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Anna Brdulak
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Happy City - How to Plan and Create the Best Livable Area for the People

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Preface

The present collection of articles seeks to highlight the diversity of viewpoints on what exactly influences the quality of life for city dwellers. As these editors firmly believe, diversity fosters creativity and we therefore took it as the key criterion in selecting contributions to this publication. Among the authors are academics, experienced and at the beginning of their career, coming from schools of economics, universities and institutes of technology, but also practitioners—men and women of various age, different backgrounds, from Poland and abroad, including politicians and decision-makers at the central and local level. This gives us a wide range of opinions which—in an attempt to grasp the quintessence of a "happy city"—are presented here along with examples of those already treading this path and with findings of research taken to identify the key ingredients of what people call the "quality of life".

The city can be seen as a system of interacting elements (subsystems), which means that no such component should be analysed separately, but only in conjunction with the other ones. The elements listed most frequently include: transport, sewerage, power supply, heat generation, parks and green spaces, and street lighting/traffic signalisation. In an ideal contemporary city [1] the focus is on all aspects of sustainable development—economic, environmental and societal. As pointed out in the Global Compact report [2], happy cities take care of adequate living conditions for all residents, accepting their diversity and multiple requirements. Blueprints for such cities are being developed by people of a whole range of professions and occupations—to name economists, sociologists, engineers, architects and anthropologists—but if they are to deliver, this must surely be a collaborative effort.

A one-size-fits-all approach would not work here. Research findings demonstrate [3] that in different countries the happiness index is impacted by different factors—and per capita GDP is by no means the weightiest of them. These editors subscribe to the opinion that a key predictor of people's satisfaction with life is social capital, based on relationships. According to the U.S. economist John Helliwell [4], the utmost psychological effect of urban living is reflected in its impact on people-to-people relations [5]. Social capital represents primarily an ability to

maintain and keep relations with people, those close to us and outsiders alike. It is correlated with trust which people have in government, businesses and in other people. And trust is conducive to civic attitudes, where residents seek to proactively contribute to their environment and local authorities seek to engage citizens with the decision-making process.

To these editors the notion of social capital brings to mind the image of a Japanese zen garden, where it is the space between rocks that counts, not the rocks themselves. With happy cities things are similar, and space again is of paramount importance—in the broad sense of the notion, involving relationships between buildings and parks, between people and buildings, between parks and people, and also the relationships between residents.

With different groups having their quality of life influenced by different factors—from which it would not be possible to extract a single set suiting all—it is crucial that the "golden mean" be sought and bridges built between these groups, to bring home how important it is to understand the needs of the other groups, not just one's own.

Listening to the concerns of others is a first step towards raising social capital, and hence the significance of communicating—and respecting—these concerns. Next comes providing the space in which different groups will exchange opinions while showing themselves mutual respect. In successive stages, it is important to develop a culture of discussion that enables constructive conclusions and draws all stakeholders into the implementation of agreed projects. Obviously, a city's progress to happiness is also impacted by finances. The pace of change tends to accelerate when European Union funds are available (as far as EU member states are concerned), an appropriate budget level is assured, and systems to finance city investments are transparent. But many elements improving the quality of life are not directly linked to the availability of funds.

Happy cities are usually governed along democratic lines, involving free access to urban space and equal (non-discriminatory) treatment of residents, whatever their differences. But as is quite frequently the case, the city space—full with pathways leading to it—happens to be controlled by varied vested interests. Meanwhile, access to this space and pathways is shown by research to exert considerable influence on the quality of life for inhabitants.

Another question that must be asked when discussing happy cities is about creativity. Is residents' happiness linked to creativity? Smart city analyses usually highlight the opportunities provided by technology—from the Internet of Things (or, more broadly, the Internet of Everything) to Big Data to creative industries. According to Florida [5], the key driving force in the knowledge-based economy is precisely the creative capital, or capability to produce new ideas, processes, designs and culture creations, and turn them into valuable products and services. While physical capital is easy to measure, the creativity metrics are fairly complicated. Broadly speaking, creativity comprises three parts—talent, technology and tolerance—which, combined with social capital, add up to the concept of a smart, or happy, city. Talent means concentration of people with great competences and high creative potential; technology is concentration of R&D infrastructure; and tolerance

represents an open attitude to change and new ideas. Thus the winners are those cities which can attract the best educated, most innovative, and most enterprising people. Driven by creative energy, those individuals form the "creative class" that spearheads the contemporary knowledge-based economy. They include academics, designers, artists, engineers, programmers, film producers, publishers, script writers, movie directors and financial analysts, weaving a development-friendly fabric and thus adding a competitive edge to their cities. Creative intellectual ferment is an indispensable ingredient of development, and it is best stirred up by this very class.

The concept discussed in this collection defines the directions of urban development. It no longer suffices to provide physical infrastructure in order to make residents feel they experience a good quality of life. This must go hand in hand with an expansion of educational services, a richer leisure-time offer, an infrastructure for sports and games, etc.

This publication is an attempt to put the spotlight on diverse ideas that inform the notion of a happy city.

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References

1. Graham W (2016) Dream cities. Seven urban ideas that shape the world. Harper Collins Publishers
2. Brdulak H (2016) Zrównoważone miasta. Mapa drogowa do 2030 r. Brdulak A (2016) Rola samorządów w zrównoważonym rozwoju miast. In: Zrównoważone Miasta. Życie w zdrowej atmosferze. United Nations Global Compact
3. Happy City Index (2015) World Bank
4. Helliwell J (2006) Well-being, social capital and public policy: what's new? Econ J 34–35
5. Florida R (2014) The rise of the creative class-revisited: revised and expanded. Basic Books

Contents

Summary

The conclusions that can be drawn from the present publication fall into several headings.

1. Social capital and its importance for building human relations in cities

An important theme taken up by contributors to this collection is about the level playing field, most notably in accessing occupations/professions, promotions or also certain spaces. Research findings demonstrate that where this is the case (i.e. there is no disconnect between declarations and facts), people believe the quality of their lives is higher. It thus follows that the contemporary cities should place stronger emphasis on egalitarianism, not elitism, by creating structures that accept people's diverse needs and enable various groups to mix (rather than confining spaces to particular districts). An interesting example of an effort to build bridges between different social groups is provided by Ciclovia street park, a concept that originated in Bogota, where 121 km of streets were once closed to cars for one day, with all residents invited to turn out. The idea was to open up a space that would link districts with different income levels and give their communities a chance to connect. More than 1.5 million inhabitants took part in that initial project, riding bicycles, moving on roller-skates, or engaging in activities, such as aerobic, yoga and tai-chi. The diversity challenge must have been met well enough to enable Ciclovia to turn into a cyclical event. Similar projects were later embraced by New York, Los Angeles, San Francisco and Edmonton.

Equal access to occupations and professions means respect for free, unrestricted access to urban space by different social groups. This calls for rules of conduct in public space to be laid down and observed, lest a single group overwhelm this space.

Writing about the formation of a creative class, authors take note of university campuses, their structures and also approaches to education. With the creative class these approaches must be different, involving stronger emphasis on partnership in student-professor relations. Knowledge-based cities require that people learn on a continuous basis. Consequently, a participatory model of interpersonal relations

appears to be better suited for mutual learning experiences, compared to the hierarchical model that stayed so popular until recently.

Trust is the key factor in building social capital, which however may be impacted by economic upheavals, rising uncertainty, and a growing perception of impending threats. This should never be lost sight of by those at the helm of city governance.

2. Sustainable development, involving residents' proactive participation in shaping the urban space (participatory model)

A major problem adversely affecting city residents' quality of life is created by pollution and noise. Cutting down on gas emissions generated by the huge numbers of private cars which move at relatively short distances (usually from home to work, and back) should be a major goal for city authorities, to be pursued with a help from local communities. An increase in spending on developing a convenient and safe public transport system (primarily, rail transport), restrictions on private cars' access to city centers and/or charges for entry into the most polluted zones, and deployment of innovative (mostly electric) self-driving cars—these are but a few of the proposed solutions. Other ones include expanding the network of bike paths (which, as an added value, also promotes healthy lifestyles), enhancing the pedestrian space, and enlarging the area occupied by parks, green spaces and other open spaces (some authors propose that the distance to the nearest green area from each place of residence be no longer than 500 m, no matter which direction a pedestrian takes). An interesting solution, presented in this publication, is known as Balonodrom. It is an enormous balloon, seen from various part of a city and covered with an electronic coating which changes colour in accordance with the degree of environmental pollution. This gives each resident an opportunity to help curtail pollution, by choosing public transport over private car when they see that the balloon has taken a warning hue. The project is an extended version of the Balloon Air de Paris, displaying colour-based information about air quality in every district of the French capital. The Polish Balonodrom project, involving visual elements, Big Data and sophisticated technology, is also about building social capital and letting individuals influence the quality of their immediate natural environment. In this context, the notion of "sustainable mobility" has emerged, which these editors (authors/writers) believe is intrinsically linked with how responsible-transport behaviours are promoted and environmental awareness instilled among all residents. Providing the material infrastructure is certainly not enough, and people must be encouraged to use bike paths, sidewalks, parks and public transportation. A case in point is Copenhagen, where 41 out of 100 journeys are taken by bike. When Danes buy cars, the motive is not so much to move within cities as between them.

An important element of sustainable development is waste management, where a comprehensive approach needs to be taken to the entire supply chain, including the collection of municipal refuse, its handling and conversion into biodegradable waste that can be turned into renewable energy. The search for a more efficient energy management in cities—which, globally, consume some 70% of energy and

generate around 80% of pollutants—translates into using adequate construction materials, which will provide comfort inside houses as well as preventing heat losses.

Participatory governance requires monitoring the needs of different stakeholder groups, which involves studying the levels of residents' satisfaction with the quality of their lives, and creating systems to track related indicators. Quality of life can be measured with a number of yardsticks, of diverse complexity and little-standardized methods of collecting the information needed to establish the value of a given indicator. Comparability may thus pose a problem. The monitoring should be conducted on a continuous basis, which is not particularly difficult given the information collecting opportunities (Big Data). At the same time, though, it may prove necessary to change the selection of critical indicators that inform the conclusions drawn. Creating a system to help decision-makers with such changes, based on relevant analyses, would surely be well worth the effort.

3. Regulatory framework, as an indispensable part of building responsible city structures

Regulations for city management (e.g. the ISO 37120:2015-03 standard) provide a groundwork enabling cities to operate with greater transparency. In pursuing the Happy City, it is important that local government be vested with increased decision-making powers. As research findings demonstrate, the highest quality of life is provided by the cities which meet citizens' security-related requirements and which enjoy a high degree of regulatory autonomy.

4. Digital transformation, as a basis for creating the Happy City of the future

The happy, smart cities, providing comfortable living conditions, involve the full use of digital technologies, thus enabling an efficient management of not only electricity, gas, heat or sewage but also of city transport. This requires integrating sensor systems, so that the flow of people, cars and vehicles can be streamlined. ICT systems make it possible to launch intelligent urban cards, giving their holders access to institutions of culture (cinema, theatre) and public transport.

Does the development pattern in cities currently undergoing transformation comply with the actual requirements of residents and other groups temporarily using the city space? Will the cities of the future look like those which today we regard as models for other "happy cities" such as, for example, Copenhagen? Answers to such questions will not come easy, being forged in discussions and informed by the sharing of diverse visions and expectations.

As these editors see it, the ideal cities provide spaces where people can meet, connect and share, while respecting otherness and diversity. These are green cities, friendly to children, senior citizens and the disabled—in other words, friendly to the weaker. They are inspiring cities with talent-pulling power, where the creative class makes up a considerable portion of the populace. Cities where people move serenely, observant of one another. Cities free of contamination and noise.

