engagement

PwC. (2013, November). *Safe Cities - The India Story*. Retrieved from PwC India: https://www.pwc.com/gx/en/psrc/assets/pwc-psrc-safe-cities-the-india-story.pdf

Randaxhe, J. (2021, January). *Baromètre Wallon 2020*. Retrieved from Smart City Institute: https://orbi.uliege.be/bitstream/2268/255549/1/Rapport%20BW20-FR.pdf

Resa. (2021, March 23). *La modernisation de l'éclairage public se poursuit en province de Liège !* https://www.resa.be/fr/news/la-modernisation-de-leclairage-public-se-poursuit-en-province-de-liege/

Ricee, S. (2021, May 13). *Social Sustainability – Everything you need to know*. Retrived from Diversity for Social Impact: https://diversity.social/social-sustainability/#2-four-dimensions-and-principles-of-social-sustainability

Romelaer, P. (2005). L'entretien de recherche. In P. Roussel & F. Wacheux (Eds)., *Management des ressources humaines: Méthodes de recherche en sciences humaines et sociales* (pp. 65-100). Louvain- la-Neuve : De Boeck Supérieur. doi: 10.3917/dbu.rouss.2005.01

RTBF. (2019, December 26). Liège : le wifi gratuit en ville, c'est fini. *RTBF Info*. Retrieved from RTBF : https://www.rtbf.be/info/regions/detail_liege-le-wifi-gratuit-en-ville-c-est-fini?id=10395975

Shorten, A., & Smith, J. (2017). Mixed methods research: expanding the evidence base. *Evidence Based Nursing*, *20*(3), 74–75. doi: 10.1136/eb-2017-102699

Sibelga. (2020, November 25). *Bientôt un éclairage public intelligent à Bruxelles*. Retrieved from Sibelga: https://www.sibelga.be/fr/blog/bientot-eclairage-public-connecte-bruxelles

Sibelga. (2021, July 6). *Un éclairage test grandeur nature au Bois de la Cambre*. Retrieved from Sibelga: https://www.sibelga.be/fr/blog/un-eclairage-test-grandeur-nature-au-bois-de-la-cambre

Sminkey, L. (2007, April). *Road traffic crashes leading cause of death among young people* [Press release]. Retrieved from World Health Organization: https://www.who.int/news/item/19-04-2007-road-traffic-crashes-leading-cause-of-death-among-young-people

Soe, R. M. (2017, June). FINEST Twins. *Proceedings of the 18th Annual International Conference on Digital Government Research*. doi: 10.1145/3085228.3085287

SPF Economie. (2020a). *Baromètre de la société de l'information 2020.* Retrieved from SPF Economie: https://economie.fgov.be/sites/default/files/Files/Publications/files/Barometre-de-la-societe-de-l-information-2020.pdf

SPF Economie. (2020b). *Les TIC en chiffres*. Retrieved from SPF Economie: https://economie.fgov.be/fr/themes/line/les-tic-en-belgique/les-tic-en-chiffres

Stad Brugge. (2017, December 19). *Luchtkwaliteit: Brugge koploper in vergelijking met andere Vlaamse steden*. Retrieved from Stad Brugge: https://www.brugge.be/luchtkwaliteit-brugge-koploper-in-vergelijking-met-andere-vlaamse-steden

Stad Brugge. (2019). *Het Brugs beleidsprogramma 2019–2024*. Retrieved from Stad Brugge: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwi46azP0JnyAhXH_KQKHZktBZoQFnoECAMQAw&url=https%3A%2F%2Fwww.brugge.be%2Fbeleidsprogramma2019-2024&usg=AOvVaw03O_klcPGDu58P_lTW1MRz

Stad Brugge. (2020, May 13). *Stad Brugge investeert in bijkomende wifi in verschillende stadsgebouwen* [Press release]. Retrieved from Stad Brugge: https://www.brugge.be/stad-brugge-investeert-in-bijkomende-wifi-in-verschillende-stadsgebouwen

Stad Gent. (n.d.). *Groen in Gent - Voor elk wat wilds*. Retrieved from Stad Gent: https://stad.gent/sites/default/files/page/documents/20140730_PR_groen_in_Gent_website_0.pdf

Stad Gent. (2014). *Gents Groen : Voor elk wat wilds*. Retrieved from Stad Gent: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwi93Z7WzpnyAhVMzKQKHXSoC_QQFnoECAcQAw&url=https%3A%2F%2Fstad.gent%2Fsites%2Fdefault%2Ffiles%2Fpage%2Fdocuments%2F20140730_PR_groen_in_Gent_website_0.pdf&usg=AOvVaw2BLyl0129IxQuzaoLwoSy_

Stad Gent. (2018). *Ruimte voor alle Gentenaars - Structuurvisie 2030*. Retrieved from Stad Gent: https://en.calameo.com/read/00639544718be5889f528

Stad Gent. (2020, December). *E-inclusie aanbod Gent - Hulp bij digitale vragen en versterken van digitale vaardigheden*. Retrieved from Stad Gent: https://stad.gent/sites/default/files/media/documents/Overzichtsbrochure_2020_druk2_LR%20%28web%29.pdf

Statista. (2021, April 7). *Worldwide digital population as of January 2021*. Retrieved from Statista : https://www.statista.com/statistics/617136/digital-population-worldwide/

Steffen, W., Grinevald, J., Crutzen, P., & McNeill, J. (2011). The Anthropocene: conceptual and historical perspectives. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *369*(1938), 842–867. doi: 10.1098/rsta.2010.0327

Swiss Life. (2017, May 8). *Combien de temps peut vivre un bâtiment?* Retrieved from Swiss Life: https://www.swisslife.com/fr/home/hub/combien-de-temps-peut-vivre-un-batiment.html

United Nations Human Settlements Programme [UN Habitat]. (2016, October). *New Urban agenda*. Retrieved from UN-Habitat : https://unhabitat.org/sites/default/files/2019/05/nua-english.pdf

United Nations Human Settlements Programme [UN Habitat]. (2020a). *SDG Cities*. Retrieved from UN-Habitat : https://unhabitat.org/sites/default/files/2020/01/fp5-sdg_cities_v261119.pdf

United Nations Human Settlements Programme [UN Habitat]. (2020b, October). *Indicator 11.1.1: Proportion of urban population living in slums, informal settlements or inadequate housing*. Retrieved from UN-Habitat : https://unstats.un.org/sdgs/metadata/files/Metadata-11-01-01.pdf

United Nation Conference on Trade and Commerce [UNCTAD]. (2019). *The impact of rapid technological change on sustainable development*. Retrieved from UNCTAD: https://unctad.org/system/files/official-document/ecn162019d2_en.pdf

United Nations [UN]. (2015). *Transforming our world: the 2030 Agenda for Sustainable Development*. Retrieved from UN: https://sdgs.un.org/2030agenda

United Nations [UN]. (2018). *The World's Cities in 2018 - Data booklet*. Retrieved from UN department of economic and social affairs: https://www.un.org/en/events/citiesday/assets/pdf/the_worlds_cities_in_2018_data_booklet.pdf

United Nations [UN]. (n.d.). *Cities*. United Nations Sustainable Development. Retrieved January 8, 2021, from https://www.un.org/sustainabledevelopment/cities/

United Nations Statistics Division [UNSD]. (2021). *SDG Indicators – Metadata repository*. Retrieved from Sustainable Development Goals: https://unstats.un.org/sdgs/metadata/?Text=&Goal=&Target=11.7

Van Batenburg, G. (n.d.). *Innovating technology for the Smart Zone in Antwerp*. Retrieved from Schréder https://www.schreder.com/en/projects/smart-innovative-lighting-solution-adapts-lighting-real-time-citizens-needs-antwerp-smart

Van Poppel, M. (2020, June 18). *Antwerp pilot city for project with air quality sensors*. Retrieved from VITO: https://vito.be/en/news/antwerp-pilot-city-project-air-quality-sensors

Van Roy, K., Peersman, W., de Lepeleire, J., Mamouris, P., de Sutter, A., de Maeseneer, J., & Goderis, G. (2017, January). *Evaluatie Impulsfonds - rapport*. Retrieved from UGent en KULeuven: https://www.zorg-en-gezondheid.be/sites/default/files/atoms/files/Rapport%20evaluatie%20Impulsfonds%202017-02-14.pdf

Ville de Bruxelles. (n.d.). *C'est quoi le budget participatif ?* Retrieved from Faire Samen : https://www.fairebruxelles.be/NOH-Mutsaard/p/budget

Ville de Charleroi. (2019). *Programme stratégique transversal Charleroi*. Retrieved from Ville de Charleroi : https://www.charleroi.be/vie-communale/projet-de-ville/plan-strategique-transversaletats-generauxpdu-synthese-et-conclusions-des-travaux

Ville de Charleroi. (2020a, December 8). *Charleroi, territoire d'inclusion numérique : un plan d'actions pragmatique et volontariste* [Press release]. Retrieved from Ville de Charleroi : https://www.charleroi.be/actualites/charleroi-territoire-dinclusion-numerique-un-plan-dactions-pragmatique-et-volontariste

Ville de Charleroi. (2020b, February). *Perspective de Développement Urbain - Ville de Charleroi 2019–2024*. Retrieved from Ville de Charleroi : https://www.charleroi.be/assets/files/Perspective-de-Developpement-Urbain-PDU.pdf

Ville de Liège. (2017). *Liège-LABVILLE*. Retrieved from Ville de Liège : https://www.liege.be/fr/vie-communale/services-communaux/urbanisme/liege-labville/liege-labville

Ville de Liège. (2019, September 30). *Programme Stratégique Transversal issu de la démarche participative Liège 2025*. Retrieved from Ville de Liège : https://www.liege.be/fr/vie-communale/projet-de-ville/liege-2025/actualites/programme-strategique-transversal-issu-de-la-demarche-participative-liege-2025

Ville de Liège. (n.d.-a). *La participation citoyenne continue !* Retrieved from Reinventons Liege : https://www.reinventonsliege.be/nouvelles/actualites/la-participation-citoyenne-continue

Ville de Liège. (n.d.-b). *Trouver à 10 minutes de chez soi un parc ou un espace vert*. Retrieved from Reinventons Liege : https://www.reinventonsliege.be/projets/trouver-a-10-minutes-de-chez-soi-un-parc-ou-un-espace-vert

Ville de Mons. (2019, September). *Programme Stratégique Transversal 2018 - 2024*. Retrieved from Ville de Mons: https://www.mons.be/ma-commune/vie-politique/transparence/programme-strategique-transversal

Ville de Namur. (2019, August). *Namur, votre ville, ses objectifs, ses actions 2019 - 2024 - Programme Stratégique Transversal*. Retrieved from Ville de Namur: https://www.namur.be/fr/grands-dossiers/programme-strategique-transversal-ou-pst

Ville de Namur. (2020, October 29). *Le Nid*. Pavillon Aménagement Urbain. Retrieved from Le Nid: https://www.le-nid.be/le-nid

Vlaamse Maatschappij voor Sociaal Wonen [VMSW]. (2021, May 26). *Woningen sociale sector*. Departement Kanselarij en Buitenlandse Zaken. Retrieved from Statistiek Vlaanderen: https://www.statistiekvlaanderen.be/nl/woningen-sociale-sector

Vlaanderen. (n.d.). *Ledverlichting langs gewestwegen*. Retrieved from Vlaanderen.be: https://www.vlaanderen.be/vlaamse-regering/vlaamse-veerkracht/ledverlichting-langs-gewestwegen

Vlaanderen. (2018, October 8). *Burgerbudget Gent: inwoners realiseren zelf hun ideeÃ«n voor een betere stad*. Retrieved from Vlaanderen Intern : https://overheid.vlaanderen.be/communicatie/participatie/burgerbudget-gent-inwoners-realiseren-zelf-hun-idee%C3%ABn-voor-een-betere-stad

Wallonie. (2021, June 1). *Etablir un Plan stratégique Transversal (PST)*. Retrieved from Le site Officiel de la Wallonie : https://www.wallonie.be/fr/demarches/etablir-un-plan-strategique-transversal-pst#endetail

Weingaertner, C., & Moberg, Å. (2011, October 12). Exploring Social Sustainability : Learning from Perspectives on Urban Development and Companies and Products. *Sustainable Development*, *22*(2), 122-133. doi: 10.1002/sd.536

Witt, C. (2017, March 20). *A New Definition of Integrative Health*. Retrieved from The Institute for Integrative Health: https://tiih.org/who/blog/new-definition-integrative-health/

Wonen Vlaanderen. (n.d.). *Welke opdracht heeft uw gemeente voor de realisatie van een sociaal woonaanbod? Het BSO in cijfers*. Retrieved from Vlaanderen is wonen : https://www.wonenvlaanderen.be/grond-en-pandenbeleid/bindend-sociaal-objectief-welke-opdracht-heeft-uw-gemeente-inzake-het

Woodcraft, S. (2012). Social Sustainability and New Communities : Moving from Concept to Practice in the UK. *Procedia - Social and Behavioral Sciences*, *68*, 29-42. doi: 10.1016/j.sbspro.2012.12.204

Woodcraft, S. (2015, January) Understanding and measuring social sustainability. *Journal of Urban Regeneration Renew.*, *8*(2), 133–144. Online https://www.researchgate.net/publication/286595877_Understanding_and_measuring_social_sustainability

Woodcraft, S., Bacon, N., Caistor-Arendar, L., & Hackett, T. (2012, November). *Design for social sustainability - A framework for creating thriving new communities*. Retrieved from Social Life: *http://www.social-life.co/media/files/DESIGN_FOR_SOCIAL_SUSTAINABILITY_3.pdf*

World Commission on Environment and Development [WCED]. (1987). *Report : Our Common Future*. Online https://www.are.admin.ch/are/en/home/media/publications/sustainable-development/brundtland-report.html

World Economic Forum. (2020, April 17). *COVID-19: What can smart cities tell us about social distancing?* https://www.weforum.org/agenda/2020/04/smart-cities-technology-coronavirus-covid19/

World Health Organization [WHO] & UNICEF. (2015–2020). *JMP* [Dataset]. Retrieved from WHO/UNICEF Joint Monitoring Programme:

https://washdata.org/data/household#!/bel

World Health Organization [WHO]. (2018, May 2). *Ambient (outdoor) air pollution*. Retrieved from World Health Organization. https://www.who.int/en/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