The pursuit of happiness in urban settings calls for collaboration among all residents, which requires striking a balance between individual needs and the

common good. Even if in today's cosmopolitan city an individual finds it much easier than ever before to separate from others, the greatest satisfaction—whether in the workplace or at the playground—will be afforded by teamwork. Consequently, the level of happiness of the city's community goes up, and so does the social capital of the whole nation.

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Part I
Sustainable Urban Mobility

Sustainable Mobility in Smart Metropolis

Robert Tomanek

Abstract Smart mobility is a key factor for sustainable mobility in the metropolis. The study shows the nature and importance of smart mobility in the smart city, the planning process of sustainable urban mobility (SUMP), application of ITS in sustainable mobility, as well as the impact of metropolization on the transport system and mobility (based on the Polish experience).

Keywords Sustainable transport · Sustainable mobility · Metropolization · Intelligent transport systems · Public transport

1 Introduction

Modern city is the city of multiple functions and relations. The growth of cities leads to development of metropolis, where urban functions are accumulated, and the number of citizens and relations is increasing. The functioning of metropolis must be effective, therefore it is so important to implement organizational solutions which can produce synergy effects. The implementation of "smart" solutions is a particularly promising trend. This especially concerns smart mobility, which is a component of the smart city. Smart solutions can be understood in different ways: usually as integration of information technologies. However, apart from components such as ICT and integration, it is also social stakeholders co-participating in development of these solutions that should be taken into consideration. Smart city, and in particular smart metropolis, is a result of synergy between contemporary information technologies which integrate urban functions with the participation of social stakeholders whose activity leads to an increase of social capital. Smart metropolis is an effective metropolis. In the mobility area, this means sustainable development. Sustaining mobility in urban areas depends not only on the role of sustainable transport (public transport, bicycles, pedestrian movement), but also on

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transport behaviors of citizens, and in particular on transport intensity of the functioning of the city, which is influenced by the modern electronic forms of communication. Therefore, the level and character of mobility in a metropolis depends not only on internal conditions, but also (and apparently increasingly) on external factors, such as implementation of e-communication and digital services.

At the same time, it should be noted that ICT systems (and especially telematic systems in transport—Intelligent Transport Systems (ITS)) are usually implemented with more difficulty than it could have been expected: this particularly concerns the time and costs of implementation. Moreover, the previously assumed effects are frequently lower than predicted. Smart solutions do not solve all problems related to the quality of living and efficiency of metropolis, probably because they do not sufficiently take into consideration social conditions, such as complexity and non-linearity of social capital formation.

This study shows the problems of implementation of the concept of smart cities and sustainable cities in Poland. Poland is an interesting subject of study because of historical and political reasons—"jump" stages of economic and social development (in the field of ICT applications and new urban concepts too).

2 Smart Mobility in the Smart City

2.1 Directions of Urban Development

Economic and social development is concentrated in the cities. This particularly concerns Europe, North America and Asia (especially Japan, Korea, Taiwan, China) [1]. City can be defined in many ways, however, it is usually perceived as a population center and area of intensive development, where the scale effect leads to intensification of interpersonal relations, which accelerates social and economic development [3]. The essential problem is how to delimit the city area. While historically it was determined by fortified walls and natural barriers (especially seas and rivers), nowadays the concentration of people and buildings of various intensity make it difficult to determine where a particularly city begins and ends—especially in the areas which take the form of agglomerations. For example, the number of citizens within the administrative borders of London is 7.4 million, however, in the metropolitan area, according to different definitions, it exceeds 13 million [18].

With the urban population expanding around the world, the importance of cities in social and economic development is growing. It is estimated that while currently 54% of global population live in the cities (2014), this number will increase to 66% in 2050. The level of urbanization varies globally—the biggest urban population is in North America (82%), followed by Latin America and the Caribbean (80%) and Europe (72%). The forecast for the level of urbanization in Europe in 2050 is 82%. In Poland, 61% of the population lived in the cities in 2014, whereas in 2050 the number is expected to be 70% [36].

It is not only the positive effects of development, but also negative social and environmental phenomena that concentrate in the cities. One of the important questions is the evaluation of efficiency of metropolization processes—is it possible that the costs of this process will exceed the benefits? If so, when might it happen? This question is especially significant due to the fact that there are tendencies in the largest population centers to accelerate the increase and develop megametropolis, i.e. megalopolis [16]. Although significantly less people live in large metropolises in Europe than in North America and Asia, certain doubts concerning the effects of metropolization arise here as well, including increased pollution, social tensions, crime rate, and recently also terrorism.

The vision of the city of the future is based on the paradigm that it is a sustainable city, i.e. a city where the needs of citizens are fulfilled without reducing the opportunities of future citizens to fulfil similar needs. The question of uncontrolled and therefore unsustainable urban development was raised in the so-called Bruntland Report, published by UN in 1987 [32]. Since then, many initiatives have been taken with the intention to fulfill the concept of sustainable urban development. Such approach is presented in numerous documents and declarations in Europe, including in particular the "Europe 2020" strategy [14].

The vision of European city of the future is based on the assumption that city is [6]:

- a location of advanced social progress, characterized by high value of social capital and easy access to socially useful urban functions
- a platform of democracy, cultural dialogue and diversity
- a location of ecological restoration, with large share of green areas and systems
- a driving force of economic growth, thanks to the support of creativity

This ideal vision currently faces significant barriers. The first of them is demography. Europe is getting old, which has significant developmental consequences, especially for the social capital. Another problem is the integration of migrating population—Europe needs human resources, and at the same time the assumption to maintain cultural diversity in practice transforms into ghettoization of foreign population, which causes social alienation rather than integration, leading to breakdown of social bonds and establishment of foundations for spreading social pathology and terrorist ideas, which has been particularly severely experienced by Europe at the turn of 2015 and 2016.

The spontaneous development of cities must be replaced with a sustainable approach, where the availability of resources means restriction of various activities. In particular, this refers to natural environment resources. Due to the size and complexity of metropolises, the problem of sustainable development becomes a priority.

2.2 Smart City and Smart Mobility

Smart city is a fashionable term, frequently used, and even overused. The word "smart", used interchangeably with "intelligent", is ascribed to multiple issues,

processes and systems. The career of the "smart city" concept results to a great extent from the research activity of scientific teams and marketing activity of IT companies. As a result, there are many definitions of smart city, as well as numerous examples of assigning "smart" features to partial solutions only for the purpose of promoting teams, companies or political systems [40].

The concept of smart city was developed in consequence of the search for ideal city, which would eliminate negative effects while maintaining the benefits of urbanization at the same time. Other terms used interchangeably with reference to modern cities include: intelligent city, knowledge city, sustainable city, talented city, wired city, digital city and eco-city. All these concepts are based on the promising effects of applying information and telecommunications technologies, as well as on the belief in the possibility of effective implementation of complex urban and social functions thanks to ICT. The role of ICT in these expectations is also usually demonstrated in the applied definitions of smart city [24]. Defining smart cities is reminiscent of searching for utopian cities according to the nineteenth century concepts developed by Charles Fourier. As we know, those cities did not last. However, searching for ideal model solutions is an ongoing ambition of the mankind [7].

The presented definitions have static character. They can be referred to smaller cities, whereas in the case of metropolis, the presented assumptions of smart city appear to be unrealistic. In this case, it seems to be more appropriate to use the dynamic approach, in which smart city (metropolis) is developed in consequence of processes which improve the functioning of the city, leading to an increase of the value of social capital through complex and integrated application of knowledge, organizational solutions and modern information technologies. The essence of smart city consists in significant improvement of the functioning of a city rather than development of an ideal city. Social capital should remain in the center of these processes, whereas information technologies, which are usually given a priority, should be regarded merely as tools [4, 5, 38].

The components of smart city include [24]:

- Smart economy
- Smart mobility
- Smart environment
- Smart people
- Smart living
- Smart governance

The key element among smart city components is sustainable mobility based on sustainable transport. This is mostly because transport, which is essentially public, is a source of negative external effects and congestions impeding mobility, which reduces the possibility of carrying out urban functions. Smart mobility is usually based on applying ICT—in particular ITS. Mobility should not be understood only as the transport system: integrated and effective transport, with the application of ITS, is a necessary condition of mobility, however, smart or sustainable mobility

mostly depends on transport needs, including especially transport preferences and behaviors (and also the influence of modern communication techniques) [29].

Changes in mobility models depend on many factors, including social, demographic, economic, spatial and transport conditions. These issues are universally discussed in the literature, therefore, the further part of the study focuses on two factors which are increasingly more important, but usually attract less attention: communication behaviors of young people and supply of transport services within the framework of sharing economy. The behaviors of young people—generation Y born and educated during the Internet age—have a very important long-term impact. Research conducted in Europe demonstrates the following changes occurring simultaneously within this group [33]:

- Increased share of non-motorized mode travel (bicycles, pedestrian traffic) and decreased use of cars (Germany)
- Decrease in the total annual travel length (UK)
- Decrease in the number of people with driving license (Germany, France)

Such changes lead to decrease of mobility and its sustainable development. The above-mentioned tendencies can be caused by different reasons [9]:

- Life stage
- Affordability
- Location and transport (availability)
- Driver licensing regulations
- Attitudes
- E-communication (quantity and quality development)

The sharing economy (collaborative economy, collaborative consumption, peer-to-peer economy) is not a new concept. It may even be stated that barter economy based on money has risen out of the initial sharing economy. However, nowadays, with the extended possession of multiple goods (such as e.g. means of transport, tools, real estate), which their owners do not have to use all the time (or even they are unable to), the shared use of these goods (as well as free time) has increased. Thanks to e-communication and communication software, it became possible to make these goods available on a large scale.

In transport, the result is carpooling, also referred to as ride-sharing, where car owners share their cars against payment or on the basis of exchange ("today we use my car, tomorrow yours"), which leads to increased vehicle fill. Similar effects are also caused by other types of services identified with sharing economy due to the public character of services offered by cities [33]:

- Car-sharing—making public vehicles available, which leads to the increase of vehicle use, raises the effectiveness of transport infrastructure and individual transport, as well as ensures sustainable mobility
- Bike-sharing—co-sharing of public bicycles, which also leads to more effective use of infrastructure and bicycles, as well as ensures sustainable mobility

Sharing economy is developing very fast. In the field of mobility, it is possible to extend the scope of ride-sharing (especially in urban transport) and implement a similar solution for bicycles, as well as equipment which can be used in urban logistics. In this way, sharing economy will have an influence on the development opportunities of smart mobility and sustainable mobility.

3 The Planning Process of Sustainable Urban Mobility (SUMP)

Mobility management can be identified as managing demand for transport services. In the literature, mobility management is presented as targeted actions towards reducing fulfillment of transport demand by means of cars [23, 26]. The significance and complexity of the problems of mobility management make it necessary to plan mobility. Therefore, mobility plans are drawn up for large sources of traffic (work establishments, universities, shopping centers, sports facilities) and city areas. Mobility plans are also used for incidental events, such as sports events, outdoor events or fairs [27]. Mobility plans for traffic generators are only some of the components of mobility management.

Sustainable Urban Mobility Plans (SUMP) is an idea preferred by the European Commission, which aims to improve the quality of living and functioning of cities through integrated planning, referring to all means of transport and transport behaviors. SUMP is developed with the participation of stakeholders, because the participatory approach is an important element of this concept. According to the assumptions of the European Commission, this should allow for achieving the following goals [19]:

- Ensuring availability of transport to key target destinations
- Improving safety
- Reducing external costs of transport
- Increasing transport efficiency
- Increasing the attractiveness of the city (social, environmental and economic)

Such mobility planning concept is directly related to the vision of sustainable city, as well as smart city. In metropolitan areas, planning sustainable mobility is particularly elaborate due to complicated transport systems, as well as social complexity and large number of stakeholders. The implementation of SUMP requires large expenditure, as well as complex organizational projects. Pursuit for smart mobility must be based on the implementation of ICT in transport, i.e. application of ITS, which both provides the opportunity to achieve the defined objectives of SUMP and allows to increase the efficiency of this process.

SUMPs popularized by EU are a new trend, but they result directly from the European Transport Policy, including the Transport White Paper of 2011 [35]. The components and procedures of SUMPs were developed on the basis of many

research projects undertaken at the initiative of EU. The projects included in CIVITAS programme are particularly significant, including especially CIVITAS II (2005–2009), whose slogan was "Cleaner and Better Transport in Cities". The SUMP procedure recommended by EU is and will continue to be improved, with the support of research projects financed by EU and analysis of practical experience. The assessment and improvement of urban practice in the field of SUMP is supported by means of benchmarking and audit. A specialized SUMP audit was developed and carried out within the framework of ADVANCE project [15]. In accordance with the assumptions of ADVANCE project, over 500 cities in EU should have SUMPs in 2020. The process of implementing SUMPs to replace Sustainable Urban Transport Plans (SUTPs) is also developing in Poland. Pursuant to the Act of 16 December 2010, SUMPs must be prepared by a number of municipalities and municipal associations. SUTP refers only to public transport, and its content is governed by the legal regulations. The popularization of the practice of developing SUMPs in Poland is related to investments financed from EU funds and adoption of good practices within the framework of CIVITAS programme, as well as other EU initiatives related to urban development.

4 Application of ITS in Sustainable Mobility

4.1 Elements of Smart Mobility in the Metropolitan Areas in Poland

The development of transport is one of the key factors behind the formulation of the smart city concept, and smart mobility is one of the key areas of smart cities [24]. At the same time, such shape of cities is becoming one of the key megatrends in the economic development of urban areas, including metropolises [38]. The projects undertaken in the field of smart mobility are implemented in accordance with the principles of sustainable development, which means focusing on minimization of the negative impact of transport on the environment, especially through the development and preferences for public transport. Particularly significant in this field are the projects which use Intelligent Transport Systems (ITS), including projects related to: vehicle traffic management, congestion charges and smart cards [24]. In Poland, projects related to urban traffic control system and tariff and ticket integration by means of smart cards are currently being implemented.

The improvement of vehicle flow management is increasingly executed by means of ITS, and one of the pioneers in this field is USA, where the significance of this element was emphasized in the federal programme as early as 1991 [2]. Currently, urban traffic control systems in Poland are only applied in few cities, most notably in Tricity (Gdańsk/Gdynia/Sopot) and Wrocław, where solutions covering large urban zone areas have already been implemented. Due to the large scope of the system and necessity to integrate metropolitan areas, it is worth noting

the system implemented in the Tricity in 2015—TRISTAR, the value of which amounts to approximately PLN 160 million (including PLN 136 million co-financed by EU). The system provides access to advanced traffic information, which allows to optimize behaviors of drivers (apart from that, TRISTAR also includes information for passengers in public transport, as well as parking information). Using traffic detection, data concerning road incidents and meteorological information, TRISTAR system provides drivers with information boards informing them about [28]:

- traffic obstacles,
- journey times on main and alternative routes (e.g. journey time to Gdańsk via Tricity bypass and intercity road),
- detour recommendations.

In conjunction with adapting traffic signals to traffic conditions, TRISTAR system should support sustainable transport in the Tricity agglomeration, in particular, reduce congestion and increase road transport security through more efficient use of transport infrastructure [20]. This is consistent with the expectations related to the benefits of ITS implementation. The literature on the subject widely presents relatively optimistic forecasts, which in practice seem to be unrealistic. It is sufficient to recall predictions from almost 20 years ago, when it was assumed that the implementation of ITS in road traffic management would lead to 50% reduction in the number of car accidents, 25% reduction in journey times and 50% reduction of air pollution caused by transport in cities until 2017 [17]. In practice, ITS systems are not implemented according to the assumptions: even if the ITS architecture advocated by the specialists exists, the organization of transport systems for which ITS solutions are prepared does not correspond to it. Moreover, the costs and duration of project implementation are increasing, which is the effect of underestimating the risk resulting from the specific character of the decision-making processes in the public sector responsible for the functioning of transport infrastructure [8]. In particular, it is difficult to achieve the scale effects related to integration, which is the key factor limiting the expected ITS benefits.

The barriers of integration in metropolitan areas, where it is frequently necessary to diversify tariff solutions applied in different parts of metropolis, have a similar limiting impact on the effects of ITS application in tariff systems. Striving for tariff integration in metropolitan areas requires applying flexible and intelligent ticket systems. An example could be universal tickets, providing access to transport services and other urban services, especially when the ticket performs the function of the so-called electronic purse. It seems that progress in this field will be encouraged by dissemination of modern ticket systems. They do not necessarily have to be tickets in the form of electronic cards. The so-called virtual tickets, once rare, are developed thanks to the widespread use of smartphones. In Poland, these two directions of ticket system development are widely applied, however, the biggest number of implementations are related to electronic cards, mainly applied in public transport systems [37].

Electronic ticket cards allow to:

- integrate payments in transport systems (not only public) in metropolitan areas with many transport organizers operating,
- perform measurements of transport size, which is particularly significant for financial settlements of municipalities subsidizing public transport,
- integrate multiple urban functions (e.g. access to sports infrastructure, cultural institutions, administration)

The main problems characterizing electronic card systems in Poland include [12]:

- various technical standards of cards,
- required adjustment of projects to EU operational programmes, which leads to creation of functionalities that may be characterized by low efficiency during the period of system utilization,
- closing the areas of card application within the existing organizational structures of public transport,
- high investment expenditure (acceptable to a large extent thanks to EU support) and cost of system functioning (especially future costs, related to the maintenance of less efficient functionalities)

ITS projects applied in public transport undoubtedly raise the level of economy digitization and have a positive impact on the development of social capital, however, large projects are almost entirely financed from EU funds. Formal restrictions are a source of expensive project management during the so-called project durability period, moreover, they petrify the existing organizational structures due to the necessity of determining the so-called support beneficiary. In particular, this could be the reason for preserving ineffective solutions which block changes in the organization of metropolitan structures.

4.2 SUMP in Upper Silesia Agglomeration

The rates of urbanization in Poland are relatively lower than the EU average, however, spatial development is characterized by one of the largest levels of polycentralization in Europe [13]. The Upper Silesia Agglomeration, inhabited by approximately 2.5 million people, dominates in the Silesia Province in terms of population and economy, since 69% of inhabitants live and concentrate their main economic activity and urban functions here [22]. Mobility management in the agglomeration area is impeded by the complexity of public transport organizers. Public transport, which is key for fulfilling transport needs, is managed by 5 organizers that differ from one another in terms of financing systems and provided services (quality and price). Other mobility factors (related to transport development and management, as well as spatial planning) are also dispersed and carried out by different entities. Metropolitan integration is not very advanced. Currently, the major metropolization area is the Association of

Municipalities and Districts of Agglomeration and its Functional Area, which was formed for the purpose of managing the financial instrument of ZIT (Integrated Territorial Investments) [34, 39].

SUMP for Upper Silesia Agglomeration was prepared in 2016 [30]. The plan covers the agglomeration area and its functional surrounding and was approved by the Association of Municipalities and Districts of the Central Subregion. It includes 5 Statistical Territorial Units (NUTS 3) located in the Silesia Province and inhabited by 2.8 million people. The works on the first version of the plan took 4 months, with the participation of 82 local government units forming the Central Subregion, as well as public transport organizers and operators. The lack of great deal of information concerning mobility in the Subregion area was a big challenge for the planning process. Therefore, it may be assumed that it is only the subsequent versions of SUMP that will get closer to the models specified in the ADVANCE guidebook [15].

SUMP for Central Subregion highlighted the necessity to fulfill mobility needs in effective manner and at a high level—mobility cannot be balanced by means of its reduction. Mobility in the plan is regarded as a factor of competitiveness and quality of living, as well as an element of civil liberties. The basis for such vision is competitive public transport, synergy of potentials of public and individual transport (integration), as well as prevention of congestion which restrains mobility. The functional approach was applied in order to identify the instruments required for the implementation of the Plan—instead of using a traditional branch structure for identifying tools, the instruments were divided into technical, organizational, financial, educational and promotional (soft). This approach, originating from the review of the literature on the subject (especially from the classification developed by G. Murray with his team [25]), provides the opportunity to approach mobility management in an integrated manner, with areas of intervention divided into sectors, which has positive impact on mobility and improves its sustainable development. The following measures are classified as instruments for supporting sustainable mobility [30]:

- Technical: transfer centers, modernization and purchase of modern rolling stock for public transport, modernization of nodal and linear infrastructure for public transport, development of cycling infrastructure and bicycle hire system, ITS in the field of area traffic management system
- Organizational: vehicle traffic calming, public transport integration, bicycle traffic separation, sustainable urban spatial planning
- Financial: congestion charges, parking fees, preferences for carpooling, employee allowances for public transport tickets

The above-mentioned instruments are used for achieving the targeted goals and one instrument frequently serves several purposes. Therefore, the integrated approach to planning and implementing SUMP is important. What is significant, the Subregion will dedicate more than half of the amount of EUR 793 million from ZIT instrument for 2014–2020 for the implementation of the Plan [31].

Table 1 Result indicators for SUMP of central subregion (2016)

Strategic goal	Result indicator	Target value	Source of data
1. Increase of competitiveness of sustainable transport	Number of purchased rolling stock units in public transport [items]	165	Urban transport operators
	Capacity of purchased rolling stock in public transport [passengers]	8 250	Urban transport organizers and operators
	Length of completed cycle paths [km]	1 113	Local government units
	Length of newly built tram network sections [km]	23	Tramwaje Śląskie
	Length of modernized tram network sections [km]	100	Tramwaje Śląskie
2. Transport integration	Number of completed integrated transport centers	53	Local government units
	Number of completed Park&Ride facilities	53	Local government units
	Number of parking spaces in completed Park&Ride facilities [items]	3 225	Local government units
	Number of parking spaces for the disabled in completed Park&Ride facilities [items]	700	Local government units
	Number of completed Bike&Ride facilities	300	Local government units
3. Reduction of congestion	Number of installed intelligent transport systems [items]	8	Municipal Road Authorities
	Length of roads included within ITS system [km]	1 200	Municipal Road Authorities

The feasibility of goals is a measure for assessing the adequacy of planning. Therefore, a summary of measures for achieving the intended goals was prepared within the framework of SUMP. The below list indicates the expected effects of the undertaken activities (Table 1) [30].

Since this is the initial stage of mobility management in the agglomeration area, the number of result indicators is small. The presented SUMP was prepared for the first time and, moreover, for an area with various levels of advancement of metropolization processes. Additionally, it should be remembered that this SUMP is financed mainly using the ZIT instrument, whereas sustainable mobility in the Upper Silesia Agglomeration must be developed on a significantly greater scale and with the participation of a higher number of stakeholders.