Appendices

Appendix 1 : 17 sustainable development goals

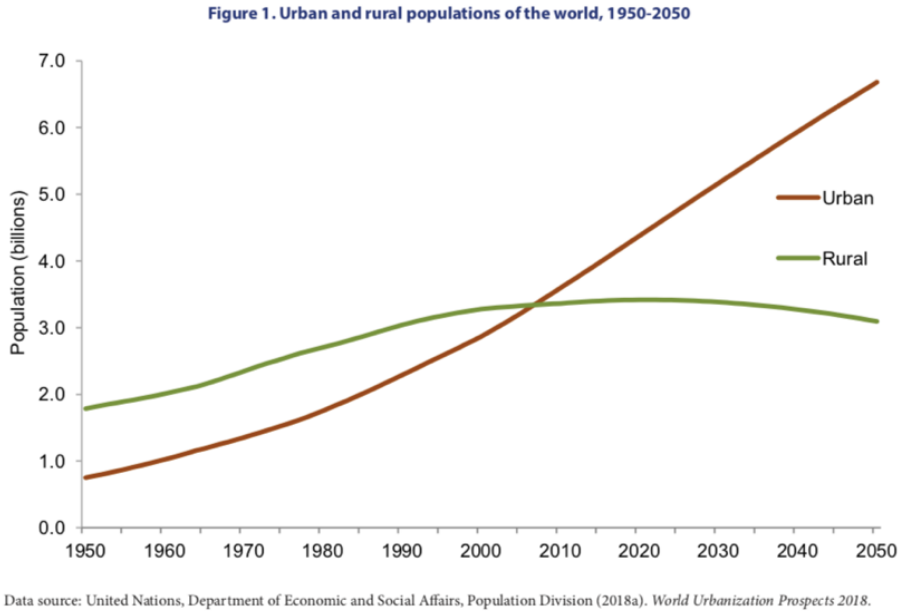
Source : (UN- PAGE, 2015)

Goal 1. End poverty in all its forms everywhere
Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 3. Ensure healthy lives and promote well-being for all at all ages
Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 5. Achieve gender equality and empower all women and girls
Goal 6. Ensure availability and sustainable management of water and sanitation for all
Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
Goal 10. Reduce inequality within and among countries
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12. Ensure sustainable consumption and production patterns
Goal 13. Take urgent action to combat climate change and its impacts*
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development

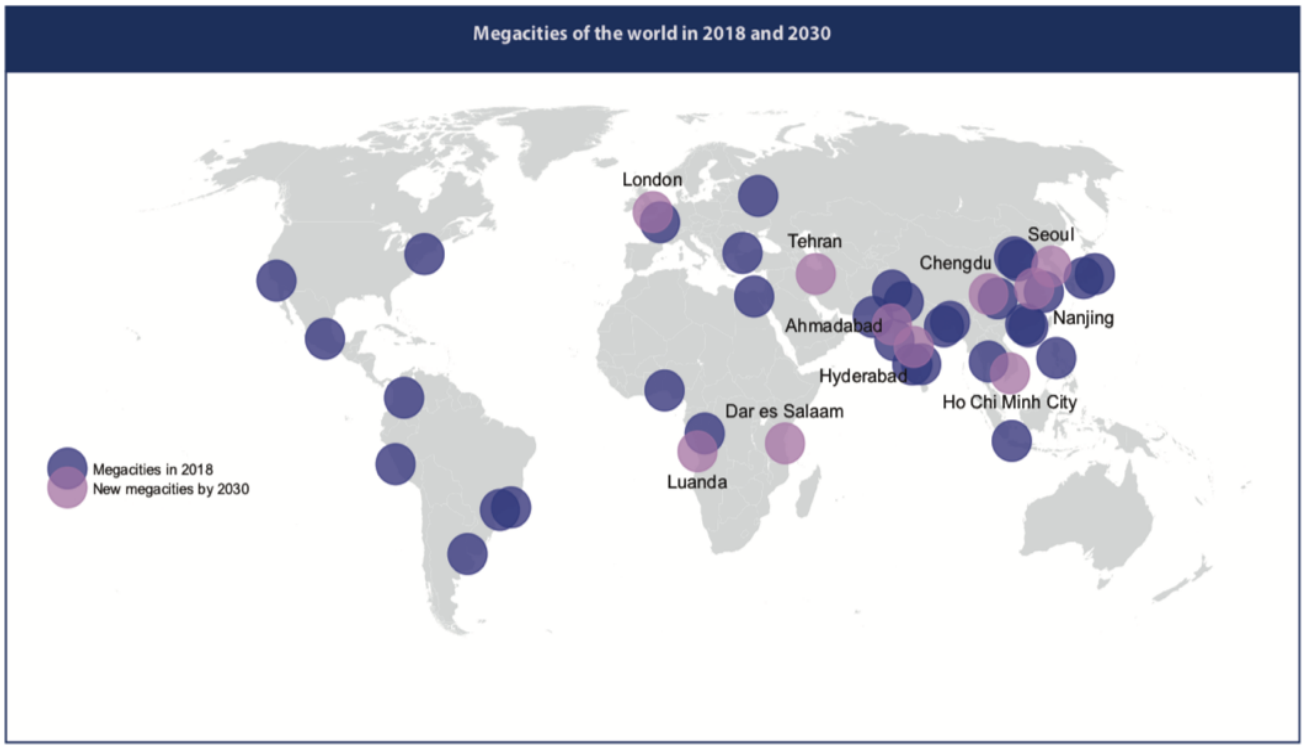
Source : (UN, 2015)

Appendix 2 : Urban and rural population of the world



Source : (UN, 2018)

Appendix 3 : Megacities of the world in 2018 and 2030



Source : (UN, 2018)

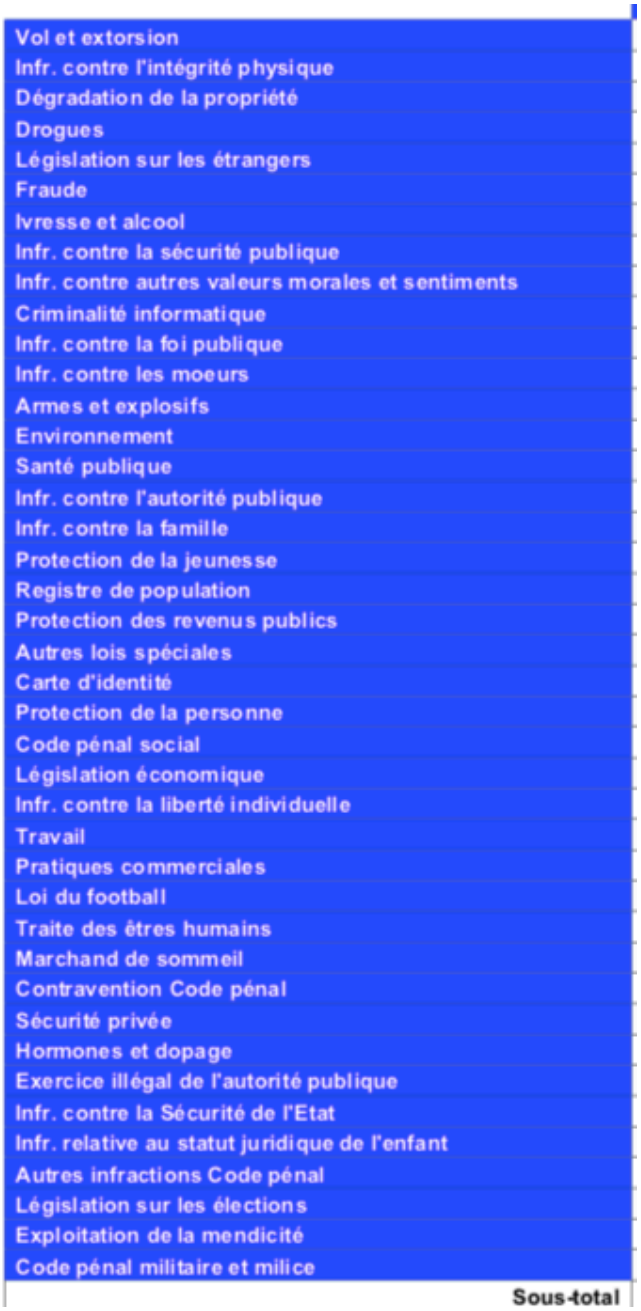
Appendix 4 : IAP2 spectrum of public participation

INCREASING IMPACT ON THE DECISION →

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

Source: IAP2 International Federation, 2018

Appendix 5 : List of criminal offenses



Source : Police Fédérale, 2021

Cities	Social Inclusion $I_{SI} = [(I_{UR} + I_{ISE} + I_{IT} + I_{EL} + I_{CC}) / 5]$					
	I_{UR}	I_{ISE}	I_{IT}	I_{EL}	I_{CC}	I_{SI}
Brussels	1,2	10,0	10,0	7,5	10,0	**7,7**
Antwerp	6,7	4,9	10,0	4,8	10,0	**7,3**
Gent	8,1	6,2	10,0	10,0	10,0	**8,9**
Charleroi	0,0	0,0	10,0	0,0	10,0	**4,0**
Liège	0,8	1,9	10,0	6,3	0,0	**3,8**
Bruges	10,0	1,0	10,0	7,6	10,0	**7,7**
Mons	2,4	1,8	10,0	6,1	10,0	**6,1**
Namur	5,5	4,9	10,0	7,8	10,0	**7,6**

Cities	Quality of Life $I_{QoL} = [(I_{SL} + I_{CR} + I_{TF} + I_{HE})/4]$				
	I_{SL}	I_{CR}	I_{TF}	I_{HE}	I_{QoL}
Brussels	5,0	0,0	6,8	5,2	**4,3**
Antwerp	5,0	8,4	10,0	2,3	**6,4**
Gent	5,0	8,2	8,1	8,5	**7,5**
Charleroi	5,0	6,6	5,5	2,0	**4,8**
Liège	5,0	3,5	7,2	1,6	**4,3**
Bruges	5,0	10,0	6,6	10,0	**7,9**
Mons	5,0	8,1	0,0	0,0	**3,3**
Namur	5,0	9,4	5,1	3,9	**5,9**

Cities	Well-being $I_{WB} = [(I_{AQM} + I_{PM} + I_{GI} + I_{HA} + I_{HQ}) / 5]$					
	I_{AQM}	I_{PM}	I_{GI}	I_{HA}	I_{HQ}	I_{WB}
Brussels	10,0	0,0	6,0	4,6	3,5	**4,8**
Antwerp	10,0	2,9	9,2	4,9	5,3	**6,5**
Gent	0,0	4,3	0,0	10,0	7,0	**4,3**
Charleroi	0,0	8,6	2,4	5,7	0,3	**3,4**
Liège	0,0	10,0	4,9	0,0	0,0	**3,0**
Bruges	10,0	5,7	10,0	1,8	10,0	**7,5**
Mons	0,0	8,6	6,7	1,7	4,2	**4,2**
Namur	0,0	8,6	8,8	0,7	8,6	**5,3**

Cities	Equity $I_E = [(I_{IA} + I_{UW}) / 2]$		
	I_{IA}	I_{UW}	**I_E**
Brussels	10,0	10,0	**10,0**
Antwerp	10,0	0,8	**5,4**
Gent	10,0	1,3	**5,7**
Charleroi	10,0	0,2	**5,1**
Liège	10,0	0,0	**5,0**
Bruges	10,0	0,7	**5,4**
Mons	10,0	0,9	**5,5**
Namur	10,0	0,4	**5,2**

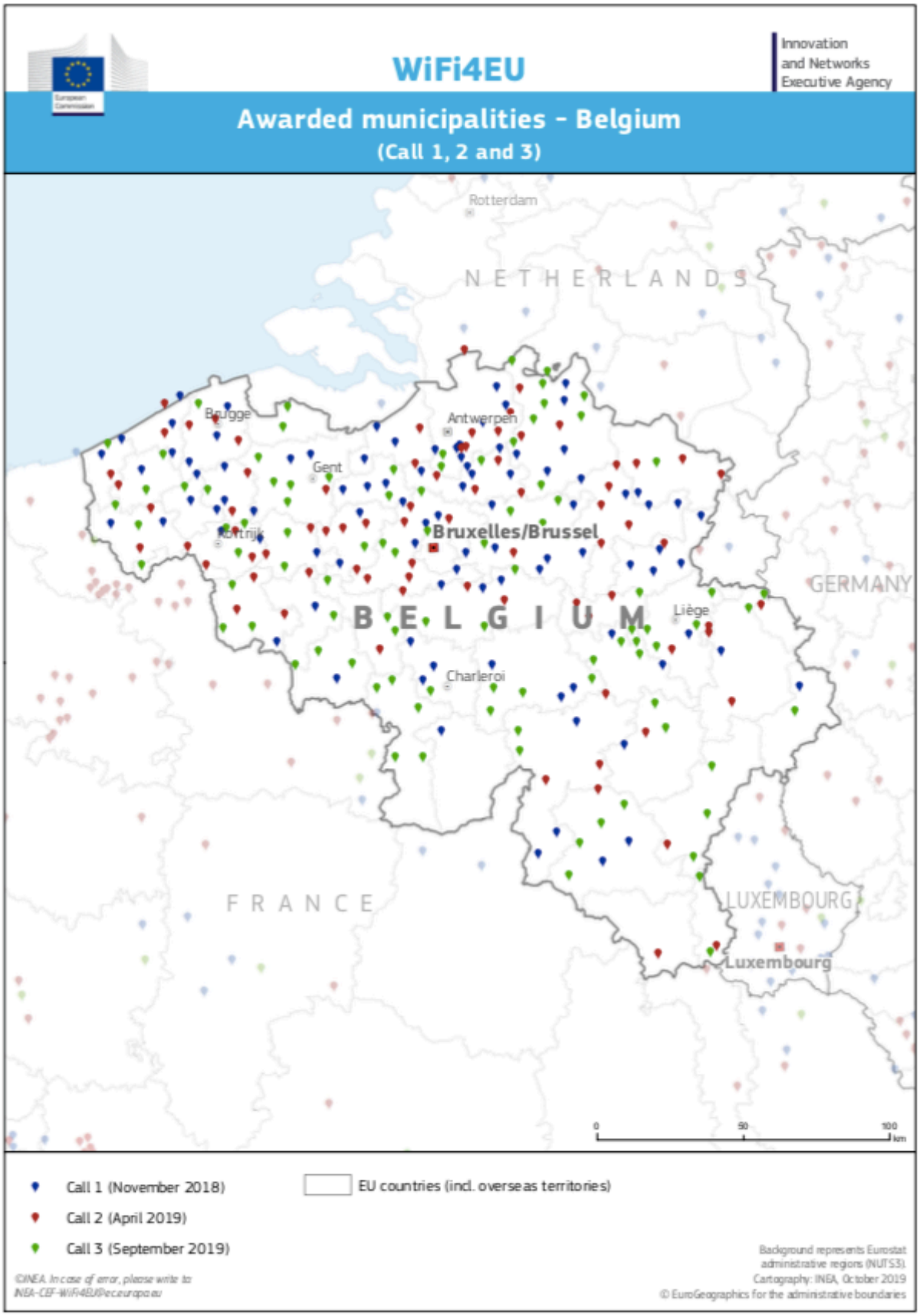
Appendix 7 : Contact list

Meeting #	Contact name	Position	City	Date	Support	Time
1	**Jessica Clement**	Sustainable public policy and strategy	Smart City Institute	15- June	**Skype**	35’
2	**Eric Goffart**	Alderman in digital competence	Charleroi	16- June	**Zoom**	45’
3	**Reinhard stoop**	Head of Department in Strategic Coordination	Antwerp	25- June	**Zoom**	19’
4			Antwerp	1 - July	**Zoom**	27’
5	**Fabian Maingain**	Alderman of the Smart City	Brussels	29 - June	**Zoom**	29’
6	**Bram de Vreese**	Data management coordinator	Bruges	5- July	**Zoom**	**33’**
7	**Bart Rosseau**	Agile & Open city coordinator	Ghent	6- July	**Zoom**	37’
8	**Kathlyn Jaminon**	Transversal Strategic Plan and European Projects Coordinator & Smart City Manager	Liège	22 – July	**E-mail**	/
9	**Lieven Duyck**	First Advisors for the local police	Bruges	08 – July	**E-mail**	/