In Poland, a set of regulation tools intended to support metropolization was prepared. The Act on Metropolitan Associations (which are to be formed by cities in agglomerations) became effective on 1 January 2016, however, its provisions are controversial and relevant amendments are currently being prepared. As a result,

metropolitan associations will not be formed earlier than in the second half of 2017. The formation of such association in the Upper Silesia Agglomeration will cause changes in the field of mobility management—it will be necessary to change SUMP and settle relationships between the agglomeration and its functional area. This means that SUMP of the Central Subregion will be subject to change.

4.3 ITS in Sustaining Mobility in the Upper Silesia Agglomeration

The problem of sustainable transport in the area of Upper Silesia Agglomeration is the subject of programme documents prepared within the framework of changes occurring in metropolitan area management. These issues were exposed in the "Strategy of Integrated Territorial Investments for the Central Subregion of Silesian Province for the years 2014–2020" [34], where sustainable mobility was distinguished among 9 strategic activities. However, the key role in sustaining mobility should be played by SUMP, presented in Item 4.2 and adopted in March 2016 [30], which takes into consideration the areas of activity that are key for sustainable mobility, including in particular the following [10]:

- in the field of public transport: attractive and flexible tariff solutions, electronic tickets and increased transport integration,
- in the field of vehicle traffic: dynamic information systems for drivers

The activities listed as SUMP elements will be executed (not only using ZIT instrument) through the application of ITS, in particular by implementing:

- Electronic ticket card system used in the agglomeration (Śląska Karta Usług Publicznych—ŚKUP)
- Urban traffic control system (or systems)

Apart from ITI Association (Subregion), the institutions which implement or may implement such projects include Komunikacyjny Związek Komunalny GOP (Communal Transport Association of Upper Silesia, associating 29 municipalities) and future Metropolitan Association (it is currently assumed that 24 municipalities will be included in the Association, including 10 cities of Upper Silesia Metropolitan Union). The organizational complexity of metropolitan management in the area of Upper Silesia Agglomeration will definitely increase the investment costs and risk in the field of ITS.

The implementation coordinator and system manager of ŚKUP is KZK GOP, however, Jaworzno, an important member city of the future Metropolitan Association, is not a member of KZK GOP or ŚKUP (the territorial scope of the system goes outside the area of KZK GOP). The system was launched with two-year delay. It had been prepared since 2008 (design), and expected to be put into use in 2013; however, in the end the system launch did not begin until the end of 2015.

Within the first two months, only 20,000 cards out of the expected number of 700,000 cards were issued. It appears that the system has too many functionalities, which were expected to be ready and provided "on a turnkey basis" [11], and such ambitious assumptions increased the financial risk, as well as the risk of not meeting the deadline for completing the project.

As of now, urban traffic control system in the Upper Silesia Agglomeration on a larger scale has only been implemented in Gliwice (for the cost of over PLN 30 million). KZK GOP has developed the concept of a system covering the Association area, whose functionalities are similar as in the case of TRISTAR system, although the costs of such project would undoubtedly be several times higher [21]. It seems that such system should be designed and implemented in a completely different manner than resulting from the experiences of Tricity and Wrocław. The basis should be the approved system architecture and strategy of solution implementation in stages (per function and region).

5 Conclusion

The growing trend towards urbanization and metropolization has its negative effects, which pose threats to the quality of living and cities' competitiveness. In accordance with the smart city concept, these risks can be counteracted by developing the social capital of the city by means of integrated ICT implementations, which is largely about achieving sustainable mobility. Sustainability must be developed in an organized manner, engaging all stakeholders in the city and its transport system. Such mobility management is possible thanks to SUMPs.

Smart and sustainable mobility is a great challenge, both for scientists and for practitioners. Mass movements in cities, substitutability of various means of transport and diversification of transport needs mean that effective management requires applying complex organizational and technical solutions. ITS are of particular significance in this case. Their implementation enables an increase in the economic and environmental efficiency of the transport system, and a better satisfaction of transport needs.

Planning sustainable mobility in metropolises requires an integrated action by various entities responsible for the functioning of the city. ITS for metropolises must have different architectures and implementation strategies, since with the growing size of systems comes an increase in costs and risks of failing to meet the deadlines for implementation and effective operation. The experiences of Upper Silesia Agglomeration show that these risks can be reduced if such systems are developed into a network in stages and in a dispersed manner. Such approach to sustainable mobility will accelerate the processes of metropolization and formation of a smart metropolis.

References

1. Albino V et al (2015) Smart cities: definitions, dimensions, performance, and initiatives. J Urban Technol 22(1):3–21
2. Benson B (2005) Implementing intelligent transportation systems. In: Button K, Henser D (eds) Handbook of transport strategy, policy and institutions. Elsevier, pp 651–663
3. Bettencourt L et al (2007) Growth, innovation, scaling, and the pace of life in cities. PNAS 104 (17). doi:10.1073/pnas.0610172104
4. Brdulak A, Brdulak H (2015) Smart city solutions in regard to urbanization processes—Polish cases. Logistics & Sustainable Transport 6(1):50–60
5. Caragliu A (2013) Smart cities in Europe. In: Deakin M (ed) Creating smarter cities. Routledge, pp 65–79
6. Cities of tomorrow—challenges, visions, ways forward (2011) doi:10.2776/41803
7. Cuthbert AR (2006) The form of cities. Political economy and urban design. Blackwell, pp 32–37
8. Borkowski P (2013) Metody obiektywizacji oceny ryzyka w inwestycjach infrastrukturalnych w transporcie. Uniwersytet Gdański, pp 68–72
9. Delbosc A, Currie G (2014) Using discussion forums to explore attitudes toward cars and licensing among young Australians. Transp Policy 31:27–34
10. Duportail V, Meerschaert V (2016) Final ADVANCE audit scheme and guidelines (2013)". http://eu-advance.eu/docs/file/d2_5_final_advance_audit_scheme_including_guidelines_en.pdf
11. Dydkowski G (2009) Elektroniczne karty płatnicze a ŚKUP. Komunikacja Publiczna 3 (36):33–38
12. Dydkowski G (2015) Transformations in the ticket distribution network for public urban transport in the processes of implementation of electronic fare collection systems. In: Mikulski J (ed) TST 2015. CCIS 531, pp 198–209
13. ESPON 1.1.1. Potentials for polycentric development in Europe. Project report, NORDREGIO (2005) http://www.espon.eu/export/sites/default/Documents/Projects/ESPON2006Projects/ThematicProjects/Polycentricity/fr-1.1.1_revised-full.pdf
14. Europe 2020. A strategy for smart, sustainable and inclusive growth (2010) COM (2010)2020
15. Final ADVANCE audit scheme and guidelines (2013) http://eu-advance.eu/docs/file/d2_5_final_advance_audit_scheme_including_guidelines_en.pdf
16. Fuchs RJ et al (1999) Mega-city growth and the future. The UN University, pp 18–31
17. Garret A (1998) Intelligent transport systems—potential benefits and immediate issues. Road and Transport Research 7:61–69
18. Grzelak G et al (2009) Obszary metropolitalne w Polsce: problemy rozwojowe i delimitacja. In: Raporty i Analizy EUROREG. http://www.euroreg.uw.edu.pl/dane/web_euroreg_publications_files/602/obszary_metropolitalne_w_polsce_problemy_rozwojowe_i_delimitacja.pdf
19. Guidelines. developing and implementing a sustainable urban mobility plan (2013) http://www.eltis.org/sites/eltis/files/guidelines-developing-and-implementing-a-sump_final_web_jan2014b.pdf
20. Jamroz K, Oskarbski, J (2006) TRISTAR—trójmiejski inteligentny system transport aglomeracyjnego. Transport Miejski i Regionalny07-08, pp 82–88
21. Koncepcja i architektura Inteligentnego Systemu Zarządzania Ruchem na obszarze działania Komunikacyjnego Związku Komunalnego Górnośląskiego Okręgu Przemysłowego (2015) http://bip.kzkgop.pl/pdf/uchwaly_zarzadu/2015/82_2015_zal1.pdf
22. Korzeniak G, Gorczyca, K (2014) Policentryczność rozwoju systemu osadniczego z udziałem miast małych i średnich w kontekście procesów metropolizacji. In: Korzeniak G (ed) Małe i średnie miasta w policentrycznym rozwoju Polski. Instytut Rozwoju Miast, pp 127–156
23. Litman T (2016) Evaluating accessibility for transportation planning. Measuring people's ability to reach desired goods and activities. http://www.vtpi.org

24. Mapping Smart Cities in the EU (2014) http://www.smartcities.at/assets/Publikationen/Weitere-Publikationen-zum-Thema/mappingsmartcities.pdf
25. Murray G et al (1997) TCRP report 21, strategies to assist local transportation agencies in becoming mobility managers. National academy press, pp 17–31
26. Nosal K (2015) Wpływ wybranych instrumentów zarządzania mobilnością na podział zadań przewozowych. Politechnika Krakowska, pp 16–19
27. Nosal K (2016) Zasady tworzenia planów mobilności dla obiektów i obszarów generujących duże potoki ruchu. Transport Miejski i Regionalny 2:3–11
28. Oskarbski M et al (2015) Information system for drivers within the integrated traffic system—TRISTAR. In: Mikulski J (ed) TST 2015. CCIS 531, pp 131–140
29. Planning and design for sustainable urban mobility. Global report on human settlements (2013) UN-Habitat, pp 3
30. Plan zrównoważonej mobilności miejskiej Subregionu Centralnego Województwa Śląskiego (2016) Uniwersytetu Ekonomiczny w Katowicach. http://www.subregioncentralny.pl/materialy/_upload/Adam/PZMM/PZMM_v.pdf
31. Regionalny Program Operacyjny Województwa Śląskiego na lata 2014–2020. https://rpo.slaskie.pl/media/files/cms/DOKUMETY%20REG./RPO%20WSL%202014-2020%20przyjęty%20przez%20KE%20i%20ZW.pdf
32. Report of the world commission on environment and development: our common future (1987) UN, http://www.un-documents.net/our-common-future.pdf
33. Research for tran committee—the world is changing. transport, too (2016) European Parliament, pp 21–22
34. Strategia Zintegrowanych Inwestycji Terytorialnych Subregionu Centralnego Województwa Śląskiego na lata 2014–2020 (2015) Związek Gmin i Powiatów Subregionu Centralnego Województwa Śląskiego: http://www.subregioncentralny.pl/strategia-zit.html
35. WHITE PAPER Roadmap to a single european transport area—towards a competitive and resource efficient transport system (2011) COM(2011)144
36. World urbanization prospects. The 2014 revision (2015) UN, pp 1
37. Urbanek A (2015) Pricing policy after the implementation of electronic ticketing technology in public urban transport: an exploratory study in Poland. In: Mikulski J (ed) TST 2015. CCIS 531, pp 322–332
38. Zawieska J (2015) Smart cities—koncepcja i trendy rozwoju miast przyszłości. In: Gajewski J et al (eds) Megatrendy i ich wpływ na rozwój sektorów infrastrukturalnych, pp 26–55
39. Zintegrowane Inwestycje Terytorialne. Nowe rozwiązania dla miast w polityce spójności na lata 2014–2020 (2015) Ministerstwo Infrastruktury, https://www.mr.gov.pl/media/9915/Broszura_PL.pdf
40. Zysińska M Et et al (2014) Koncepcja smart cities w kontekście rozwoju systemów transportowych. Logistyka 6:11969–11982

Fair Access to City Space—Establishing Principles

Jacek Szołtysek

Abstract The space in a city has a lot of disintegrated varieties. In human activity, city space seems to widen and, simultaneously, is losing its continuity. Access to it is controlled in many ways. Being under the dominion of organizations and groups of people, the city space and the way of it is used significantly influence the quality of life and future chances of any city. Where citizens' access to city space is limited, this requires laying down principles based on co-determination and joint responsibility.

Keywords Public and private space · City · Fair access · Polish

1 Introduction

Issues related to the functioning of cities in their social context attract more and more attention—probably due to the rising interest in the actual dimension of human rights to live in clean environment, respect people's views, self-realize and obtain public approval, and also in how this influences the development and success of cities. The interconnection between these processes is relatively new, but it does not surprise anybody. For ages it has been known that a city's success is linked to contentment of its inhabitants. What is new in this approach is that we pay more and more attention to satisfying individual residents (people) rather than to the overall result, this being an attempt to generalize happiness and satisfy the crowd (groups of people, social classes, whether of all residents).

The main goal of this paper is to establish principles of fair access to city public space based on survey research conducted in 2016 on a sample of 1400 residents of five big Polish cities (each with more than 100,000 citizens). A total of 1270 questionnaire forms were found suitable for examination. The discussion is provided against a theoretical background mainly (but not exclusively) represented by

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Polish authors, to show Polish city ideas and the domestic theoretical approach. The presented findings were not subjected to statistical processing to enable the reader making their own analyses in a freely chosen perspective. The snowball sampling technique was applied, whereas the questionnaire form was created according to the cognitive model.

2 Some Thoughts About the Nature of Cities

Cities are the place where a majority of mankind lives. On the other hand, character of cities resulting from their specificity contrasting cities without-of-cities results in difficulties in realization of exchanged demands that are premises of the life satisfaction [31].

Satisfaction of a city dweller from conditions a city enables is defined through aggregate Quality indicator of Life or Quality of Living for the individual realization of its purposes and aspirations. The methodology of determining these rates sometimes differs, and therefore rankings of cities are different depending on who carries out research. A possibility of the participation in the social life, carried out at different levels is one of conditions for people to be pleased with their lives—within the family, of the most immediate neighborhood, at the work, in the district, in the support group, in associations etc.

This type of functioning usually has more long-term character and brings notable benefits to people from one side. On the other side, it has a tendency of strengthening views and beliefs due to the top stair of the homogeneity of such social groups. This is one side of the phenomenon—social, more and more willingly concentrating on individuals, not on groups.

From the other side, we deal with the city that I most willingly understand as collective space that belongs to those who live in it, who have the right to find there conditions for their political, social and ecological fulfillment, thus undertaking duties of solidarity [11]. This definition seems to me the most cognitively inspiring —because it is stimulating to discussion. Firstly in this definition we find "a collective space" that one should understand multifaceted.

Firstly, there is physical space—location of specific place with prescribed limits that are separating the city from its surrounding area. Secondly, there is spiritual, immaterial space that is a way of conveying history of the city, its culture, character, finally with information resources that have different potential. This definition is adjudicating the law top-down to the city—who is the owner of the city and who is supposed to have a prime move in fates of the city. It is a problem that is often analyzed in theoretical works nowadays. Space belonging to people is also a problem of sharing it and having the right to it, which in practice means that cities belongs to their residents. Here we are coming back to the social dimension for a short moment trying to recognize whether two identical spaces, identically developed, having the same physical dimensions and economics can become different cities when are settled by other communities.

K. Frysztacki does not define a city but the way of treating it determines that deals with the city as the social community [14], whereas P. Rybicki thinks, that separateness of the city as the social community depends on the following: population numbers and its dense concentration, heterogeneous composition of the population, abundance of planted types of the work, size of social layers with different styles of typical living, settling and laying out in the special social and space arrangement. A multitude of social groups co-occurring in the city and a net of social links between individuals and groups are further trademarks" [27]. R. Florida in "Who is your city" once again points to the fact that a city that offers better conditions of living for desired persons will be a place such people live until a new competitive offer appears [13].

Then these people, along with their resources (also financial) will simply leave the town. It is going to be easier for them because the city will be more boring and they will move to places where they find more interesting. This means that the city should make sure it is not boring [13]. Finally, we have to remember of the right to find conditions and duties of solidarity. There are not only rights or duties in the city only. Responsibility for the city should include balance of rights and obligations, and, in addition correct assessment should not be unstable. That should not also mean the absolute evenness of citizens in performing duties for the city.

This is how we understand solidarity-union or fellowship arising from common responsibilities and interests, as between members of a group or between classes, peoples [Dictionary.com] Solidarity is a principle of action. It bonds an individual to the group and group to the individual. Solidarity among the members of a society is necessary for the stable and long-lived functioning of the society. Solidary behavior of the members of the society is the reason why societies do not fall apart [32].

3 Public and Private Space—Problem of City Life Democratization

A way of carrying the ownership transfer out decides on character of the space. Fundamental division into the public and private space was observed at the beginning of the seventies of the 20th century—developed by O. Newman, the author of the famous book "Defensible Space". People that had an absolute power supervised the private space and they could decide who could enter and who could not. The public space was a space for Newman "no one's"—even if he this way did not literally describe it, this understanding was a consequence of his works [24]. How can we describe both types of the city space? Perhaps it will be sufficient to point to main differences in their characteristics. We can discern four broad categories of things that people commonly appeal to under the guise of public and private. Drawing on the rather diverse resources of Dewey [10], Arendt [3],

Waldron [33], and Geuss [16], we can include in the "public" bundle the following ideas:

1. Freely accessible places where "everything that happens can be observed by anyone", where strangers are encountered whether one wants to or not, because everyone has free right of entry [16]. These are places where the spotlight of "publicity" shines, and so might not just be public squares and market places, but political debating chambers where the right of physical access is limited but informational access is not.
2. The things that concern, affect, or are for the benefit of everyone, Arendt's second sense of "public" [3] his realm includes "common goods" [17], goods like clean air and water, public transport, and so on; as well as more particular concerns like crime or the raising of children that vary in their content over time and space, depending on the current state of a particular society's value judgments and discursive battles.
3. The people or groups that have responsibility for that realm covered in (2), which might include rulers, or "public figures", or might be defined more broadly to mean all of us: "the public" as a noun, not an adjective.
4. Things which are owned by the state or the people in (3) and paid for out of collective resources like taxes: government buildings, national parks in most countries, military bases and equipment, and so on.

In the private bundle, we can include the following:

1. Places that are not freely accessible, and have controllers who limit access to or use of that space.
2. Things that primarily concern individuals and not collectives.
3. The people who primarily deal with such items; or rather, the roles that people play when they are so dealing, referring to the common distinction between politicians' "private" commercial and family interests and their "public" roles managing collective resources and concerns.
4. Things and places that are individually owned, including things that are cognitively "our own", like our thoughts, goals, emotions, spirituality, preferences, and so on.

Assuming that all city dwellers have equal rights and a city belongs to all residents, access on equal bases to the any space in the city is a practical dimension of democracy. Democracy depends to a surprising extent on the availability of physical, public space, even in our allegedly digital world. It also argues that in many respects the availability of space for democratic performance is under threat, and that by overlooking the need for such space—or arguing against that need—we run the risk of under-mining some important conditions of democracy in the modern world. A democracy that lacks a single site for binding collective decision-making is a more-easily attenuated democracy, because it is one that is taken less seriously by its citizens, and one in which decisions can too easily pass undetected and undefended [25].

Table 1 Characteristics of public and private space in cities

	Characteristics	Public space	Non-public space
1	Accessibility	Freely accessible places	Not freely accessible
2	Benefits/beneficiaries	Everyone	The owners and those who are permitted by the owners
3	Responsibility stands for	Everyone/group of people, public figures	The owners, controllers Short term relationship
4	Ownership of infrastructure	Government/everyone paying taxes	Private property
5	Flexibility of decisions	Rather low	High
6	Freedom of wives expressed	High	High

Some of characteristic and differences between public place and private space (non-public) are presented in Table 1.

4 Framework for Public Space Selection Criteria

What worries many writers on the urban experience is that the freedom to enjoy the city is more restricted than appearances might suggest. There are places that appear open but in which one meets a much more narrow slice of society than if it really were fully accessible. There are places that are controlled not by their denizens but by much more limited elites, property developers, investors, business associations, and their friends in local government and local police who tear down and rebuild the city to suit their interests, or who sometimes set troubling limits on what kinds of actions are permissible and what are not. There are places whose residents are cutting themselves off from city membership behind gates, walls, and razor-wire fences [25]. Before starting procedure of creating/changing/cancelling the city public space city authorities should pay attention to criteria which decision-making is based on it. The criteria in Poland are not fixed and finally established. In Polish cities there is no custom of discussing publicly any decision to transform the public sphere in private. Existing regulations are only a substitute for public discussion and practically allow for doing any operations converting character of space of the city. The idea that democracy depends on the physical space in various ways is opposite to the current orthodoxy in the democratic theory and wider political science. Issues of physical space are almost entirely off the radar of scholars of politics. Those very few political theorists who use the term "public space" use it interchangeably with "public sphere" or "public realm". They generally take it to be a metaphor that refers to the myriad ways in which citizens separated in time and space can participate in collective deliberation, decision-making, and action (e.g. Benhabib [7], Nagel [22], Nagel [23], Hénaff and Strong [18]) go so far as to claim that "the literal meaning has almost been wiped out".

4.1 Literature on General Criteria

Many previous studies on supplier selection and evaluation defined numerous evaluation criteria and selection frameworks for supplier selection. In consideration of the criteria for supplier selection, the pathfinder work by Dickson [19] has been one of the most cited studies.

In order to shape the public space competently, one should state what elements influence its attraction, and which cause; that the space remains not-used and not-noticed by people. Such a balance sheet, prepared based on elements discussed by the following authors: Gehl [15], Bauman [5], Bogdanowski [9], Wejchert [34], Alexander [1], and Stiles [30], and organization People for Public Spaces. Having elements were listed in Table 2 positive and adverse impact to the quality of the public spheres. However not every of mentioned element has the same importance, therefore at this work they were described in the hierarchical presentation, as main elements, assisting and accompanying ones.

4.2 Criteria in the Opinion of Residents of Big Polish Cities —Research Results

The test procedure of criteria consisted of two parts—of appointing keywords describing the public space, without outlining any restrictions (e.g. of classification categories) and without defining the notion.

In the first phase, the result of which is presented in the picture of word cloud (see Fig. 1), 120 persons (aged 21–40 years) took part. Every person was provided with a sheet of paper and a pencil and was asked to write out any number of nouns describing the desired public space within 3 min. Based on collected expressions (of words) and frequencies of their appearing, further to the ranking presented in Table 2, they negotiated survey questions and they asked for the evaluation of every of categories in 5-degree of the Lickert scale (“definitely yes”, “yes”, “no opinion”, “no”, “definitely no”). The second phase was a questionnaire examination of 1400 residents. The results are presented in Table 3.