10	/	Antwerp local police	Antwerp	07 – July	**E-mail**	/
11	**Pascal Ledoux**	First Senior Inspector of Police	Charleroi	28 - July	**E-mail**	/

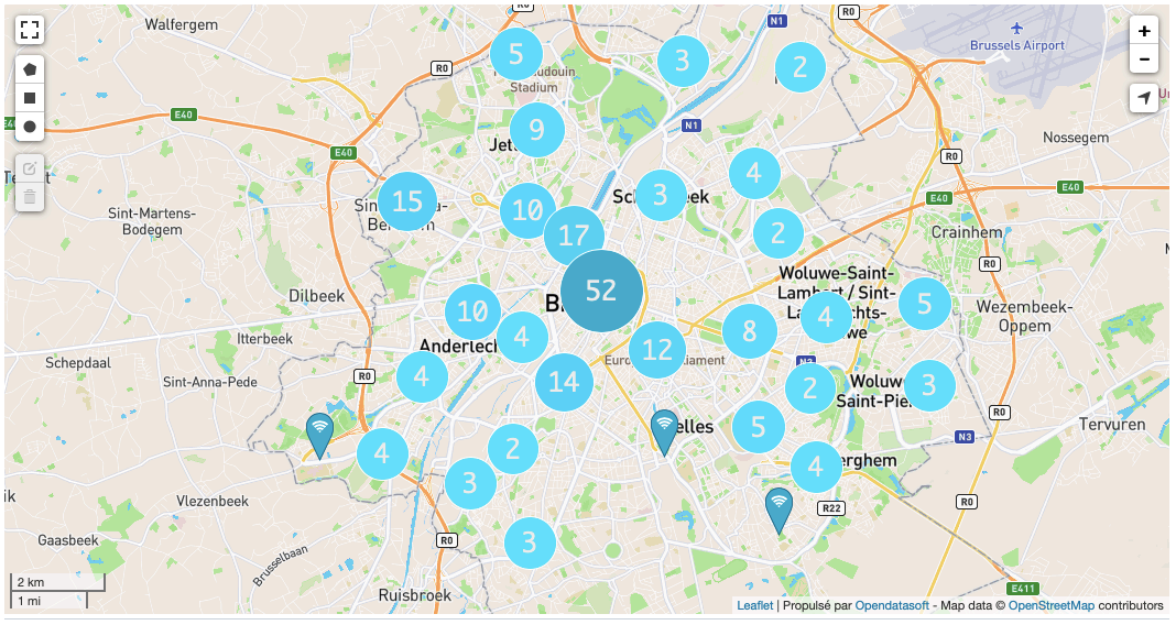
Table 7 : Interviews list

Appendix 8 : Awarded Belgian municipalities for WIFI4EU



Source : INEA, 2019

Appendix 9 : Map of the hotspot available through Wifi.Brussels in Brussels Region.



Source: open data brussels

Appendix 10 : Dataset and indicator results

Equity		Indicators	Calculation	Unit	Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur	MIN v	MAX
Inclusive society	Internet access	**Availability of Internet access in households**	Proportion of households with Internet access.	%	90	92	92	89	89	92	89	89	89	92
					REGION BXL	***WALLONIA***	***FLANDERS***							
				%	90	89	92							
		Source			https://bestat.s	https://bestat.s	https://bestat.statbel.fgov.be/bestat/crosstable.xhtml?datasource=d0ffd91e-2c69-4105-90fd-d92c2d4c1bd5							
	WIFI availability	**Availability of WiFi in public areas**	Number of WiFi hotspots at certain points in the city centre per km2	#/ km2	**2,42**	**0,19**	**0,32**	**0,05**	**0,00**	**0,18**	**0,23**	**0,11**	0	2,42
			# wifi	#	79	38	50	5	0	25	33	19		
			Municipality area	km2	32,61	204,5	156,2	102,1	69,39	138	146,6	176		
		Sources			https://openda	https://www.vi	https://stad.ge	Email (5 + biblic	digital cities	https://www.br	https://www.oc	https://www.odwb.be/explore/c		
					https://smartci	https://portaal-stadantwerpen.		https://www.ch	email		https://www.sudinfo.be/art/1615156/article/20			

Equity standardised		Indicators	Min value	Max value	Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
Inclusive society	Internet access	**Availability of Internet access in households**	89	92	**10,0**	**10,0**	**10,0**	**10,0**	**10,0**	**10,0**	**10,0**	**10,0**
	WIFI availability	**Availability of WiFi in public areas**	0,00	2,42	**10,0**	**0,8**	**1,3**	**0,2**	**0,0**	**0,7**	**0,9**	**0,4**

Table 8 : Indicators data

Social inclusion		Indicators	Calculation	Unit	Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur	MIN value	MAX value
Training	Employment	Unemployment rate (15-64)	Share of the total city labor force that is unemployed	%	19,17	9,90	7,62	21,20	19,83	4,36	17,12	11,99	4,36	21,20
			Source		https://bestat.s	https://bestat.s	https://bestat.s	https://bestat.s	https://bestat.s	https://bestat.s	https://bestat.s	https://bestat.statbel.fgov.be/bestat/cro		
		Share of employment in ICT	Share of the total city labor force working in the ICT	%	4,55	3,16	3,51	1,80	2,33	2,09	2,30	3,15	1,80	4,55
			Source		https://statbel.	https://statbel.	https://statbel.	https://walstat.	https://walstat.	https://statbel.	https://walstat.	https://walstat.iweps.be/walstat-catalog		
	ICT training	Availability of training to improve ICT skills	Availability of training to improve ICT skills	Yes = 1,00/ No = 0,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,00	1,00
			Sources		interview	interview	https://stad.ea	interview	https://www.r	https://www.	https://www.m	https://www.		
	Education level	Share of the population with a higher education degree	Share of the population with a higher education	%	31,00	25,60	36,10	16,10	28,60	31,20	28,30	31,60	16,10	36,10
			source		https://census.	https://census.	https://census.	https://census.	https://census.	https://census.	https://census.	https://census2011.fgov.be/data/resul		
Creativity	Citizens' creativity	Active interaction with citizens through the implementation of participatory budget	Availability of a participatory budget for citizens	Yes = 1,00/ No = 0,00	1	1	1	1	0	1	1	1	0	1
			Source		https://www.b	https://2020-2	https://stad.ea	https://www.ci	https://www.li	https://www.b	https://www.b	https://participation.namur.be		
					https://www.bruxelles.be/bun		https://overheid.vlaanderen.be/communicatie/participatiebudget-gent-inwoners-realiseren-zelf-hun-idee%C3%8							

Social inclusion standardise	Indicators	min value	max value	Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
Training	Employment	unemployement rate (15-64 ans)	21,20	4,36	1,2	6,7	8,1	0,0	0,8	10,0	2,4	5,5
		Share of employment in ICT	1,80	4,55	10,0	4,9	6,2	0,0	1,9	1,0	1,8	4,9
	Training	Availability of training to improve ICT skills	0	1	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
	Education	share of the population with a higher education degree	16,10	36,10	7,5	4,8	10,0	0,0	6,3	7,6	6,1	7,8
Creativity	Citizens' creativity	Active interaction with citizens through the implementation of participatory budget	0	1	10,0	10,0	10,0	10,0	0,0	10,0	10,0	10,0

Democracy & governance		Indicators	Calculation	Unit	Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur	MIN value	MAX value
Administration	E-guichet	Online administrative platform	Presence of a platform to facilitate online administrative procedures (e-guichet)	Yes = 1,00/ No = 0,00	1	1	1	1	1	1	1	1	0	1
			source		https://www.b	https://eloket.	https://extra-v	https://eguiche	https://e-guich	https://brugge	https://www.r	https://namur-auth.guichet-citoyen.be		
Citizens' participation	Direct citizens' participation	Collaborative platfrom	Presence of a collaborative platform	Yes = 1,00/ No = 0,00	1	0	1	0	1	1	0	0	0	1
			Source		https://www.5	interview	https://stad.ge	interview	https://www.r	interview	creative valley	https://proximitybelgium.be/static/Na		
					https://smartcity.brussels/nev		https://stad.gent/sites/default/files/article/d			http://smartcityinnovation.eu		https://participation.namur.be/la-part		
					https://www.bruxelles.be/pro		https://participatie.stad.gent/nl-BE/			https://www.detoekomstvan		https://www.le-nid.be/co-construire		
	Indirect citizens' participation	Voter turnout in the last municipal elections	Voter turnout (municipal elections)	%	87,78	89,00	91,10	86,00	84,90	90,60	84,60	86,00	84,60	91,10
			source		https://walstat	https://www.v	https://www.v	https://walstat	https://walstat	https://www.v	https://walstat	https://walstat.iweps.be/walstat-cata		
Open government	open data	open data platform	open data platform available to citizen	Yes = 1,00/ No = 0,00	1	1	1	0,5	1	1	0,5	1		
	Datasets	Number of inventoried open datasets that are published	inventoried open datasets that are published	#	548	470	125	3	54	94	26	173	3	548
			sources		https://opendat	https://portaal	https://data.st	https://www.c	https://opendat	https://www.b	https://www.c	https://data.namur.be/pages/statistic		
					https://datast	https://www.antwerpen.be/nl/overzicht/ope			https://www.r	https://www.brugge.be/handl		https://data.namur.be/explore/?sort=		

Democracy & governance standardize		Indicators	MIN	MAX	Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur		
Administration	E-guichet	Online administrative platform	0	1	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0		
Citizens' participation	Direct citizens' participation	Collaborative platfrom	0	1	10,0	0,0	10,0	0,0	10,0	10,0	0,0	0,0		
	Indirect citizens' participation	Voter turnout in the last municipal elections	84,60	91,10	4,9	6,8	10,0	2,2	0,5	9,2	0,0	2,2		
Open government	Datasets	Number of inventoried open datasets that are published	3	548	10,0	8,6	2,2	0,0	0,9	1,7	0,4	3,1		

Quality of Life		Indicators	Calculation	Unit	Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur	MIN value	MAX value
Safety	Safety system	Security network	Share of data collected through security devices between security representatives and the city	Yes = 1,00/ No = 0,00	1	1	0,5	0	0	0	0	0	0	1
			Source		https://cirb.br	https://www.p email police	interview	email police	https://www.r	email police + li	https://www.d	file:///Users/p		
		Street lighting	Presence of street lamps under automatic management using ICT	Yes = 1,00/ No = 0,00	1	1	1	1	1	1	1	1	0	1
			source		https://smartcit https://www.si	https://www.st https://antwerp	https://stad.ge https://stad.ge	https://www.cl	https://www.li https://www.r	https://smartlig	https://www.m	https://www.l		
	Street safety	Crime rate		#	52526	64426	32862	31690	42986	10753	12154	11286		
			Number of crime rate per 100.000 inhabitants	# / 100 000 persons	28376,63	12173,14	12451,17	15630,39	21685,68	9062,33	12675,34	10128,15	9062,33	28376,63
			Source		http://www.sta	http://www.sta	http://www.sta	http://www.sta	http://www.sta	http://www.sta	http://www.sta	http://www.stat.policefederale.be/statist		
	road safety	Traffic fatalities		#	9	12	10	12	9	6	10	7		
			Number of traffic fatalities per 100.000 inhabitants	# / 100 000 persons	4,86	2,27	3,79	5,92	4,54	5,06	10,43	6,28	2,27	10,43
				100000th of the population	1,85	5,29	2,64	2,03	1,98	1,19	0,96	1,11		
			source		https://statbel.	https://statbel.	https://statbel.	https://statbel.	https://statbel.	https://statbel.	https://statbel.	https://statbel.fgov.be/fr/commune/brues		
Health	Health efficiency	Number of general practitionners	Number general practicionners per inhabitants	GP /1000 persons	1,19	0,96	1,45	0,94	0,91	1,57	0,78	1,09	0,78	1,57
			Source		https://monitor	https://www.g	https://www.g	https://walstat	https://walstat	https://www.g	https://walstat	https://walstat.iweps.be/walstat-catalogu		

Quality of Life standardised	Indicators	Min value	Max value	Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
Safety	Safety system	Security network	0	1	10,0	10,0	5,0	0,0	0,0	0,0	0,0	0,0
		Street lighting	0	1	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0
	Street safety	Crime rate	28376,63	9062,33	0,0	8,4	8,2	6,6	3,5	10,0	8,1	9,4
	road safety	Traffic fatalities	10,43	2,27	6,8	10,0	8,1	5,5	7,2	6,6	0,0	5,1
Health	Health efficiency	Number of general practitionners	0,78	1,57	5,2	2,3	8,5	2,0	1,6	10,0	0,0	3,9

Well-being		Indicators	Calculation	Unit	Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur	MIN value	MAX value
Environmental quality	Air quality	Air quality monitoring	Presence of air quality monitoring initiatives	Yes = 1,00/ No = 0,00	1	1	0	0	0	1	0	0	0	1
			Source		https://influen	https://vito.be/en/news/antwerp-pilot-city-project-air-quality-				https://www.brugge.be/open-data-milieu-natuurMk				
		Annual concertation of $PM_{2.5}$	Annual mean level of fine particles ($PM_{2.5}$)	$\mu g/m^3$	16	14	13	10	9	12	10	10	9,0	16,0
			source		https://www.w	https://www.gc	https://www.gc	https://www.w	https://www.w	https://www.gc	https://www.w	https://www.wallonair.be/fr/mesures/mesures-		
	Green spaces	Share of green infrastructure	Share of green infrastructure	%	21,5	27,53	10,19	14,72	19,38	28,98	22,71	26,75	10,2	29,0
			Source		https://monito	https://data.jrc	https://data.jrc	https://data.jrc	https://data.jrc	https://data.jrc	https://data.jrc	c.ec.europa.eu		
Housing	Housing affordability	Housing Affordability	Number of social housing units per 100 private households	# /100 ménages	9,3	9,52	13,00	10,04	6,15	7,36	7,29	6,63	6,2	13,0
			Total number of social housing units	#		22164	14900	9192	6149	3851	3326	3462		
			Number of households	#		232734	117371	91567	99916	52300	45616	52202		
			source		https://walstat	https://www.vr	https://www.vr	https://walstat	https://walstat	https://www.vr	https://walstat	https://walsta		
	Housing quality	Housing quality	Share of housing build beofre 1970	%	77,54	73,74	70,04	84,08	84,79	63,83	76,04	66,78	63,8	84,8
			source		https://census	https://census	https://census	https://census	https://census	https://census	https://census	https://census2011.fgov.be/data/fresult/dwell		

Well-being standardise		Indicators	min value	max value	Brussels	Antwerp	Ghent	Charleroi	Liège	Bruges	Mons	Namur
Environmental quality	Air quality	Air quality monitoring	0	1	10,0	10,0	0,0	0,0	0,0	10,0	0,0	0,0
		concertation of $PM_{2.5}$	16,00	9,00	0,0	2,9	4,3	8,6	10,0	5,7	8,6	8,6
	Green space	Share of green infrastructure	10,19	28,98	6,0	9,2	0,0	2,4	4,9	10,0	6,7	8,8
Housing	Housing Affordability	Housing Affordability	6,15	13,00	4,6	4,9	10,0	5,7	0,0	1,8	1,7	0,7
	Housing Quality	Housing quality	84,79	63,83	3,5	5,3	7,0	0,3	0,0	10,0	4,2	8,6

A) Interview transcripts

Clement J. - Stratégie et politique publique durable au Smart City Institute (15/06/2021)

[…Explication du contexte de la recherche]

Quel est votre parcours ?