5 Fair Access to the City Space

Issues of the social fairness belong to the research current represented by representatives of many sciences, religious and political doctrines and comprehending the fairness in the different way treats. Seeking sources of the fairness in the conduct of people and the evaluation of the naturalness of such proceedings are directing the remark of scientists’ different motives causing that people are confronting their benefit with top-down principles of fairness. Most economic models

Table 2 Selected positive and negative elements of public space in cities—criteria for making decision process (based on literature study and [20])

	Positive influence	Negative influence	Hierarchy
The location and the availability of the space	1. Good location: "on the way"	1. Bad localization: on the out-of-the-way place	Main
	2. Majority of the pedestrian traffic and bicycle	2. Majority of the motor traffic	Main
	3. Easiness of entering (availability) and of evacuation	3. Of hampering in the entry and the evacuation	Main
	4. Convenient journey with various means of public transport	4. Lack/insufficient amount of mergers of the public transport	Assisting
	5. Great rotation of parking	5. Small rotation of parking	Accompanying
Perception of space	1. Feeling the identity, the spirit of the place	1. An identification is lacking the place	Main
	2. Spaces visible from a distance, noticeable, having significance	2. Empty spaces	Main
	3. Favorable first impression	3. Adverse first impression	Main
	4. The place	4. Semi-places	Main
	5. Sense of security	5. Feeling the threat	Assisting
	6. Positive impact on health (physical and psychological and general)	6. A positive income is missing to the physical and mental health and the frame of mind	Accompanying
	7. The cleanness and the spatial order	7. Littering and the disarray	Accompanying
Diversifying the space and ways for/of using it	1. Different kinds of the activity	1. A space is lacking adding variety in the way of using	Main
	2. Space adapted to walking, standing, the seat, etc.	2. Not adjusted space to different ways of staying in it	Main
	3. Developing social contacts inclusive with promoting the cultural and commercial activity.	3. Space serving exclusively consumers	Main
	4. Surrounding about multi-functional character	4. Surrounding about mono-functional character	Main
	5. Space used in different times of the day, of year and in different weather conditions	5. Limited time of using the space	Main
	6. Simple, attractive contact with natural elements of the environment	6. Missing contact with the nature	Accompanying

Fig. 1 Wordcloud presenting the results of phase 1 of the project—establishing criteria for public space distinction

are based on the self-interest hypothesis that assumes that all people are exclusively motivated by their material self-interest. Many influential economists, including Adam Smith [29], Becker [6], Arrow [4], Samuelson [28] and Amartya [2], pointed out that people often do care for the well-being of others and that this may have important economic consequences. Yet, so far, these opinions have not had much of an impact on mainstream economics. In recent years experimental economists have gathered overwhelming evidence that systematically refutes the self-interest hypothesis. The evidence suggests that many people are strongly motivated by other-regarding preferences and that concerns for fairness and reciprocity cannot be ignored in social interactions. Moreover, several theoretical papers have been written showing that the observed phenomena can be explained in arigorous and tractable manner [12]. Many regard a fair society as one governed by the principle of equality of opportunity, in such a scope it seems sensible to search for the meaning of the just access to resources of the city, in it to the public sphere. It is worthwhile directing attention to one concept associated with the notion fairness equilibrium. In a pioneering article, Rabin [26] starts from the observation that our behavior is often a reaction to the (expected) intentions of other people. If we feel that another person has been kind to us, we often have a desire to be kind as well. If we feel that somebody wanted to hurt us, we often have the desire to retaliate even if this is personally costly. And one more remark, considering the equal rights of citizens. The city is today the space for all kinds of meetings and, therefore, of all kinds of possibilities. At the same time it is the field of all contradictions and all dangers: in the urban space with its uncertain frontiers appear all those discriminations rooted in unemployment, poverty, the disdain for cultural differences, while at the same time civic and social practices of solidarity are sketched out and multiply. City life today involves the obligation to define certain rights more clearly, because we live in the city, we seek work, we move about. It imposes also on us the recognition of new rights: a respect for the environment, the guarantee of sound food, tranquility, possibilities of social interchange and leisure, etc. [11].

Table 3 Results of the questionnaire survey in the evaluation of the importance of criteria connected with the public space in the city

	Definitely yes	Rather yes	No opinion	Rather no	Definitely no
Elements of public space					
Unrestricted access to space	**739**	348	77	67	25
Joint rule of this space	409	**451**	197	149	44
Co-determination about this space	435	**520**	154	110	34
Joint incurring costs of using space	343	**438**	257	151	60
Access free of charge to this space	**741**	366	64	60	20
Label border of this space	366	**388**	244	183	72
Supervision of the safety of staying and using it	**524**	479	141	82	24
Freedom of behaviors of users	367	**409**	158	251	66
Equipped with benches, waste-paper baskets	**820**	330	50	36	16
Equipped with public restroom	**696**	357	103	69	28
Presence of a lot of green	**716**	332	100	80	25
Priority access to public space					
Pedestrian	**934**	235	41	19	27
Cyclist	**529**	479	107	89	46
Private passenger cars	239	**354**	248	285	127
Shared car (e.g. car pooling)	189	297	**353**	259	154
Public transport	**557**	433	131	65	64
Parking cars in public space					
Free everywhere	**473**	211	110	282	180
Free in designated places	**537**	366	90	101	167
Paid everywhere	30	31	89	295	**806**
Paid in designated places	274	**370**	121	183	305
Paid for some users	119	185	211	250	**480**
Forbidden	44	46	110	239	**816**
Allowed only for residents	92	147	170	326	**521**

5.1 Literature on General Criteria

The concept of fairness is often emphasized in religious, political and juridical texts that aim to shape society. The reason for this emphasis is that the concept of fairness affects the behaviors of individuals in a society or in a group; and it is also affected by these behaviors. In addition, as human rights are to be ensured in organizational,

as well as social life, organizational fairness also becomes an obligation. Consequently, what societal fairness means for a society can be said to have the same meaning in terms of organizational fairness [8]. Seeking the uniform set of criteria in such conditioning is sentenced to the failure. Due to the subjective nature of fairness, there is no single fairness criterion that is universally accepted by policymakers and academics alike. As such, a great challenge lies in identifying the appropriate fairness constraints that the allocation outcomes of a policy should ideally satisfy. In case of every examining feeling the social fairness an individual set of criteria, helping to describe the justice for the purposes of the examined group is being selected. They often belong to such sets: respectful partnership, systematic fairness, Life satisfaction, due to "Fair Learning Environment Questionnaire" developed by Lizzio et al. [21]. Majority of scientific works on fairness is being led in forms of public experiments and games. The behavioral observation of participants in experiments, in situations stimulated by researchers, allows for the inference.

Thus, real world examples where fairness concerns are likely to matter abound. Nevertheless, in the following we concentrate on clean experimental studies because in most real life situations it is impossible to unambiguously isolate the impact of fairness motives. A skeptic may always argue that the notion of fairness is only used for rhetorical purposes that disguise purely self-interested behavior in an equilibrium of a repeated game [12].

5.2 *Criteria in the Opinion of Residents of Big Polish Cities —Research Results*

The same procedure as presented in Sect. 4.2 was conducted. Participants were asked to mention elements consisting to the fairness but with reference to the dimension of the availability to the public space. They suggested that they made a decision on the availability as persons that not yet are using this space, but they are willing. The results are presented on Fig. 2. The second phase was questionnaire examination of 1400 residents. The results are presented in Table 4 and on the Fig. 3.

Fig. 2 Wordcloud presenting the results of phase 1 of the project—establishing criteria for fairness distinction

Table 4 Results of the questionnaire survey in the evaluation of the importance of criteria connected with fair access to the public space in the city

	Definitely yes	Rather yes	No opinion	Rather no	Definitely no
The fair access to the public sphere consists in the principle					
of free access	**732**	348	68	70	35
of unlimited access	**598**	368	110	120	63
diversified for all sorts groups of people	262	**273**	231	238	240
community of beliefs	174	225	**329**	244	287
safety	**734**	361	87	35	29
after complying with the requirements—e.g. of the appropriate dress and the behavior	212	**320**	253	244	222
honesties of everyone towards everyone	**613**	404	145	51	46
of democratic access	**490**	345	234	90	87
of access of only residents	100	103	174	434	**439**

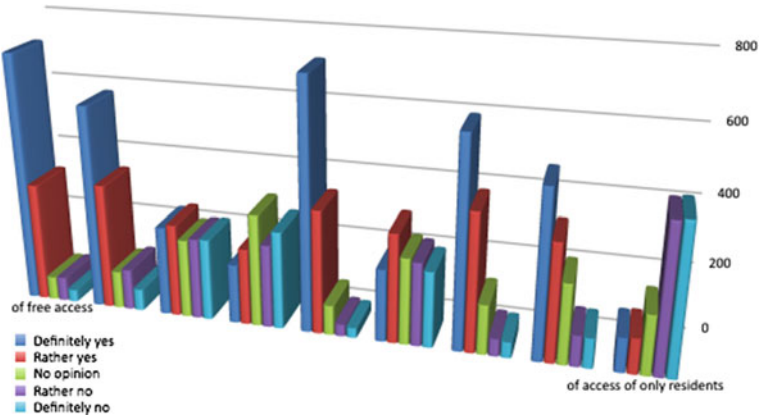

Fig. 3 The answers to the question: "the fair access to the public sphere consists in the principle…"

Difference between the research on elements, making characteristics of the public sphere up and the fairness in conveniently to the space is visible in pictures in the form of the size of fonts. Thus, unlike the first part of examinations, it is worthwhile commenting one—feature standing out—Equity. Equity is a base of functioning of the good city, described in the definition presented in this paper. We know very well that not all city dwellers are equal—after all, there are different social groups existing in the city, having a different impact on development and a

success of the city. I mention this in the article. However the idealistic aspiration to equality, justice, and freedom manifests itself in examinations of persons irrespective of their membership to of the one whether of other social group.

Equity comes from the idea of moral equality, that people should be treated as equals. Thinking about equity can help us decide how to distribute goods and services across society, holding the state responsible for its influence over how goods and services are distributed in a society, and using this influence to ensure fair treatment for all citizens. Applying these ideas in a specific country context involves hard choices, and embedding discussions of distributive justice into domestic political and policy debates is central to national development, but three areas of considerable consensus can be identified [19]. In order of priority, these are:

1. Equal life chances: There should be no differences in outcomes based on factors for which people cannot be held responsible.
2. Equal concern for people's needs: Some goods and services are necessities, and should be distributed according solely to the level of need.
3. Meritocracy: Positions in society and rewards should reflect differences in effort and ability, based on fair competition.

Considering above mentioned elements I decided not to include proposed features of the fair access of the notion in the list "equity", making the specific dispersion of this notion to other suggested features.

6 Discussions

Two phenomena were put through this examination—features marking the public space in the city and matters of the fair access to such spaces. Both mentioned phenomena were (1) identified by residents of big Polish cities, participating at first in the process of the identification and selection of elements, and (2) in the evaluation of the identified elements. Received results were confronted with theoretical studies and brought for discussion.

Elements forming the public space in the city:

In a group of "good location and availability of space" there were placed the following elements (having the bigger number votes for "definitely yes" + "yes"):

pedestrian (934 + 235), public transport (557 + 433), cyclist (529 + 433) which can be combined with *unrestricted access to space (739 + 348) and access free of charge to this space (741 + 366)*. From one side these results confirm the significance of the factors identified to be 'main' (see Table 2). On the other side there is a sequence of factors that exists in practice of the public sphere and that are not relevant for any emotional evaluation.

In a group of "perception of place" there were placed the following elements:

equipped with benches, waste-paper baskets (820 + 330), presence of a lot of green (716 + 332), equipped with public restroom (696 + 357) that may fulfill the elements listed in Table 2.

In a group of "diversifying the space and ways for/of using it" the following elements were placed: there are significant elements that received lot of votes for "definitely yes" and "yes".

And so respondents perceive the public space in the city as the place relatively readily available in the financial dimension. This space should be available free of charge and should be adapted above all to the slow migration—for pedestrians, for cyclists.

The journey to this space should also be available on foot, by bicycle, or by public transport (557 + 433), at least with some surprise one should accept the high readiness for the possibility of free parking everywhere (473 + 211), in designated places (537 + 366), at the explicit strong opposition against paying everywhere (295 + 806—"yes" + "definitely yes") or forbidden parking (against 239 + 816).