A la base je suis économiste mais après ma thèse chez changé vers le développement durable, et maintenant je suis vraiment focalisée sur la transition des villes durables et intelligentes. Normalement je travaille dans la perspective des politiques donc j'essaie de comprendre ce que les villes font au niveau politique pour entamer leur transition. J'étudie les stratégies, les documents, les indicateurs m'intéressent mais comme il y a peu de donnée c'est difficile de travailler avec ça. J'ai aussi fait un peu de travail sur la résilience des villes au COVID, la digitalisation des villes et l'utilisation des TIC dans la crise et le lien avec la durabilité mais on a pas trouvé un lien très fort entre la durabilité et la crise du COVID. Et je travaille aussi parfois avec des transformation de territoire dans un cadre plus large mais normalement je reste au niveau des villes. Maintenant, je suis en train de travailler sur une étude pour comprendre si les stratégies officielles des smart city contribuent ou pas aux SDG, donc je comprends déjà un peu le potentiel des smart city pour atteindre ses SDG. Et je pense que c'est tout qui est relevant pour l'étude, donc en résumé c'est les transitions durable et intelligente pour les villes et le côté politique. Mais évidemment le coté social m'intéresse beaucoup parce que le but des smart city est d'améliorer la vie des citoyens et de rendre le territoire plus durable, donc effectivement il y a un lien très fort.

Et donc justement quand vous interagissez avec ces villes, on voit souvent que les villes avancent comme premier objectif « l'amélioration de la qualité de vie des citoyens », mais à côté de ça on voit très peu de mesures pour voir cet impact. Donc si cet objectif premier semble si clair, pourquoi est-ce un aspect peu mesuré ? Qu'en penser vous ?

La première chose que je peux dire, je sais qu'un collègue vient de finir un rapport sur le monitoring et évaluation et en effet on a vu que sur le territoire belge il y a très peu de suivi et très peur d'indicateurs mis en place pour mesurer et voir si le projet à bien marché en général mais aussi au niveau des citoyens. Donc c'est pas encore présent maintenant, et aussi le concept des smart city en Belgique, c'est pas nouveau, mais c'est pas rependu non plus. C'est quelque chose qui arrive, avec par exemple le projet de Digital Wallonia, un appel à projet etc., donc la première chose que je peux dire c'est que c'est nouveau et que même s'il y a quelques projets qui ont commencés, ils sont pas souvent dans un cadre ou dans une stratégie avec un suivi formalisé. Après, dans le contexte de la Belgique, pour ma recherche entre la corrélation des stratégies smart city et les SDG, j'ai pris une stratégie, j'ai pris la liste des SDG et j'ai fait un exercice ou je vois si les stratégies correspondent avec les 169 objectifs différents des SDG, j'ai pour le moment fait que 20 stratégies, donc je ne peux pas généraliser, mais en effet pour le moment les points les plus forts avec les smart city et le développement durable c'est l'économie, l'innovation, l'infrastructure et un peu avec le climat. Ce que j'ai vu déjà, il y a un lien très fort avec ça mais pas du tout avec les citoyens, notamment l'aspect de genre, pour le droit des femmes etc., c'est pas du tout présent.

Avec le mémoire que vous devrez faire, quelque fois il ne faut pas oublier que de ne pas avoir de résultat à la fin peut aussi être un résultat. Donc si vous n'arrivez pas à trouver des indicateurs et qu'à la fin certaines données sont manquantes, c'est intéressant car ça veut dire que c'était vraiment difficile de de trouver des informations par rapport à telles ou telles pratiques avec les citoyens dans les rapports etc., mais en même temps vous pouvez faire un lien avec ce problème la et les limites de projets donc ça peut être un résultat. Après c'est aussi possible de faire les recommandations à la fin pour adresser ça à l'avenir et je pense que ça va être super intéressant parce que vous pouvez expliquer que maintenant il y a une tendance à localiser les objectifs de développement durables, donc les SDG, qui étaient fait pour le niveau national, mais maintenant il y a beaucoup de villes qui commencent à adopter les mêmes objectifs mais à l'échelle local, et c'est une tendance qui pour le moment n'est pas du tout présente et il n'y a pas de lien avec les smart city et c'est un problème parce que il y a plein d'organismes, la commissions européenne, la Belgique, etc qui pousse beaucoup les smart city et à la fin c'est peut-être pas lié avec les bons axes. Donc n'oubliez pas que à la fin, il y a quelque chose à faire, parce que si la recherche est impossible il y a un problème. Parce que les smart city disent que les projets doivent toucher les citoyens, les smart people, smart living, smart governance etc. Mais ça commence, il y a beaucoup d'espoirs que les projets puissent être améliorer dans l'avenir, mais pour le moment c'est juste nouveau, il y a aussi peu de compétences.

Goffart E. – Echevin du développement numérique à la Ville de Charleroi (16/06/2021)

[…Explication du contexte de la recherche]

Quel est votre rôle au sein de la Ville de Charleroi ? Comment la Ville aborde cette transition intelligente et durable ?

Je suis échevin depuis 2012, essentiellement des travaux publics et depuis 2018 échevin du développement numérique et des travaux publics. C'était une demande que j'ai formulé moi-même quand on a négocié l'accord de majorité, car quand on a construit une liste citoyenne en 2018, une série de personne sont venues avec de nouvelles idées et m'ont convaincus qu'il était important d'avoir une personne responsable du numérique et de développer une politique à ce niveau-là sur le territoire de Charleroi. Je suis donc devenu échevin du développement numérique mais quel échevin du numérique j'allais être ? C'est vraiment très large. Historiquement on aurait considéré que c'était l'informatique administrative et le fait d'équiper l'administration d'ordinateurs. Aujourd'hui c'est beaucoup plus large, mais est-ce que c'est les Smart Cities avec les gadgets, les capteurs partout en ville qui coutent très chers ou des applications qui sont très vite périmées qui ont une obsolescence quasiment immédiate et qui font un peu de bruit quand elles sortent et puis plus personne ne les utilisent ? Ou est-ce que c'est l'échevinat du développement économique au travers du numérique ? Ça oui certainement. Est-ce que c'est l'échevinat de la simplification administrative au travers de formulaire intelligent et de la mutation numérique de l'administration et du service public ? Certainement.

Mais plus généralement au fil du temps, et le confinement a accéléré ça, mais j'ai considéré que mon échevinat c'était d'abord et avant tout l'échevinat du numérique pour tous. A Charleroi, il y a 200.000 habitants, et on est dans une région ou le taux de chômage est très important, c'est une ville qui a des difficultés en termes de reconversion industrielle et on a des situation de décrochages social qui sont très importants, liés à des difficulté d'intégration, a l'alphabétisation, a l'accès à l'emploi et parfois au logement. Et donc, avoir en plus des

difficultés d'accès au numérique, qui sont aujourd'hui le vecteur unique, parfois, de sociabilisassions ou le vecteur unique d'accès à une série de fondamentaux de la vie en société, le logement, de quoi vivre au quotidien et des services sociaux élémentaires, des divertissements élémentaires, tout ça aujourd'hui passe par le numérique et le risque c'est que les personnes qui ne s'en sortent pas avec le numérique soit dans des situations de décrochage social profond, je dirais même encore plus profond que ce qu'une partie de la société était auparavant. C'est le sujet de votre thèse donc votre mémoire donc vous connaissez les chiffres de la fondation roi Baudouin et de l'agence du numérique, et une partie de la population est en difficulté avec le numérique, soit en situation de décrochage complet, soit dans des situations ou, on est pas en décrochage total mais on a des difficultés à utiliser les applications élémentaires. A Charleroi sur 200.000 habitants ça fait 80.000 personnes, c'est énorme. Donc mon challenge c'est quoi, c'est de faire baisser ce nombre de 80.000 personnes. Et donc au quotidien je mets en place une série d'action. J'ai un programme stratégique, je vais pas m'étendre sur l'ensemble du programme stratégique mais l'idée c'est vraiment d'avancer sur 3 axes qui permettent de faire en sorte d'avoir une action intégrée au niveau de notre territoire à Charleroi sur les fondamentaux de la fracture numérique.

D'abord j'ai considéré que l'humain était l'aspect sur lequel on devait beaucoup plus travailler, c'était l'aspect prioritaire. Tout simplement parce que souvent, quand on pense au numérique, on pense à des Geek, on pense à des laptops et tablette. Et beaucoup se disent qu'ils vont acheter des tablettes qui vont les distribuer et que comme ça on va réduire la fracture numérique. C'est utile mais c'est pas la priorité. La priorité c'est de former les gens. Aujourd'hui on le voit avec la nécessité de prendre rendez-vous pour se faire vacciner ça se fait au travers de plateforme numérique, tout le monde doit y passer, d'abord les personnes plus âgées en plus et on le voit, beaucoup ne s'en sortent pas. Et ça touche pas que les plus âgés, beaucoup de jeunes qui savent sans doute très bien jouer et utiliser des consoles, mais remplir un formulaire administratif ou utiliser des choses un peu utiles pour les parcours personnel ils n'arrivent pas à le faire. Donc c'est transgénérationnel. Et puis surtout, ce qui est important c'est de commencer par l'humain et on a lancé un grand programme qui vise à former des aidants numériques. C'est simplement un éducateur, c'est quelqu'un qui est derrière guichet, c'est un assistant social, peu importe, finalement c'est quelqu'un qui est en contact avec le grand public et qui incarne le visage de son institution. On a travaillé, à ce stade-ci, avec 2 types de d'institutions, le monde administratif : la ville de Charleroi 3500 fonctionnaires le CPAS 2000 fonctionnaires une société logement qui s'appelle la sambrienne et qui gère 10000 logements sociaux dont 10000 familles à priori plus précarisés et puis tout le monde associatif qu'on est en train de mobiliser parce que, avec une visée sociale, il y a beaucoup de mission aujourd'hui qui ont été déléguées par l'autorité publique au monde associatif, subventionnées, mais ça peut être dans le secteur de l'aide à la jeunesse, de l'intégration, des centres de planning familiaux, donc vraiment des secteurs où on est vraiment en contact avec le public les plus fragilisés de la société et donc ceux qui seront le plus facilement sujet à la fracture numérique. Donc l'idée c'est vraiment de former des aidants numériques au maximum parce que c'est public cible qu'on identifie généralement ce sont les femmes seules avec enfants, les personnes âgées isolées, les personnes sans emplois, c'est le public qui théoriquement dans des études universitaires sont très facilement identifiés mais sur le terrain pour aller les chercher c'est assez difficile précisément parce qu'ils sont peu raccrocher à la société. Donc nous notre objectif c'est se dire on va pas lui chercher le directement on va aller former c'est un peu « train the trainer », on va aller former les personnes qui sont en première et qui vont pouvoir aider c'est public. Donc on a mis en place un grand programme de formation qui se déroulera avec la ville de Charleroi, le CPAS de Charleroi et aujourd'hui on est en train de mobiliser tout le monde associatif, avec des financements qui viennent à la fois du privé et du public. J'ai tenu à mobiliser le privé et notamment les banques, notamment le

secteur des nouvelles technologies des télécoms, parce que ce sont des entités qui aujourd'hui bénéficie clairement du basculement numérique. C'est aussi des structures publiques, la SNCB d'aujourd'hui vend ses billets via son application qui est super bien faite, les personnes qui l'utilisent bah c'est ça on doit pas attendre, on a une carte de crédit, on a l'application et voilà, 3 clicks, on monte dans le train, on montre son smartphone au contrôleur et ça roule. Sauf que, il faut une carte de crédit, il faut un smartphone, il faut un abonnement, il faut savoir utiliser tout ça et ça c'est pas à la portée de tout le monde. Et donc, il est important que la SNCB, de mon point de vue, qui est un service public, aide à mettre en place des dispositifs de formation et d'accompagnement pour lutter contre la fracture numérique.

c'est le cas pour le SP finances qui aujourd'hui avec taxe on web incite tout le monde à rentrer sa déclaration fiscale en ligne. C'est le cas de SFP pension, à nouveau, des personnes plutôt âgées isolées, ou simplement âgées, même s'ils ont fait parfois une belle carrière, qu'elles ont un niveau d'intégration socio culturel et socio-économique important, mais pour aller sur mypension.be et voir ce à quoi elles peuvent prétendre comme pension à l'égard de leur carrière, c'est très difficile. Donc les exemples sont multiples et ce qui est important, pour moi aujourd'hui, c'est que moi je suis Échevin à Charleroi donc mes compétences se limitent au territoire de Charleroi, c'est un territoire qui est quand même assez peuplé, c'est une grande ville donc c'est important, mais voilà je ne travaille pas, à ce stade, au-delà des limites de Charleroi. Mais ce qui est important pour moi c'est que, sur notre territoire, les gens aient la possibilité d'être mieux formés et mieux accompagnés pour s'en sortir avec la fracture numérique. Donc on est très ambitieux, on veut vraiment, enfin j'y viendrai par la suite, mais que être leader sur la question de la fracture numérique. On travaille donc beaucoup en la matière.

Cette approche et ambition d'être leader dans le domaine de la fracture numérique, comment s'est-elle faite ? Est-ce que ça rentrait dans une approche long terme de pouvoir entamer une transition Smart ?

Tout est lié. Ce qui est important pour le développement de Charleroi au sens très large c'est que sa population soit bien, on considère au niveau de la majorité que Charleroi à grandi grâce au charbon, à la matière grise et que ça a fait la richesse de la ville à l'époque, au moment de la révolution industrielle on a bien vécu de ça, mais aujourd'hui on est dans une phase de reconversion industrielle et on considère que la matière grise elle est dans la tête des gens. On a pas la chance d'avoir une université à Charleroi mais enfin, on considère qu'a priori les gens ne sont pas plus bêtes qu'ailleurs. Donc on veut vraiment mettre l'accent et le paquet sur la formation, l'accompagnement et notamment, dans le cadre du numérique, alors ici on est sur des connaissances de base pour le grand public pour que chacun et singulièrement les publics de plus fragilisés, sachent se raccrocher au numérique, le train du numérique s'en va et personne ne peut rester à quai, on veut faire en sorte que tout le monde puisse l'intégrer mais à la faveur de cette formation générale de la population, ce qui est important c'est que des vocations puissent naitre. On a becode, on a des écoles de codages, on a des formation informatiques qui sont en train de se développer, l'intérêt c'est aussi potentiellement de raccrocher la population à ces métiers, qui sont des métiers à haute valeur ajoutée, qui nous permettent de rendre notre région plus compétitive à l'échelle européenne et internationale et donc potentiellement attirer de nouvelles industries et de générer de l'activité économique et faire en sorte que cette ville renaisse. Donc ça c'est l'objectif, c'est l'aspect spécifique lié à la formation au numérique en général dans un environnement lié à la reconversion de Charleroi. L'idée c'est de mettre le paquet sur la création de cette communauté en aide numérique, dans le but de sensibiliser les personnes à la fracture numérique.

Ça c'est le premier volet de notre action : formation, accompagnement, création d'une communauté de personnes sensibiliser à la cause de la fracture numérique. Le deuxième axe c'est la connectivité. Il faut que Charleroi soit un territoire très bien connecté. Il y a deux types de connectivité, d'abord on avance en partenariat avec Proximus pour développer la fibre optique le plus largement possible sur notre territoire communal. Et Charleroi est une des villes où ils sont le plus développé dans l'installation de la fibre optique et c'est important parce que notamment pour nos PME, pour une série d'interlocuteurs, il faut pouvoir avoir de la data de qualité, de la bande passante à domicile et dans les entreprises. Mais surtout, au-delà de ce programme qui vise la connectivité individuelle, on cherche à avoir une bonne connectivité grand public la plus large possible. On a un programme de wifi urbain qui est en train de se déployer, qui va permettre d'avoir du wifi dans les espaces publics au niveau du parc, au niveau de l'esplanade, des grandes places à Charleroi, on aura du wifi gratuit accessible à tous. On a en plus choisi des lieux qui sont plutôt fréquentées par les jeunes, pour que les jeunes qui ont des petits abonnement puissent s'en sortir et avoir du WIFI gratuit.

Il est en train d'être installé. On commence par la maison communale, donc ça c'est en intérieur, mais ils sont en train d'installer des boîtiers un peu partout pour pouvoir installer ce WIFI urbain dès que l'ensemble des dispositions sont réunies. La difficulté là c'est qu'il faut avoir l'accord des propriétaires pour mettre les boitiers sur les maisons.

Au-delà de ça ce qui est vraiment intéressant c'est que, à la Ville de Charleroi on a 550 bâtiments qui sont répartis dans tous les quartiers. Parmi ces bâtiments il y a des bibliothèques, des centres sportifs, des maisons de jeunes , donc beaucoup de bâtiments qui sont accessibles au grand public et qui sont localisés pas très loin d'où vivent les gens. Ce qui est important pour moi c'est que ces bâtiments retrouve une nouvelle attractivité parce que il y a un Wi-Fi gratuit et de qualité. Donc quelqu'un qui habite au fond d'un quartier où c'est difficile de faire ses études à la maison, parce que il y a du monde, puisse allez dans une bibliothèque où on va trouver une bibliothécaire qui est une aidante numérique qui fait partie de notre programme et puis surtout on va trouver une bonne connexion. Parce que on aura installé dans notre bibliothèque du wifi ouvert grand public. On fait ça dans l'ordre suivant, bibliothèque, centre de 3e âge, maisons jeunes et puis les centres sportifs et du CPAS.

J'ai prévu pour ça un budget d'un million d'euro par an sur 4 ans. C'est colossal, on aura trop mais j'ai prévu les disponibilités budgétaires nécessaires. Et puis dans un 2nd temps, toujours sur cette enveloppe de quatre million en 4 ans, mettre à disposition des supports numériques pour faire en sorte qu'un jeune qui s'en sorte pas, qui a pas beaucoup de sous, qui doit suivre ses cours en ligne, donc il faut pouvoir se connecter aux plateformes, mais on n'a pas de connexion, on a pas d'appareils pour se connecter. L'idée c'est que, à la ville de Charleroi, il y a une bibliothèque, une maison de jeune, un centre, vous allez pouvoir y aller, trouver de la connectivité, si vous vous en sortez pas, trouver quelqu'un pour vous aider, vous accompagner et vous orienter et si vous n'avez pas de supports numériques, on vous en fourni, pour travailler, monter votre projet en collaboration avec les collègues, donc ça se limite pas aux étudiants. On a typiquement des personnes âgées aujourd'hui qui ont être 65-70 ans, qui sont pas du tout maladroite, mais qui n'ont pas accrochés au train du numérique et elles se rendent aujourd'hui dans des centres de 3e âge. Là si sur place elle peuvent trouver quelqu'un qui peut les aider à utiliser le numérique, créer un profile sur les réseaux, envoyer un mail, des choses aussi élémentaires que ça, enregistrer des photos de vacances, etc. Ce qui est important pour moi aussi c'est de pouvoir créer une communauté où les gens s'entraident. Si on prend les seniors par exemple, il y a des personnes aujourd'hui de 65 ans qui, dans les années 80, ont vu les

premiers ordinateurs, ont commencé à s'y intéresser et donc ils s'en sortent avec l'informatique et que ces personnes puissent aider d'autres seniors, qui dans leur carrière n'ont pas dû s'y intéresser mais aujourd'hui peuvent bénéficier d'une entraide.

Voilà, donc ça c'est le plan, donc premier volet : formation, accompagnement, 2e volet connectivité et 3e volet mise à disposition de supports numériques. Et comme ça on a toute la chaîne.

Comment avez-vous prévu de communiquer ce plan ? Comment engagez-vous les citoyens à prendre part à vos 3 axes ?

Donc moi j'ai présenté ce plan stratégique le 8 décembre et donc le 8 juin, il y a une semaine, j'ai fait un point au niveau du collège communale sur 6 mois de mise en œuvre. C'est moi l'échevin du numérique, donc c'est moi qui pilote, mais je fais ça en collaboration avec l'échevin du 3e âge, l'échevin de l'enseignement et de la formation, le président du CPAS, l'échevin de l'égalité des chances. Donc mon objectif c'est d'embarquer tout le monde avec moi, parce que ce genre de plan général ne plus réussir que si on a le concours de ceux qui finalement au quotidien s'occupe des publics cibles que moi vise.

En terme de communication des actions concrètes, on a déjà formé 50 aidants du numérique en interne, on a lancé une dynamique ou les inscriptions sont en train d'être prises, on va lancer des sessions d'ici au mois de septembre, on a obtenu des montants importants de Belfius pour financer des éléments numériques dans le monde associatif, etc. Donc on communique au fur et à mesure des bonnes nouvelles parce que le programme se construit semaine après semaine.

On communique au maximum, mais le plus intéressant, c'est qu'on va faire un salon de l'inclusion numérique, et on lancera ça au mois de novembre. Parce que en réalité, de fil en aiguille on a découvert plein de choses, et que en réalité des projets pour lutter contre la fracture numérique il y en a plein, qui se déployer dans plein de villes et d'associations et que donc que ça servait à rien de tout inventer. Ce qui est important pour moi c'est de coordonner toutes les bonnes initiatives et faire en sorte qu'il y ait une mise en contact de toutes les bonnes idées et donc l'idée d'un salon c'est justement ça. Il y aura des prises de parole, des stands avec des entreprises, des administrations, des associations qui viennent expliquer ce qu'elles ont fait pour lutter contre la fracture numérique.

Donc la dessus on va essayer de communiquer le plus possible, pour sensibiliser. Mon mandat cours jusqu'en 2024, donc après cette année il en reste 3, ce qui est important pour moi c'est de faire en sorte que, d'ici là on sache que Charleroi s'occupe de la fracture numérique et que on soit reconnu pour ça et pour qu'on puisse aussi diffuser les meilleures pratiques.

Cette année on fait un salon, en 2022 on fera un grand congrès, qu'on fera avec des acteurs, notamment la Fondation Roi Baudouin, et d'autres chercheurs qui vont identifier les meilleures pratiques et voir comment on peut les mettre en avant, commente on peut les publier, etc. Et notre public cible ça sera vraiment toute la Belgique francophone. Donc l'objectif c'est que, à Charleroi, puisse se rassembler ceux que la cause intéressant en Wallonie et à Bruxelles. Voilà donc, qu'on puisse rassembler autour de cette cause toute les meilleures initiatives et je suis assez convaincu que ça va vraiment bien marcher parce que c'est une cause qui aujourd'hui est importante et présente pour tous.

Je m'intéresse aussi aux outils numériques mis en place, comme l'open data, l'e-guichet, une plateforme collaborative. Charleroi n'a pas développé beaucoup de ces initiatives. Pourquoi ? Est-ce dans les plans futurs ?

Je pense que vous l'avez bien compris mais pour nous, l'intérêt c'est de mettre l'humain au centre, parce que au final, l'informatique c'est pas quelque chose de compliqué. Le fait qu'on ait pas une plateforme open data c'est vrai, on est en réflexion pour mettre en place une stratégie globale open data. Il y a des ville, comme Namur ou Lyon qui s'y sont lancé il y a des années en publiant énormément de jeux de données mais parfois ils sont publiés pour le plaisir de mettre en ligne mais derrière sans grande réflexion quant à la pertinence de leur utilisation. Donc parfois quand on évalue l'open data on se rend compte qu'il y a beaucoup de data mise en ligne qui ne serve à rien. L'open data pour l'open data n'a selon moi pas beaucoup de sens, il faut pouvoir se donner un objectif. Par exemple développer une politique open data par rapport à la mobilité, l'environnement, avec des jeux de données qui sont fiables, contrôlé et intégré parce que on poursuit un but derrière et le grand public le sait. Donc oui, on est en réflexion la dessus.

Plateforme collaborative, il y en a une qui est en train d'être mise en ligne mais notre objectif est d'abord de s'assurer que les gens aient la formation nécessaire pour l'utiliser, sinon ça n'a pas de sens. Pour parler en terme d'expérience, tout le monde pense que il faut de la participation citoyenne, que les gens veulent, mais non, la participation citoyenne c'est exigent, ça veut dire qu'on doit apprendre, qu'on doit s'intéresser, qu'on doit passer du temps et prendre patience parce que les dossiers publics sont soumis a certaine contrainte qui fait que ça prend du temps. Donc y a une forme d'éducation là derrière, s'il y a pas de suivi et rien derrière c'est juste pour faire de la com. Donc si on est met une en place, on veut d'abord s'assurer qu'il y ait un suivi derrière pour que quand on la lance elle soit utilisée massivement. Et que derrière la réalisation de certain projet soit réellement soumise à l'utilisation de cette plateforme, mais ça veut dire que derrière il faut des gens qui soient capable d'utiliser cette plateforme.

Étant donné qu'il n'y a pas encore de plateforme collaborative, où les citoyens peuvent proposés des projets, au niveau du budget, est-ce que pour le moment il n'est consacré qu'à la réalisation de ce plan en trois axes ou est-ce que à côté de ça d'autre projets sont mis en place?

On envisage d'entreprendre des projets plus smart mais ce qui est important c'est une forme de ROI et de bonne gestion des données publics. Pour reprendre mon autre compétence, je suis échevin des travaux publics depuis 9 ans et y a encore aujourd'hui des quartier qui n'ont pas d'égouttage, des quartiers ou les voiries sont catastrophique, je consacre tous mes efforts pour rénover ces espaces et en faire des lieux de vie beaucoup plus accueillants. Ça prend beaucoup de temps, d'énergie et d'argent. Je ne pourrais donc pas aller dire à des habitants de ces quartiers qu'on ne met pas d'égouttage chez vous parce que on va mettre des capteurs smart en centre-ville, pour en plus des objectifs pas assez bien défini. Je pense qu'il y a aussi une grosse industrie derrière tout ça et qu'il ne faut pas se laisser avoir. Il y a beaucoup de gens qui veulent gagner beaucoup d'argent en vendant parfois des choses un peu gadgets qui ne garantissent pas une utilité public réelle et les montants qu'on va consacrer à ça, on ne les consacrera pas à des choses plus élémentaire, rénover les quartiers etc. Je suis tout à fait ouvert à des projets intéressants, qui sont pas toujours les plus couteux évidemment. Je ne cherche pas la médaille smart city, par contre si on me fait la démonstration qu'un projet vaut la peine en terme de mobilité ou qualité de l'air, et que en terme financier et d'utilité public y a un véritable retour, que c'est quelque chose qui sert quotidiennement au gens ou à l'autorité public, alors oui tout

à fait. Mais c'est pas si facile, y a beaucoup de gens qui entreprennent beaucoup de choses mais peu sont capables de démontrer.

Rosseau B. – Agile & Open city coordinator for the city of Ghent (06/07/2021)

[…Context of the research]

What is your function at the City of Ghent ?

My function is that I'm managing the data information unit of the Ghent City Council, so we are a team of about 20 people and we do the statistics the shield data, open data, information management, etc. So now we're in a in a big operation to become more data driven as an organization so that's challenging, especially now with corona because we have to monitor the data every day of how many people were infected, where they are and so on. So that's one part of the job and then for 12 years I'm active in different European projects based on data and digitalization, that's where the smart city comes in and in that capacity I was also very active and still in the euro cities network, that's a network of European cities and there was a branch called a knowledge society forum where Ghent, together with cities like Barcelona, Helsinki, Rotterdam, Amsterdam, Lyon, we worked together on division on how the smart city work for city governments and not just for the companies and there we also introduced the concept of human centered smart city, because before it was quite dominated by technology.

Then we three years ago and you mayor started forward to with a team of vice mayor's and we released a policy brief on "More than a smart city" so in Dutch it says "Better then slimme stad" and there we explain how we see the evolution of a digital city and its a cocreation and without limitations, so those are the key elements.
And we don't have a separate smart city strategy because we think it should be part of your overall strategy. Because we notice that smart is good to focus on certain aspects but it's hard to maintain. That's in shorts where I'm from and my experiences in the field

I have actually some more precise question regarding citizens participation in the projects in general. What is your approach ? Is it more like top down bottom or bottom up or is it both ways ? I saw that you have a lot of participative tools (citizen budget, collaborative platform, crowdfunding, living lab) So how do you work with all of those tools?