Respondents think that the space should be the green space (716 + 332), equipped with places aimed at rest (benches) and facilitating keeping the place clean (waste-paper baskets) and public conveniences. In this respect the requirements concerning the public space are similar to the requirements directed at the address of urban parks. Such a space than should be marked (366 + 368) and co-managed by its users (524 + 479) that also means the participation in the democracy on the local level.

In the case of such a space users are able to incur some part of the costs provided the costs are identified with the owners. Using the public space should allow for some freedom of behaviors (367 + 409) and want on their own to care about their safety (524 + 479). They are among features that do not have strongly expressed evaluations. Two of factors subject to this research—possibility of using private passenger cars and the system of the car sharing—were not attributed any decisive evaluations.

Elements forming the principles of fair access to public space:

An evenness of city dwellers is an important component of justice. It results not only from beliefs of respondents, but also is written in the definition of the city, not distinguishing any group amongst persons living in a town. Even more—for everyone is assigning equal rights and regular duties to residents. Probably therefore, every depriving of one group of people of even some little entitlement causes feeling of injustice.

Respondents recognized access to the public sphere in the city to be just when the access is free of charge (732 + 348), based on principles of the honesty (613 + 404), unrestricted (598 + 368) and safe (734 + 361). I believe that it is possible to describe this access to be "relatively democratic" (490 + 345) Some danger in certain circumstances may appear, especially when the majority takes control of the space.

Lack of strong bonds with the requirements that determine dress codes or behaviours being social labels that allow for using the public space is positive.

Answers “not” and “definitely not” should be treated as some negation of the fair access.

Additionally, a limited access exclusively for owners (then such a space loses attributes of the public space) and diversification of the access depending on the membership to a specific social group are not recognized in positive manner.

An attitude of respondents to the issue of ties of beliefs is alarming. The largest number of votes (329) was given by those who are not clear in this issue (option “no opinion”).

Votes for and against are more or less equal. There is a slight majority of opponents of limiting access to public space this way.

Votes “for” and “against” shared evenly, in addition with the light majority of opponents of such a restrictive attempt at the just access to the space.

7 Conclusions and Reflections

In creating public spaces that would reflect a city’s signature character and the way its inhabitants live, attention should be paid to residents’ opinions about location, furnishings/equipment, and the regime governing space use.

A decision about principles regulating the use of public sphere will inevitably touch on the sensibilities of some groups of residents, and may cause their dissatisfaction. Every city constitutes a separate, inimitable financial and social entity, which means that relying on copy book solutions, particularly in the social context, may end up in a failure. Therefore:

1. The decision-making processes on creating and maintaining the public sphere in cities should begin with examining what residents have to say on the subject.
2. As part of this process, rules should be established to govern access to the city space. Every city should study the requirements of residents in this respect.
3. The city authorities who listen to citizens’ views on the use of municipal space receive additional insights on how residents perceive municipal cohesion and how far they are willing to participate in local democracy.

From the viewpoint of theoretical background verifications, being used for recognizing principles of creating the public spheres in cities I stated:

1. An examination of public space features demonstrates that the criteria developed in theory accurately describe the public sphere in cities.
2. The conducted examinations show the existence of a number of additional criteria, supplementing the characteristics of the public sphere.
3. The conducted examinations point to criteria of fair access to the public sphere. It is possible in the future to hierarchize these criteria depending on intensity of readings by respondents.

4. The criteria that do not have clear preferences may provide an area in which to create the fair access principles (number of votes for and against is similar); this also holds for those where the number of neutral votes is high.

References

1. Alexander C (2008) Język wzorców. Miasta, budynki, konstrukcja. GWP Gdańskie Wydawnictwo Psychologiczne, Gdańsk
2. Amartya S (1995) Moral codes and economic success. In: Britten CS, Hamlin A (eds) Market capitalism and moral values. Edward Eldar, Aldershot
3. Arendt H (1958) The human condition. University of Chicago Press, Chicago
4. Arrow K (1981) Optimal and voluntary income redistribution. In: Rosenfield S (ed) Economic welfare and the economics of soviet socialism: essays in honor of Abram Bergson. Cambridge University Press, Cambridge
5. Bauman Z (2006) Płynna nowoczesność. Wydawnictwo Literackie, Kraków
6. Becker G (1974) A theory of social interactions. J Polit Econ 82:1063–1093
7. Benhabib S (1992) Models of public space: hannah arendt, the liberal tradition, and Jurgen Habermas. In: Habermas and the public sphere. MIT Press, Cambridge, MA, pp 73–98
8. Beugre CD (2001) Understanding organizational justice and impact on managing employees: an African perspective. Int J Hum Resour Manag 13(7):1091–1104
9. Bogdanowski J (1981) Architektura krajobrazu. PWN Warszawa-Kraków
10. Dewey J (1924) The public and its problems. Holt, New York
11. (The) European Charter For the Safeguarding of Human Rights in the City
12. Fehr E, Schmidt KM (2003) Theories of fairness and reciprocity—evidence and economic applications. Advances in Economics and Econometrics. Econometric Society Monographs. Eight World Congress 1:208–257
13. Florida R (2008) Who is your city? How the creative economy is making where to live the most important decision of your life. Random House, 140
14. Frysztacki K (1976) O niektórych aspektach kształtowania się kierunków badawczych w socjologii miasta. Studia Socjologiczne, nr 1:235
15. Gehl J (2009) Życie między budynkami. Uzytkowanie przestrzeni publicznych. Wydawnictwo RAM. Kraków, 11
16. Guess R (2001) Public goods, private goods. Princeton University, Princeton
17. Hardin G (1968) The tragedy of the commons. Science 162(3859):1243–1248
18. Henaff M, Strong T (eds) (2001) Public space and democracy. University of Minnesota Press, Minneapolis
19. Jones H (2009) Equity in development. Why it is important and how to achieve it. Working Paper 311. Overseas Development Institute, November, London VI
20. Kubicka H (2013) Środowiskowe aspekty kształtowania przestrzeni publicznych. Studium Parku Handlowego Bielany. Politechnika Wrocławska. Wrocław. (not published)
21. Lizzio A, Wilson K, Hadaway V (2007) University students' perceptions of a fair learning environment: a social justice perspective. Assess Eval High Educ 23(2):195–213
22. Nagel T (1991) Equality and partiality. Oxford University Press, Oxford
23. Nagel T (1995) Personal rights and public space. Philos Public Aff 24(2):83–107
24. Nawratek K (2012) Dziury w całym. Wstęp do miejskich rewolucji. Wydawnictwo Krytyki Politycznej. Warszawa, 36
25. Parkinson JR (2012) Democracy and public space. The physical site of democratic performance. Oxford University Press, Oxford, p 173

26. Rabin M (1993) Incorporating fairness into game theory and Economics. Am Econ Rev 85 (5):1281–1302
27. Rybicki P (1972) Społeczeństwo miejskie. PWN Warszawa, p 334
28. Samuelson P (1993) Altruism as a problem involving group versus individual selection in economics and biology. Am Econ Rev 83:143–148
29. Smith A (1759) (reprinted, 1982) The Theory of moral sentiments. Liberty Fund, Minneaoplis
30. Stiles R (2012) Wskazówki do opracowania zagospodarowania przestrzeni miejskich: Strategia: działanie 3.3. Instytut Projektowania Przestrzeni Miejskich i Architektury Krajobrazu. Politechnika Wiedeńska. Wiedeń
31. Szołtysek J (2016) Logistyka miasta. PWE Warszawa
32. Trifunović M (2012) The principle of solidarity: a restatement of John Rawls' law of peoples (dissertation). Humboldt-Universitat zum Berlin
33. Waldron J (1988) The right to private property. Clarendon Press, Oxford
34. Wejchert K (1984) Elementy kompozycji urbanistycznej. Arkady Warszawa

Enterprise Architecture-Based Model of Management for Smart Cities

Andrzej Sobczak

Abstract The city is a highly complex complicated and multi-dimensional organism that can be viewed as a system and as a network. By adopting this perspective, it is feasible to achieve deep conversion (transformation) and build a so-called smart city. The present article discusses an enterprise architecture-based model of management for smart cities, defining its main components and outlining directions for future improvements.

Keywords Enterprise architecture · Smart city · Systemic thinking · Network thinking

1 Introduction

Most organizations in today's world are subject to constant changes of a different scope, depth and timing, a situation perfectly summed up by C. Zook from the management consultancy Bain & Company: "The world goes faster. Depending on the area of life, it has been changing from 2 to 4 times faster than over recent 30 years" [26]. This observation also refers to the cities, which A. Gontarz described as very complex, complicated and multidimensional organisms [8]. In the current social, economic and technological environment, the need for a substantial reorganization (transformation) of how cities work, towards creating so-called smart cities, has been increasingly recognized and discussed.

Attempts so far to implement this concept have usually been piecemeal and uncoordinated. These involve "optimally local" solutions (both technological and organizational), which seek to address a specific problem/issue (such as city transport management), while not contributing to actual change in the way an urban space functions. An alternative method, targeted to find and realize the "global

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optimum", takes the "enterprise architecture" approach (based on a system paradigm, with elements of network thinking) which implies a holistic perception of a city and city projects.

The present article aims to identify key aspects involved in the pursuit of a smart city, set them out in the form of a definition of this term, and explain how this work can be conducted in accordance with the enterprise architecture concept.

These aims impose a specific structure of the article: Sect. 2 includes an attempt to define a smart city; Sect. 3 discusses the perception of a city in terms of systems and network thinking; Sect. 4 highlights the main concepts of Enterprise Architecture; Sect. 5 presents the structure of an authorial model of the construction management of a smart city compliant with the systems and network paradigm, taking into account architectural approach; the article ends with a summary and indication of the course of further research.

2 Attempt to Define a Smart City

In a number of works on smart cities you may find a conclusion that one coherent and complete definition of this concept has not been developed yet. This fact has been emphasized both by researchers [20, 22] and publicists [9]. Undoubtedly, it is a methodological weakness of this field of research.

Some of the initial definitions of a smart city have been introduced by IT and consulting companies due to projects implemented by these companies (e.g. IBM—project "Smarter Cities Technology Centre" [11], McKinsey Global Institute—project "Urban World: Mapping the economic power of cities" [18]). However, as it has been emphasized in the work, these materials have plenty of methodological limitations and lack an in-depth literature research.

It is believed that one of the oldest (from 2007) but also the most complete definitions of a smart city may be found in a report prepared by Vienna University of Technology (VUT) [6]. According to the report, a smart city is: "[a city] well performing in a forward-looking way in these six characteristics, built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens." These six characteristics of the concept of a smart city include: economy, people, governance, mobility, environment and living.

A different approach was applied by the European Commission in a study from 2011 which defines the determinants of cities of tomorrow not using the term "smart city" [14]. According to the Commission's materials, "European cities should be places of advanced social progress and environmental regeneration, as well as places of attraction and engines of economic growth based on a holistic integrated approach in which all aspects of sustainability are taken into account" [14].

Another definition of a smart city has been presented by T. Bakici, E. Almirall and J. Wareham who state that these cities: "base their strategy on the use of information and communication technologies in several fields such as economy,

environment, mobility and governance to transform the city infrastructure and services" [1]. According to this approach, information and communication technologies are becoming a tool for urban development. The aims of the use of IT translate directly and indirectly into a number of benefits—such as: resource efficiency, generating new jobs, improving the lives of inhabitants, and innovation growth. The role of IT solutions has also been emphasized in the work [20]. The authors note that modern cities should not be viewed in the framework of their physical structure, but also as an enormous network of cyber connections enabling the optimization of a city's resource use and the prevention of negative spillover effects resulting from the functioning of a city in accordance with the principle of sustainable development.