How do we work with this? Very carefully because it's true that we have different tools but the tool is for me detail because we notice that you need to be credible in order to have a significant interaction and cocreation. People have to believe and trust you as a government that you will do the right things with it and that it's not just an exercise to say "Yes we organized participation" and then you do something. It's also that the idea of involving people was did not originate from the smart city strategy but was something that came from before that became that came more from the urban planning sides, how you create livable neighborhoods, etc. So we grew on that and then we added a digital layer because we found out that people are willing to talk, not just about where the parking places or the trees should be, but they also have very good ideas on how to develop a city in a digital and inclusive way. So those talks happened more during our open data events where we have those young digital creative people.

We also notice that when you have digital tools you can use those tools in other fields, like urban planning, mobility which was a big issue in Ghent, to prepare for the physical meetings.

An important point is that they still will never replace the value of meeting somebody face to face. So you need different tools depending on the context, how difficult it is, how much money it costs, how much human efforts it costs to maintain everything, etc. So there's no one tool but it's just using what's there and we also look at other cities, what's their experiences and they are actually quite similar. So you can use a tool but you have to maintain the tool and you have to be very careful, especially on a platform to make sure that the rules are very clear, to avoid trolling etc.

When you use those tools and you call citizens to propose some projects, is it completely free or do you have specific theme that you want them to focus on ?

Well it's difficult because you have to filter. It's not so much the topics but about what they should add to the city, it cannot be for one company or one group. So those guidelines should be very clear. Topic wise we noticed that, we very strongly believe and participation, but project will never present itself fully formed. So it's people saying : "this is a problem and maybe there's a solution there" but you need this process to mature into something that is feasible. So that's on the smart city digital part of it. To me it's more of maintaining a continuous dialogue, that you can meet with people and be very open and transparent. It's not clear cut process.

On the other hand, when we talk about these neighborhood budgets and citizen budgets, that is quite clear but you still have to be careful. So to me, the guidelines are more important than the topics. We started, I think 15 years ago or maybe 12, that we had this crowdsourcing called "My digital idea for Ghent" and to be honest the new ideas are not coming from this crowdsourcing. So crowdsourcing can help prioritize, that you can see what do people think is important.

To be honest when you ask people for ideas, they will say "I need this" "I need that" but they won't say "I want to digitalize this or that".

So you use these tools to maybe try to see what projects would be more impactful for people, more than just to have ideas? It is more to gather the general opinion of the citizens about projects ?

Yes, also. I'll try to give an example : in Ghent the way we organize participation is very neighborhood centric. So Ghent is divided in 25 neighborhoods because that's very recognizable for people, they feel an attachment to their neighborhoods and that's the basis of the participation. And the people who are managing and coordinating this process, they know "these are the topics for this neighborhoods". So those topics are established there and tried and proven process of how to involve people, how to be credible and how to prioritize. And then we can come from the digital part to say "Ok, if you use this digital tool or you add that components, you can reach more people or it can go faster or you don't have to wait between two meetings and to gain information". So the digital is supportive of existing processes but it's very hard to organize the process as a whole because that is very marketing like.

By using this maybe neighborhood centric approach, do you think that it's help you to increase diversity in citizens who propose projects and participate ? Because as you said, on platforms in can often be young people, that are digital natives, that are more comfortable with all these technological tools, etc. So do you think it helps you to increase this diversity in citizens ?

I'm not sure. We also know that the they call it the participation paradox. It's the people who have time, who have money, who are predominantly white and little bit on the left or center, that are willing to participate. And people who are not falling into that category will demonstrate. And digital won't help this because it's not that the image of the city will change because it's a digital interaction. For me and especially for the colleagues who are working on the solution to be more inclusive, it is not in finding new tools but a reputation management. That you go to those key people, in those areas or groups, to say it's important for you too.

I do believe that you have to do everything you can when you create digital tools, that you don't build an extra barrier. So that it's easy accessible also for older people etc. So the digital can enhance a problem but it's never 100% solution.

What is according to you the biggest obstacles that you have when implementing a project ?

I think technical aspects and budgets. With technical aspects I mean that a lot of the digital smart projects are based on data sensors and it's quite expensive. The sensors as such can be quite cheap, when you looked at a projects like there is this project, so in the Flemish region it is a project where people can build something or buy something, they put it near the window and they count cars and bicycles. And this is uploaded to a service so there is different points all over Flanders. You have similar things in Germany on air quality. So the sensors as such are quite cheap but then you need to capture the data on the central hub or platform and you need to manage and organize this. That's where a lot of those projects stop because you have something for the duration of the project and then once the project is finished the whole technical backbone is gone as well. It works when you have like 20 sensors and you can do this on a laptop but once you go on a bigger scale you need heavy investments. Also that solution from company A is not compatible with the solution from Company B, so there's a lot of technical issues to be tackled there. We are now in the process, also other cities are doing this, like regardless what's happening we now understand what needs to be there in order to grow and mature those projects. The second thing is skills, not just with the citizens but also with the civil servants because not everybody is tech savvy but I feel that this is changing quite fast. The third thing is : what's the added value of a digital project ? How do you measure a difference ? So there's the technical aspects, there's the skills and there's the relevance.

And regarding this measurement, do you have something to measure the impact of your projects ?

We try to do this in advance to say : when we do this, we want to achieve that and that but there's not a lot of KPIs. We have KPIs on results, we have KPIs on effort because in a government contexts it's quite hard to prove the effect of something. So we identify the goals and we try to validate and achieve these goals. Like we have a project that wants to use AI to go through the City Council papers and the sessions, to recognize what it is about, and then we want to present those in a searchable way to citizens City Council members. We had interviews with all those people to see what they expected from this so that's our standards that we want to achieve. There are also some international standards on how to do this in a technical way and so on.

Regarding the those sensors you were talking about, one dimension I am looking at is the ecological well-being of citizens. You talked about air quality monitoring and I saw that you have a on your website air quality plan. I was wondering if you were using sensors ?

Well, it's very high on our wish list because we have budget issues. We are working on a plan together with other cities to calculate the cost because if you have the sensors : what's the average lifespan of a sensor ? How soon you have to replace them ? Then there's this whole debate which engineers : how calibrated those sensors need to be ? And this is a very interesting topic for me, to make distinction between. You can have air quality sensors that say: green, yellow, red; quite simple, it doesn't need to be calibrated at all but when I talked to the people from the climate departments, the engineers, they found those data useless because they want to know how many micrograms, etc. So we need to be very clear, when we have that sensor network, is it for sensibilization, is it for measuring impact results or is there a good combination, that you have some calibrated sensors on key spots and then you can enrich that information with a lower grade sensors. That's one part of the equation, the other part is that Ghent is very long, so how many sensors do you need and how do you create a dialogue with public about the right place to put the sensors. Because not everybody trust the government and they say : "I know why you put the sensor in that street because there's no cars there and 50 meters down there's a big crossword". So you have to explain why you choose those locations. So the plan is there and that's the colleagues from the climate department but we are helping them with let's say, when you have the sensors how you roll them out, what is good technology, what is a good mix between the scientific sensors sources and the do-it-yourself sensors, how do you break all the data together in a technical way. Then how are we going to use that data, is it just to show color or are we looking for correlations.

And do you use sensors for other areas, like safety or traffic monitoring ?

On chosen spots there is traffic monitoring because mobility is a very high priority in today's City Council, especially like keeping cars as far away as possible from the city center. So on our open data portal you can see a lot of mobility data : the occupancy of the parking garage, the average speed on the ring road, so we use sensors there. We have some cameras, but that's very debated, on some hotspots for illegal littering and also to monitor the business. With the corona and when the shops were open again we needed to measure how busy the streets were in order to say : we need to close the streets, etc. We experimented a new technology with a company and they were measuring disturbances in an electromagnetic field so we use that as well and we also use telecom data with Proximus and they tell us how many phone signals they are picking up at a given days, at different times during the day, etc.

So would you say that's the kind of the priority for Ghent would be mobility ?

Well, we have 12 vice mayors so there's different prior priorities but when we talk, mobility, sustainability, equality and poverty is a big chunk and digital is also a big chunk. Mobility is important but it's also very sensitive subject because the policy is to make to make people aware that the car should be avoided as much as possible and a lot of people react very hostile towards it. For example, some parking places are going to disappear to make room for some trees and that's a very heated debate.

de Vreese B. – Data management coordinator for the city of Bruges (05/06/2021)

[…Context of the research]

What is your role within the city of Bruges and what is the vision of Bruges regarding this smart and sustainable transition ?

I am a technical person in the smart city, my function title I am a dataminer, I am also de coordinator for the data of the city of Bruges. Since 2018 there is a part of it that is, in a more marketing terms, call smart city. We have a smart city strategy, mission and vision.

We went at the smart city congress and the mayor of Singapore said “I am the mayor of a rather small city of 5 million inhabitants…” and that put our vision of a smart city in perspective. If Singapore is rather small what is Bruges in comparison.

We have the SDG in mind and we selected three main topics as a focus point which are : mobility, climate, citizenship. Besides the SDG we see another theme where we want to be a leader and that’s for culture and heritage.

How did you decide to focus on those topics ?

We have beleidsnota, every legislative has its own nota where the key points they are going to do in the next six years. So we talk with a lot of schepen. For us smart city is about technology, innovation and sustainability. So it was decided with all representatives of the city (top-down) and then we defined action points for each. So it’s not from a technical pov that we chose this aspects, we are going to work on every aspects but we have some aspect where we see some possible evolution or where we already have some projects and it will be easy to implement technologies.

We work with subsidies from different partners (interreg, scifi, horizon Europe).

We have a gamification project around mobilizing everybody to enable them when they have to take public transport or bicycle, it’s between 0 and 7 kilometers, so it’s a citizen participation project.

Is it the only citizens’ participation tool you have ?

Yes we have a collaborative platform. There is the possibility to put some ideas for the city and to work together.

And the project you mentioned does it come from the platform ?

It’s a combination. It’s a top down and bottom up approach. We have local entrepreneurs who come with ideas, that search for some funding to do a poc (prove of concepts), we have some students who come and give some proposition, we have citizens, we enable it during some workshops, we also have a yearly event call “city hacks” where students of the different schools come together and work around topics (voir coffee hacks).

2019 was about measuring culture and the different aspect of measuring culture aspect. This year (2020) was about sport and the year before was about food waste.

So you chose the topic and then people come with ideas ?
The topics come out from our strategy, we look in it and we take each year another topic that has a place with the goal we see.

You try to have a transversal approach regarding the SDGs and take care of each of them ?
Yes that's a good translation of what I meant.

And regarding these participative tools, do you also look at diversity, to make sure that everyone can participate ?

In every aspects of the thing we do we have a reflection on the type of users we are talking with, we have persona cards for every projects. We try to collaborate with everybody but that's not always easy to get everybody on board. At this moment we have a big project about the digitalization of our website, which is not really a website it's more a whole thing with a website, an app and so on. And we have a group of 40 people from each department of the city and a lot of them have something to do with the social aspect and the different social status of the citizens. So it's in our process to enable them to work with us but it's not in every poc or in every innovation project that we work together.

And what are the biggest obstacles for them to participate ?

It's a difficult question for me to answer because I'm involve with everything so I know the social aspect is really important but how they get involved in it I don't know because I look at it from a technical point of view. But I know it's not always easy to get citizens. In our organization there are some people who have disabilities (blind or deaf) and in our project intern we always make sure that they are around the table to see if what we do also work with their disabilities, digitally and not digitally, but with citizens if we do interrogation about different project we always make sure that they are from every different social economic group.

Do you have surveys for citizens to give their opinion ?

Yes we have, we put them on social media, in the info office, etc. We ask a lot from the people, the feedback is always interesting for us because we always have some value out of it.

Safety : do you have some projects to increase safety, surveillance camera, smart lighting, sensors or captors ?

We have a lot of cameras but they are from the police and we don't switch the data, so we don't use the data from the police to do some project. So it's from safety but we don't use it.

Maingain F. – Echevin de la Smart City de Bruxelles and Liebens C. – Juriste et conseillère politique chez Cabinet de l'Echevin F. Maingain. (29/06/2021)

[…Context of the research]

Quelle est la place de la durabilité sociale au sein de la stratégie smart city de la ville de Bruxelles ?

Liebens C.
Je pense qu'on essaie de mettre un aspect social dans beaucoup de nos projets en fait, même si certains projets de premier abord, par exemple on est en train de travailler sur le développement en 5 ans d'un quartier énergie positive, on inclut en fait les citoyens justement dans le processus

on essayera d'avoir des consultations populaires, bon à petite échelle, parce que on a aussi été un peu embêté par le covid, mais on fait des réunions virtuelles avec les citoyens. On a aussi un gros projet qui est qui va sortir en fait justement qui est une plateforme justement de participation citoyenne, donc qui sera vraiment orienté avec des votes, un forum, etc, pour que les citoyens puissent donner leur avis sur justement les initiatives pour la ville de Bruxelles. Et pour revenir sur les projets qui n'ont parfois un peut rien avoir je pense, notamment on est en train de tout à fait reformer l'architecture informatique de la ville de Bruxelles, et en fait on a prévu aussi des accompagnements pour les citoyens qui justement, eux, auront accès à tous leurs documents informatiques etc chez eux, mais on a prévu évidemment ne pas laisser dans le noir entre guillemets ceux qui vont pas savoir comment utiliser ces outils ou qui vont avoir des difficultés à comprendre comment notre nouvelle fonctionnalité se mettent en marche. On prévoit des ateliers, notamment cet été, d'inclusion numériques, ça on travaille depuis plusieurs années avec ce genre d'atelier.

Aussi au niveau de de l'emploi, monsieur Maingain est aussi échevin de l'emploi et on a certaines ASBL qui font aussi des ateliers d'inclusion numérique, plus centré beaucoup sur l'emploi, comment faire ses recherches d'emploi en ligne, etc. On a aussi un incubateur justement de formation plus nouvelle technologie pour les jeunes qui viennent d'un public fragilisé qui va se mettre en place.

Donc on a pas mal de choses qui sont en fait en cours, parce que ce sont des initiatives qui prennent pas mal de temps en Smart city.

Maingain F.:
Ce qui est intéressant en fait c'est qu'on a des actions concrètes sur le 5 piliers que vous avez cité. Donc dans la stratégie on englobe les 5 piliers dont vous parlez. Donc la vision de la ville sur le Smart City c'est vraiment cette vision d'abord porté sur le bien-être du citoyen, donc qui va revenir à cette définition de la durabilité sociale, dont vous parlez, avec utilisation de nouvelles technologies pour améliorer leur cadre de vie et pour faciliter la vie et avoir aussi cette vision plus durable dans la gestion des ressources de la ville. Donc c'est là-dessus qu'on a bâti notre stratégie et notre vision et du coup c'est vrai que ça se décline dans toute les politiques en fait, de manière extrêmement transversale. Un gros projet c'est la refonte de notre architecture informatique et de notre contact avec le citoyen tourné vers les nouvelles technologies avec un pôle très important sur la fracture numérique parce qu'on voit à quel point il y a une déconnexion importante. Donc tout miser sur les nouvelles technologies digitales se seraient exclure d'office une partie de la population. Le 2e axe qui peut retrouver votre sujet d'étude c'est cet aspect gestion énergétique mais au profit des gens et je crois que un projet qui est le plus représentatif c'est effectivement le projet de quartier énergie positive qu'on a établi dans le quartier nord où on profite d'une rénovation de **logements sociaux**, pour amener une politique de gestion des ressources et notamment d'isolation et de gestion de l'ensemble des ressources énergétiques, pour essayer d'abord et avant tout de faire diminuer la facture dans les logements sociaux. Aujourd'hui dans les logements sociaux la moitié de la facture envoyée par le logement social c'est pas le loyer, c'est les consommations d'énergie. Donc il y a vraiment cette volonté de venir avec ce programme, avec un projet européen qui nous accompagne avec cette vision sociale. On veut un impact concret sur la vie du citoyen. On a sinon parfois tendance à développer les outils qui peuvent être gadget si je puis dire en Smart City. Le coté social on va le retrouver sur l'aspect **sécurité**. On travaille a améliorer le suivi judiciaire dans un certain nombre d'interventions de police. Il y a un aspect social très fort parce qu'on sait aujourd'hui il peut exister des tensions entre la population et la police donc ça permet aussi de remettre dans

le contexte global d'une intervention policière d'éventuelles la contrôler derrière. Donc c'est un outil d'apaisement social qui est visé par rapport à ça.

Donc on essaie vraiment à chaque fois de décliner cette politique Smart city en se disant qu'est ce qui a un impact concret sur la vie du citoyen et donc elle n'a pas social sociétal fort avec cette vision de durabilité, qui est aussi l'amélioration du cadre de vie. On a aujourd'hui des politiques qui permettent de mesurer la **qualité de l'air** et ça c'est une manière tout à fait participative. Je peux par exemple citer curieuzenair, partenaires avec la région mais c'est ça, c'est débloquer des outils de contrôle de la qualité de l'air, chez les habitants, avec un volet extrêmement participatif. Sur le pôle **gouvernance**, outre le gros travail qui a été fait sur la transparence de l'administration avec un site internet qui reprend le maximum possible d'information, il y a la plateforme open data qu'on va continuer de développer dans les années qui viennent.

Et la plateforme open data justement c'est une plateforme qui est directement reliée à la région Bruxelles-capitale ?

Maingain F.:
Il y a une plateforme propre à la ville et une propre à la région et on fait communiquer les plateformes pour qu'elles travaillent ensemble. Notre enjeu principal maintenant c'est l'automatisation des données qui sont dessus. Les données étaient générée par la cellule smart city, on est en train de procéder à une refonte de notre plateforme pour permettre l'automatisation de ces données et faire en sorte que la plateforme soit une vraie mine d'or en terme de donnée qui pourront être exploitées par les entreprises et les citoyens.

On est convaincu que les métier du digitaux et la formation au digital sont des sources d'emploi durable pour Bruxelles. On sait qu'il y a des poches d'emplois incroyables qui sont développées et développables dans cette économie la donc on a besoin de créer cet écosystème avec des start up dans le domaine du digital et les formations qui vont avec pour permettre aux citoyens d'y accéder.

Liebens C. :
On est toujours à l'écoute des projets des citoyens, ils nous contactent pour proposer des projets et à ce moment-là on les dirige vers la cellule smart city, si on peut les subsidier et que le projet nous parait tenable et intéressant on essaie de le faire. Donc on écoute aussi les projets des citoyens, pour les citoyens.

Donc vous allez mettre en place une plateforme collaborative, qui couvrirait les 3 aspects de la collaboration citoyen ville, information, sondage et collaboration. Avez-vous aussi comme projet de mettre en place un living lab ou un lieu où les citoyens peuvent eux-mêmes entreprendre cette transition ?

Maingain F.:
La plateforme va venir apporter l'utiliser des TIC dans la politique de participation citoyenne. Conseil de quartier qui permettent la co-création de projet par les citoyens. Cette plateforme va donc venir en support numérique à cette participation beaucoup plus large. Donc on retrouve ce but, partir du citoyen et utiliser ces nouvelles technologies pour faciliter tant l'information que la participation.

Comment avez-vous identifier les challenges et les domaines à couvrir dans les dimensions de la durabilité sociale ? Avez-vous un moyen de mesurer l'impact de vos projets ?

La vision multidimensionnelle c'est parce que on a voulu une politique transversale. C'est la première fois qu'il y a un échevinat de la smart city à Bruxelles mais quand on a construit notre programme, on a réfléchi smart city, dans chaque pilier et dans chacune des compétences des échevinats, c'est pour ça qu'on a un aspect quasiment complet des compétences de la ville et donc de l'intérêt des citoyens parce que dans chaque compétence on a réfléchit comment intégrer les TIC pour améliorer le bien-être des citoyens et la gestion des ressource. L'enjeu c'est de le mesurer. Là on est en train d'établir un plan Smart City qui sera transversal sur l'ensemble des compétences avec des indicateurs et des actions concrètes, ce qui permettra de mesurer les actions qui sont faites. Il y a un rôle de coordination pour s'assurer que dans chaque compétences chaque échevin rempli la mission qu'on lui a donné et agisse sur les compétences qui sont les siennes pour remplir l'ensemble de ces piliers. Ce plan est en cours, je ne sais pas exactement le moment quand il sera fini mais ça sera plus ou moins fin 2021 car ça prend quand même du temps parce qu'il faut changer les mentalités, effectivement c'est le premier échevinat de la smart city donc pas mal de projet se font en silo donc c'est aussi à nous de venir parler avec tous les départements pour interviewer, demander le besoin etc. et maintenant ils sont en train de rédiger une stratégie qui comprend tous ces piliers, et pour mesurer ou à tous les deux ans des indicateurs qui sont remplis par la cellule smart city, donc très quantitatif (ex : nombre de personnes qui ont accéder à telles données etc.) et on se base sur ça pour voir un peu ou on en est par rapport à ces objectifs.

Est-ce que la stratégie SC et les objectifs de la ville de Bruxelles se différencient un peu ou rejoignent complètement la stratégie de la région BXL capital ?

La région a défini sa stratégie après la nôtre. Maintenant on travaille en collaboration avec eux. L'enjeu de la région c'est surtout de fournir des outils aux communes. Mais elle ne fournit pas une stratégie aux communes, elle fournit plutôt les outils. Là où les collaboration vont être plus forte ça sera plus sur la simplification administrative car la vision sera plus coordonnée entre les communes. Ici l'avantage de la ville d'avoir eu 2 ans d'avance sur la conception de la stratégie c'est que on a pu lancer notre politique donc elle est coordonnée dans le sens où ils sont au courant de ce qu'on fait, nos équipes et outils collaborent mais aujourd'hui la stratégie de la région vis-à-vis des communes c'est de fournir avant tout les outils. Mais par contre ils appliquent eux même une stratégie SC dans la gestion de leurs compétences (mobilité, parking, etc.).

Par rapport à la participation citoyenne, avez-vous a un moment ressenti des obstacles/limites par rapport à l'implémentation de certains projets vis-à-vis des citoyens ?

Le principal obstacle de la participation citoyenne c'est la capacité de participation, tout le monde ne maitrise pas les outils, ça a été un vrai frein extrêmement important. Quand les écoles sont passées en digital on a dû fournir des ordinateurs, et aussi des clés USB pour fournir la 4G u 3G, donc il y a une croyance général que tout le monde à accès à internet mais c'est pas le cas. Le deuxième frein, on le retrouve dans la participation direct et indirect c'est d'avoir un public représentatif. On a souvent des public socio économiquement plus élevé et éduqué qui sont extrêmement participatif et impliqué dans la gestion de la cité et puis on a des publics complètement absent dans les prise de décision et dans la participation. Donc là on a un réel enjeu de représentativité pour avoir quelque chose qui tienne compte de l'intérêt de tous les citoyens.

Et donc c'est deux freins sont très liés. Qu'est-ce que vous mettez en place pour contrer ça ?

C'est pour ça qu'on a pas basé toute la stratégie là-dessus, les TIC c'est un outil qui vient appuyer la stratégie participative. L'échevin de la participation à créer par exemple un vélo babelaire qui va sur la place public et qui va venir interagir les citoyens au plus près. Donc c'est utiliser tous les différents canaux, y compris ce numérique pour toucher l'ensemble des citoyens pour avoir une participation la plus large possible et qui prend en compte l'ensemble des citoyens.

Au niveau de la fracture numérique, quelles sont vos stratégies ?

Là c'est une politique qui a été portée par la région. On a pas recréé un WIFI de la ville, il en a existé un dans le temps, parce que la ville était précurseur à la région et puis il a été considéré qu'il serait plus utile d'avoir un opérateur et de confier ça à la région. On continue à le faire et on croit aussi que la bonne manière de permettre cette inclusion numérique c'est d'avoir des lieux où il y a un accompagnement. Donc pas seulement un réseau WIFI mais aussi avoir des lieux avec de l'aide. On essaie donc de démultiplier nos espace public numérique (EPN), vous avez accès aux technologies (salle d'étude avec ordinateurs) pour avoir un accrochage et un accompagnement. Parce qu'on pense vraiment que c'est par la formation qu'on sera capable de réduire ce gap de la fracture numérique. Une croyance général c'est de penser que la fracture numérique n'est qu'une question d'âge. Mais on se rend compte que c'est faux, c'est pas parce que vous savez utiliser votre smartphone et regarder des films en ligne que vous serez capable de faire une démarche administrative en ligne. Donc il y a un enjeu des maitrises des outils numériques, etc, et donc tout ça nécessite un accompagnement donc on essaie de créer des lieux accessibles à tous et de les démultiplier, parce que il en faut beaucoup. Mais quand vous allez on vous accompagne. On la fait dans les bibliothèque, ils ont mis des EPN dans les bibliothèques et ils ont formé le personnel à accompagner les gens.

Donc vous avez également une approche « train the trainer ».

On a les deux. On propose également des formations, surtout dans le secteurs de l'emploi, via le CPAS aussi.

Donc au final, votre stratégie s'inscrit dans quel pillier ?

Clairement le pillier social. C'est une premier d'avoir cette vision un peu transversale donc ça nous intéresserait aussi de voir vos indicateurs pour savoir si on est pas dans le gadget. Mais je ne pense pas que c'est le cas, car vu les projets qu'on a lancé, ça fait moins de bruit parce qu'on essaie d'avoir la technologie dans le fond.

Stoop R. – Head of department in Strategic Coordination for the city of Antwerp (25/06/2021)

[…Context of the research]

En effet, au début je pense que le thème environnement était predominant, la mobilité aussi, mais je crois que c'est plutôt un aspect de budget. Au niveau de EU, l'environnement etc. est très important. Donc les villes qui cherchent de l'argent pour mettre en place des projets smart

city, prennent les thèmes là où il y a des subsides disponibles. Ça fait un peu le choix de thèmes pour les villes, mais il faut aussi prendre compte que toutes les villes ont une sorte de stratégie smart city mais il y en a peu qui ont implémenter beaucoup, c'est seulement des petites choses à droite à gauche, pas plus que ça. Donc je ne sais pas s'il est déjà intéressant de mesurer ces projets.

En fait mes indicateurs, ça n'est pas vraiment le nombres de capteurs où le nombre d'application développées etc, c'est plutôt ce qui est disponible pour le citoyens, par exemple une plateforme open data, un e-guichet, un budget participatif, etc.

Oui je comprends. Dans ce cas c'est plutôt une stratégie de digitalisation du service public. On prend ça un peu différemment que la plupart des villes. Pour Anvers on a mis en place déjà beaucoup de chose. Ok I'll tell you in English. So I think the PS, which is also document etc, it has taken a step beyond, especially with COVID. We also know that in Antwerp a great that part of our citizens are socially poor, we have a lot of different nationalities, so what we try to do is that we put in place what we call "Digital social inclusion". There is a lot of discussion about it because, five years ago if you had an app on a smartphone it would have only been for 5% of the population, people who work etc, but nowadays, we know that around 70% have a smartphone so if you have an app, it covers a lot of people and especially. We also tried to identify the groups that were more at risks. Another thing that we are trying now is the UX (user experience). Because, before, the digitalization of administration and public services was more about digitalization of everything but it was complicated, so we are now trying to make it more simple. Of course, you have still physical meeting points in Antwerp we tried to get rid of civil servants waiting for somebody to come for a new passport etc. So what we are trying to do is that we actually take the digital environments in the public place, like a touch screen where you can still say I need that service or I want to subscribe or I want to do something but if you don't have a smartphone you can still go to a physical place and we will help you if you can't do it yourself.

I know that some cities they also act so instead of training their citizens they train people in administration so they can help citizens. Do you also have kind of trainings that are available for personal that are working there or do you focus more on training citizens themselves ?

For citizens themselves well our IT division offer kind of training, computer learning for older the people etc., we offer that as a kind of service from the city but of course that's only a niche of persons that they themselves say "I need to know more about it". But we do offer that and it's for free but of course it's just a niche of persons. And on the other end, on the physical meeting points the people that assists are trained to assist. As I said it's still work in progress because what we see is that the civil servants they were saying "it takes us more time you know to assist the people when they're trying to do the registration themselves then if they would just type it, it would be faster" so there's still a learning curve.

In Flanders there's also this but it's now a project that is launched, in English it would be called "the man build a house without a house" something like that and it's also a project with different cities and communities about thinking of how to digitalize the public service. And also there will be attention for older people, non-digital native systems like that, but it's in the city context, at this moment, we try to digitalize as much as possible but at the same time make it more simple. It's just like the first application of the banks, there were quite complicated but now they get rid of their offices and the apps of banks gets more and more simple.

If you had to like kind of explain this strategy that you're following in Antwerp, what would be maybe the prime objectives now or more like in the next two years ?

Well the last 10-15 years we tried to, with some success of course, digitalized the administration itself. There's no paper anymore, there's no signature in Antwerp, all paper is gone. Luckily we already did that before COVID, so that made it easier for us to work from home and stuff like that. But some gaps we didn't put because we were all busy with getting the administration without paper digitalizing it, but we were not occupied with the customer as such. So if the procedure in our administration was complex it was probably complex for citizens too. So what we do now, and we have now since year a new chief digital officer and his focus is not anymore on digitalizing but getting the priorities right on customer. So customer first actually, for public services, it means civilians first. So that's what we try to do now.

We are also putting in place kind of a citizen app. Not just for sports and leisure but also to get registered when you move from one house to the other, etc. So like banks have actually one app with which you can all do all the basic stuff.

The worries is of course that if we do that than what about those who are not digitalized? One thing that is sure is that, also from the poor people, more and more people get digitalized. Also, for tourists who arrives in Antwerp probably planned his journey with a smart phone in his hand. That doesn't mean the original problem is solved but we try to do that and one thing is that we but we try to do is that it is an easy principle and then you can still come for what you want to want to do that and to be sure that as maximum as possible people actually do everything with the app still create the opportunity and possibility if that's not possible to get assistance either online like first thing would be with more client of chat box optimized when that doesn't work really with somebody helps or then you can simply call.

Is the app already out now ?

Yes. Well we already have that but we have that if you, let's say, need a new ID card. The card is expired, before you could just simply go to the civil office and wait in line for half an hour one hour or 2 hours maybe, you go to the desk and you say “mine is almost expired”, then they go like “you have a picture with you” “Oh no” “Come back tomorrow again, stay in line half an hour”. But that was before, what we’ve done now is that, and it was already before corona, you have to make an appointment and the first thing to make an appointment is that you do it online. If that's not possible, you can still call phone service and they make an appointment for you. So there's no more standing in line. And either on the website or on the phone, if you come for that ID there is a checklists that will say “bring your photo with you” and then you can do that and then at the same time a new appointment can be made for when you have to pick it up. We already have that in place and also for a bigger part online you can actually for instance if you need before you need it to go to the desk to say OK I need a new ID here's my old ID making right now you can simply do that online and only when everything is finished and you have to make your physical signature on the ID you still have to come. So we tried to simplify that and also what we tried to do now is to simplify everything. Also with culture, leisure and stuff like that and that's putting in place it kind of one of the city to do that.

Stoop R. - Head of department in Strategic Coordination for the city of Antwerp (01/07/2021)

During our last meeting, you talked about the strategy for the next few years, how you digitalized public administration and how you are trying to simplify it, now with the help of a Chief digital officer, you also talked about the "citizen" app.

I would like to know what is your strategy for citizen participation? Do you have a collaborative platform or a living lab or a participatory budget ?

As a local government you want citizens to participate and also you don't want to give them the feeling that they have to solve the problem because it's the role of the government. It's sometimes difficult, also in communication. You want to know what the problems are and how to solve it, if you put too much pressure on the collaboration on how to solve the project well sometimes that can backfire on yourself as the local government. We are very careful with that, we don't want to overstate that kind of participation tools. That's one thing. We are going to try to have participation projectories but then there was this thing about that smart lighting projects, so you do that to give the citizens a more quite night a safer street but it turned out that it was not that good for citizens (why did you do that ? it's disturbing etc.), **so** it's not that easy to implement the right projects Also, in participation you have to look out that you don't give a platform to 5% that are very negative and that want to capture the discussion about their problems. It is difficult especially for big cities.

With innovation we tried to do participation but we really guide it, we are not in favor of these free platforms where citizens can generate ideas etc. Because if you do that and if there is a problem that you, as a government, can't solve then you are the problem. So what we did, some time ago, because of climate change the river was rising, so we had to redesign it, make it higher and in the redesign we had a very broad participation with experts and citizens but it was carefully monitored (we have 3-4 scenarios, what do you think) it's balancing all the time.

Do you have something to measure the impact of your initiatives on citizens?

We do a lot of survey monitoring. We send a questionnaire every week to 500 hundreds citizens that are randomly choose. Rolling sample design so if you are picked than you are not picked anymore for the next 2 years. It is not mandatory.

The questionnaire, half of it stays the same for the next 10 years (monitor how safe people feel, how clean are the streets, mobility, etc) and then different questions about project, events (summer events) or campaign etc, we asked about it, if people would want it (everything on one app or multiple platform, etc).

Are the answers most of the time positive ?

We don't really ask about the project, we ask about preferences, about apps, but we don't say, we have this project do you like it or not. We take the key elements of it and ask what you think about that. We now know that 80% of the people in Antwerp do have a smartphone and do banking so we know if we enroll an app for the city, we know how many people are using it and can handle it. Sometimes in project we do ask likability, but it's mostly campaign monitoring. We did a safe mobility campaign and we asked the Classique questions "did you see the campaign? What did you think about it? Did you think it had effect on you?" but that's with campaign so we do have a pre and post measurement but it's not on all projects.

How do you identify the projects to implement then ?

It’s most of the time experiments. We want to do something with smart lighting and somebody had an idea. So we asked the people if they like it and it was kind of mixed feeling. Most of the time we try to measure the behavior, so for example we did safe crossing, we did some nudging on that “not to cross the streets when it’s red” it was with a screen with mini game and we had a camera installed that counted the number of people crossing when it was red and green and for that we could measure effectively if it was a good experiments and if the nudging worked and actually it didn’t really work. The thing is that people cross the street anyway, light or dark, when there is not a lot of traffic. When there is a lot of traffic and it’s red light people stop. There is no difference with that kind of nudging about safe crossing or not, so we didn’t go on with a project about safe crossing. We tried to do nudging for a lot of projects and it was actually kind of frustrating because we did not find a lot that were really working.

So you use more of a top-down approach ?

Yes and no. For the more technology-driven smart city it is like that. You have the technology and you try to find a project to do with it, to experiment it. But with big cities there are a lot of other things that civilians do, street party etc and so we support them with that, so here it’s more bottom up approach. So it is most of the time a mixed approach.

But for smart city it is mostly top down. Because you have to enroll, find the budget, find experts, etc. You do brainstorm session with people in the administration who knows the problems and want to solve things. So we find ideas within the organization about problems they know or think they want to solve.

What is the biggest obstacles when implementing projects ? Is it more related to the budget or to the implementation itself, or due to the lack of knowledge from the citizens ?

It’s all these things together. Also privacy, sometimes you want to do something, for example with cameras or noise pollution, you want to do intelligent things and help people but on the other hands you have to protect the privacy. So if you tell everybody : “We're measuring everything”, then for some people that's a problem. For instance, like with noise, if you just measure the decibel it is no problem but if you actually really capturing what noise there is and makes it to an artificial intelligence algorithm to interpret it, then you're actually listening. It is a device that is listening, if you would include that in your with your ears we just hear people talk and hear what they say on the street. So from GDPR point of view that's a problem.

So it's like, sensors are expensive, so that’s budgets but then we have sensors but it is privacy intruding, how do you do that. So you have to do on edge computing, that means that actually you capture, like the video, and at the spot you make the computer calculates how many people are passing and you only get the signal of how many people are passing and how long they stayed there for instance, but not the image of the person, but then it cost even more. So it's like that or you want to install sensors but you have to install it somewhere, so we have to actually ask people to screw them in their house. Then also participation is not easy because you have an idea that would work but then like I said with lightning, you start the project with good intentions and then all at once the neighbors are complaining. Also with things like touch screen, applications, it's not easy to make people participate.

According to you, how would it be easier to make people participate?

I find personally that if you do a project that is for you than it's a big thing but for somebody else it doesn't really matter. It's hard to capture attention from the citizens on projects for a long time. It has to be useful for them.

I get what you said about the risk of collaborative tools, such as a platform, that it can give too much power to citizens, etc. But do you think it can also be an opportunity to better capture the needs of the citizens ?

Yes exactly, that's true. That's what we also tried to do with the surveys etc. We also have a kind of hotline where you can complain and we also monitor these complaints, like every big company does to actually capture what's going on and what's the problem here. But it's something else than saying : "You can state your problems in this platform and if there's enough votes on it, we're going to solve it". That's something else. For some things as a local government you are responsible, but for other things, you're not responsible. For instance, there are bumps on the roads and on the pedestrian or bicycle roads, but it's a provincial or a Flemish roads, so you can't do anything about it. Things like that make it sometimes very difficult to have a platform and say "ok if you propose this and people like it, we will solve it".

B) Email exchange

Degueldre I. – Secrétaire au cabinet de Eric Goffart (22/06/2021)

Au niveau de l'implémentation d'un WIFI urbain gratuit, pouvez-vous me communiquer le nombre de hotspot qui seront mis en place dans les bâtiments publics ?

--> Un hotspot par MCA donc 5 + certaines bibliothèques (nombre pas encore défini)

Au niveau des dispositifs de sécurité, sauriez-vous me fournir, ou me rediriger, afin de savoir le nombre de caméras de surveillances mis en place au sein de la Ville de Charleroi ?

--> Le mieux est de s'adresser au cabinet du Bourgmestre (Fabienne Prévinaire : 071/861097) ou David Quinaux, porte-parole de la Police (071/ 21 019 11). Dans L'Avenir du 05.09.2019, il est indiqué que : « Le dispositif de vidéosurveillance compte 210 cameras. »

Au niveau du e-guichet, avez-vous une idée du nombre de démarches administratives effectuées en ligne ?

-- > Depuis leur mise en ligne, Avaloirs, RV État civil, demande extrait de CJ, demande de changement d'adresse, candidature spontanée, demande d'intervention service propreté et demande de renseignement état civil totalisaient 51081 démarches au 26.05.2021. (= les plus importantes en termes de nombre de demandes hors PEPS)

Au niveau de l'éclairage public, j'ai lu la volonté de la Ville de remplacer 889 points lumineux par des éclairages LED, y-a-t-il également une discussion afin d'équiper ces éclairages par des capteurs dans un même temps ?

-- > Le but est de remplacer l'ensemble du parc d'éclairage public (25.000 points lumineux) en 10 ans.
Le système qui est placé pourrait accueillir des capteurs dans un second temps.

Sauriez-vous me communiquer le nombre ou pourcentage de l'offre de logement sociaux au sein de la Ville de Charleroi ?

-->La Sambrienne gère 9.600 logements sociaux. Je ne connais pas le pourcentage par rapport à l'offre générale des logements. Peut-être contacter le directeur de la Sambrienne : Fabrice Jacqmin (071/ 27 20 00) pour les informations complémentaires.

Antwerp local police (07/07/2021)

Welke veiligheidsmaatregelen zijn er genomen? Is er een uitwisseling van informatie tussen de door de politie verzamelde gegevens en de stad in het kader van haar eigen bevoegdheden (Smart city, lage-emissiezone,...)?

Dank voor uw interesse. Ik zou u graag willen doorverwijzen naar onze website, waar u een overzicht vindt van welke types van camera's we gebruiken in onze Politiezone. We beschikken vandaag immers over meer dan 400 camera's die we gebruiken in het kader van politonele opdrachten. De stad gebruikt een aantal van die camera's in het kader van haar eigen bevoegdheden (autoluwe zone, Lage Emissie Zone, Smart City). Het exacte aantal camera's heeft echter voor ons weinig relevantie en houden we niet bij. Ik kan dit dus niet zo meedelen. Soms bestaat een locatie immers uit een opstelling met 5 camera's (360°), waarvan een camera wordt gebruikt door politie en door de stad in het kader van haar eigen doelen. Het aantal (meer dan 400) zegt dus weinig.

Duyck L. – Bruges local police (08/07/2021)

Welke veiligheidsmaatregelen zijn er genomen? Is er een uitwisseling van informatie tussen de door de politie verzamelde gegevens en de stad in het kader van haar eigen bevoegdheden (Smart city, lage-emissiezone,...)?

In Brugge op vandaag :

- 51 bewakingscamera's waarvan 5 thermische camera's
- 7 ANPR camera's die ikv Beacon project rechtstreeks op de federale server zijn aangesloten
- 21 ANPR camera's (waarvan er 5 pas volgende week actief worden) op eigen server via Myriade (deze server is aangesloten op de nationale backbone)
- 1 mobiele ANPR camera (stand alone)

Al onze ANPR camera's kunnen via AMS geconsulteerd worden door de andere **politiezones** (dus ook PZ Gent, maar niet stad Gent). Er worden geen CCTV beelden gedeeld.

Ledoux P. - 1er Inspecteur Principal de police (Zone de Police de Charleroi) (28/07/2021)

Notre Zone de Police a bien reçu votre demande de renseignements pour votre mémoire dans le cadre de votre Master.

Quant aux caméras ...

- la Ville dispose d'un grand nombre de caméras fixes et mobiles réparties sur l'entité
- l'utilisation de ces caméras fixes et mobiles pour assurer l'Ordre Public est bien acquise (réactions préventives ou en temps réel, recherches après la commission des faits, ...). La Direction des Opérations (qui nous lit en copie) pourrait vous donner davantage d'informations sur ce sujet
- Concernant les caméras ANPR, elles sont déployées aux entrées et sorties de Ville qui, selon le Plan Communal de Mobilité, sont susceptibles d'enregistrer le maximum de passages de véhicules. Toutefois, au regard du nombre de caméras qu'il était financièrement possible d'installer, toutes les entrées/sorties principales ne sont actuellement pas encore couvertes

Quant aux échanges de données entre Ville/Zone de Police ...

- pour l'échange de données Ville-Police, il n'y a pas (encore) de formalisation ou d'échange structurel. Cela étant, en ce qui concerne la Police, cela peut se concevoir dans le domaine de la sécurité
- dans les intentions toutes récentes, ma hiérarchie vient d'avoir une réunion ce jeudi avec l'Echevin de la Mobilité. Une réflexion a été initiée sur l'utilisation future de caméras ANPR pour pouvoir monitorer (et verbaliser) les véhicules en transit dans une rue/un quartier à caractère local. Nous sommes donc en chemin vers le concept évoqué mais la mise en oeuvre de tels systèmes n'est pas aisée. Ainsi, fin 2016, nous entrevoyions de recourir à des caméras ANPR pour "contrôler" l'accès, aux seuls véhicules autorisés, à la Place Verte, une zone piétonne coupant littéralement en deux le Boulevard Joseph Tirou. Au final, la solution privilégiée sera des bornes télescopiques avec différents moyens d'abaissement (badges, commande à distance par la Zone de Police ou les Services de Secours ou, encore, balises de détection dans les Citybus). Peut-être jugées trop avant-gardistes, les caméras "ANPR" n'ont pas été plébiscitées par l'ensemble des intervenants dans ce vaste projet de rénovation urbaine en combinaison avec l'implantation du centre commercial Rive Gauche

Pour conclure, la Ville de CHARLEROI n'est pas encore une Smart City mais des efforts louables sont réalisés chaque jour pour évoluer dans ce sens.

Jaminon K. - Cellule Stratégie et Développement (Ville de Liège) (22/07/2021)

J'ai lu que la ville de Liège avait décidé de ne plus utiliser de WIFI urbain en ville. Est-ce aussi le cas pour le WIFI indoor ? Si non, savez-vous combien de hotspot indoor sont disponible ?

Nous sommes débordés avec la catastrophe des inondations, en plus de l'attaque informatique, c'est compliqué. En effet, le wifi urbain n'est plus d'actualité car les personnes ne l'utilisent pas tout simplement. Avec la démocratisation des prix du net sur les GSM, c'était devenu un coût inutile pour la ville. Le placement des antennes wifi était compliqué aussi et couteux. Souvent sur des bâtiments privés et il était difficile d'obtenir les autorisations. Nous utilisons le wifi au sein de nos bâtiments mais je ne connais malheureusement pas le nombre. Le département informatique le connait, je leur ai posé la question. Dès réception de la réponse, je vous la fais suivre.

UNIVERSITÉ CATHOLIQUE DE LOUVAIN
Louvain School of Management

Place des Doyens, 1 bte L2.01.01, 1348 Louvain-la-Neuve
Boulevard Emile Devreux 6, 6000 Charleroi, Belgique
Chaussée de Binche 151, 7000 Mons, Belgique

www.uclouvain.be/lsm