Finally, it is worth pointing out that problems with defining the term "smart city" arise primarily from a large variety of functions in cities. As it has been noted in the work [20], knowledge-based cities focus mostly on intellectual capital development, creativity and maintaining a high level of innovation. And some cities develop by maximizing the level of use of digital technologies (digital cities). Lastly, there are cities that focus their activities on the protection of natural environment and its resources. In practice, a city described as "smart" has to combine all of the abovementioned aspects.

3 Systems and Network Perception of a City

As C. Cempel points out, system thinking presents "a new perspective on studying nature and human in creating technology and new social reality; it is also a new way of organizing the achieved research results with the use of new terms for a system, and system properties and relations" [3]. The key term of this concept of reality is "system". For the purposes of this article, the definition of a system presented by W. Kieżun has been adopted: "A system is an isolated part of the surrounding reality, with an internal structure, thus, consisting of elements organized in accordance with established principles, determining their mutual relations" [13].

When using a system paradigm to study an already existing system and its all components, one should always refer to the properties of the system as a whole, to its structure and its functions and evolution. At the same time, when creating a new system, one should consider its every newly designed component, in relation to the impact on neighboring elements, the whole system and neighboring systems. In such a concept, each organization may be considered—in accordance to the concept suggested by T. Kotarbiński—as "a whole due to the relation of its elements to the organization, namely, such an entity whose all components contribute to the success of the entity" [15].

For the purposes of this article, a city will be considered in systems and network thinking. Starting with adoption of these perspectives, it can be observed that a city is an open system, always remaining in mutually contingent relationship with the environment. It takes resources (people, information, money) from the

environment, providing it with public services, inevitable for other organizations or persons (inhabitants).

The concept of the construction of a smart city can be referred to systems axioms formed by Stefanowicz [21]:

- System equivalence axiom. Different structures of a given system may lead to the same goal. Each of them, however, can be characterized by a different measure of efficacy and effectiveness, and different construction and functioning expenses. This axiom is particularly visible in case of the construction of a smart city. This concept may be implemented in various ways—that, as a matter of fact, lead to the same goal, but differ with development expenses, maintenance expenses, time necessary for implementation, etc.
- System efficiency axiom. System efficiency, in terms of the K criterion, depends on the efficiency of its weaker element in terms of this criterion. Substantial investments in a particular element of a system will not have any advantage if other elements turn out to be defective because of the K. In case of a city that aims to be effective, it will be inevitable to take actions that will remove (or strengthen) the weakest elements.
- Synergy axiom. A system shows synergy. As a result, the whole (a system) is not a simple sum of its parts—it gains additional properties that its particular elements lack. In the context of smart cities, this axiom is incredibly important, because it makes well-performed particular works contribute to generating value added in the implementation of this concept.
- Context axiom. Every system is affected by its environment. Thus, every system has to be considered as an element of a broader whole. In case of a smart city it is essential to properly identify and manage a broad range of stakeholders who are vital for the successful realization of this concept.

As it has been noted in the work [12], since the 1990s, the theory of a network has been referred to in source literature basically in all traditional management areas. And H. Hakanson and I. Inehota define a network as three categories of entities related to each other: network members, assets they have at their disposal and measures they undertake [10].

As A. Piekarczyk and K. Ziemniewicz have observed, a systems paradigm is the basis for network thinking. They point that the whole that is called a system consists of connections between elements, and between elements and the whole. They have emphasized that a network is a result of "launching" various processes that activate a system's parts, as a result of which "chains of impacts" occur that enable the realization of established goals [19].

That is, referring to the previous definition of a city in systems thinking, its particular elements are connected with each other as a network, and providing municipal services is a result of the activation of particular components of a city. By considering a city through the prism of a network, it will be possible to design the realization of the smart cities concept in such a way that the value added by particular components of a city will be maximized by:

- improving the effectiveness of the use of any tangible and intangible assets (especially knowledge) of this network (i.e. a city);
- removing duplicate investments and actions taken in municipal entities within a network;
- offering new (innovative) services unavailable without the cooperation of particular organizations in a city network.

4 Enterprise Architecture Concept

The term "enterprise" plays an important role in Enterprise Architecture approach. Different definitions of this term have been adopted in literature on enterprise architecture [17, 23, 24]:

- a collection of activities in a specific area with actors with the same objective;
- an organized collection of resources that participate in performing specific processes;
- a system existing to implement one or many missions in a specific environment;
- a collection of organizations that have common objectives and/or common financial reporting.

A. Wegmann has noted that an enterprise can be seen as a system comprising of the assets of this enterprise. Moreover, he points out that an enterprise should be seen as a complex system, inter alia, due to the fact that people are one of the components of this system [24].

In case of local government, a town hall, for example, is an enterprise. In terms of the development of smart cities, a special type of an enterprise is essential, namely, extended enterprise. This category of an organization is defined—by author—as a network of legal units that are chained by value added, so that there is an increase of customer value. Thus, a city (broadly understood) is an exceptional case of extended enterprise.

As it has been pointed by A. Goikoetxea—there are many definitions of Enterprise Architecture in literature, and their scope and way of understanding are sometimes different [7]. Enterprise Architecture is an inherent approach to design and management, essential for providing organizational coherence that leads to a holistic alignment, versatility and confidence in achieving organizational goals and obtaining the expected results.

M. Lankhorst states that Enterprise Architecture provides a holistic view on the enterprise, and thus realizes the enterprise's organizational structure [16].

Len Fehskens describes Enterprise Architecture as "those properties of an enterprise, its mission, and their environment, that are necessary and sufficient for the enterprise to be fit for the purpose for its mission in that environment, so as to ensure continuous alignment of the enterprise's assets and capabilities with its mission and strategy" [5].

E. Yu, M. Strohmaier and X. Deng believe that Enterprise Architecture is a comprehensive description of key components that form an enterprise (and relations between them)—starting with strategies to business processes to IT systems and technical solutions [25].

In a document entitled "A Practical Guide to Federal Enterprise Architecture." Enterprise Architecture has been defined there as the organization's strategic information resource within which there are specified the organization's mission, information and technical resources necessary for realizing this mission resource and a transition process aimed to implement new technical solutions in response to strategic changes in the organization. Enterprise architecture features baseline architecture, called "As-is" in literature, and concerning both business and technical part, target architecture, called "To-be" in literature, and a transition plan that constitutes the strategy of changing the organization in terms of the transforming its baseline architecture into target architecture [4].

Nowadays, more and more often, while implementing the architectural approach, there is an emphasis on the management of complexities and organizational changes, which confirms the legitimacy of the use of the Enterprise Architecture concept when, e.g. planning and conducting complex transformational projects—such as, for example, constructing a smart city. That confirms the concept suggested by S. Bernard. He believes that Enterprise Architecture is both a transformation management program and a documentation method that together provide a coherent view on strategic objectives, business processes, flow of information and use of assets (including, in particular, IT assets) [2].

5 Architectural Aspect of the Construction of a Smart City

A smart city is not only the ITC structure or information systems. Therefore, the implementation of this concept should be considered as a consistent portfolio of coordinated IT and organizational projects and programs that implement changes in all aspects of a city's functioning. The implementation of these projects will lead to transformation of a given city into its smart version. The responsibility for these works remains with a president of a given city or a person appointed by him. And it has to be at least a vice president, secretary of the city, or treasurer. Other authorization of these works will be a significant risk factor.

Of course, with rapidly changing technological, economic and social conditions, all the portfolio's components cannot be planned at once—it should be assumed that it will evolve in time. In order to finish these works successfully, a complex approach (model), which is based on architectural approach, should be designed to manage the development of a smart city, taking into account systems and network paradigms.

The presented approach is of a generic nature—i.e. it is not associated with any specific technology, IT company or local laws. It means that it may be applied to any city—both Polish and foreign ones.

The starting point of defining the structure of an authorial model of the construction management of a smart city was an observation that to realize such a project, a specific capability to perform particular actions is essential. This capability consists of employees' skills, information resources, processes and equipment (especially IT solutions).

In the author's opinion, in order to develop a smart city effectively, it is essential to provide the capability to perform such a change at three levels, i.e.:

- the whole city considered as a network of all organizations subject to transformation—so-called macro-level;
- single organizations constituting a city, that are the elements of a network subject to transformation—meso-level;
- organizational units constituting particular organizations—micro-level.

This is the first dimension of the model proposed by the author. Figure 1 presents a graphic representation of the mentioned levels.

The second dimension of the authorial model of the management of the development of a smart city includes the areas of capability (also called aspects) that have to be at a city's disposal, i.e.:

- governance over the construction of a smart city—this area is responsible for the oversight over the implementation of component projects creating a smart city; usually it is implemented by people holding management positions and representing substantive elements of organizations constituting a network (including a president of a city, presidents of municipal companies, etc.);
- strategy and architecture—this area is responsible for defining the purposes of the development of a smart city and enterprise architecture and transformation plan resulting from it;
- portfolios, programs and projects—the area is responsible for defining and implementing the portfolios of programs and projects of the development of a smart city, and their particular components (i.e. programs and projects included in these portfolios);
- absorption, maintenance and improving capabilities—the area responsible for the capability to absorb (and in the long term maintain and improve) solutions (both business and IT) by a city that develop during the implementation of particular projects included in portfolios, programs and transformation programs;
- measuring the results—the area responsible for monitoring the achievement of the expected results (i.e. benefits) from implemented solutions (organizational capabilities provided to the organization) in the context of adopted purposes of the development of a smart city.

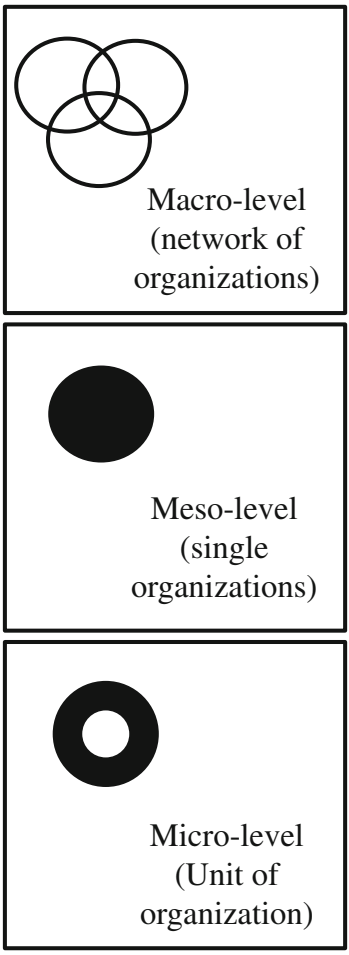

Fig. 1 Organization levels identified within the authorial model of the construction management of a smart city (*source* own work)

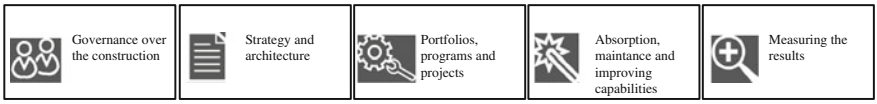

Fig. 2 Areas (aspects) of capabilities identified within the authorial model of the construction management of a smart city (*source* own work)

Figure 2 presents the abovementioned areas of organizational capabilities in a graphic form.

Figure 3 presents the whole structure of the authorial model of the construction management of a smart city. It consists of 15 cells.

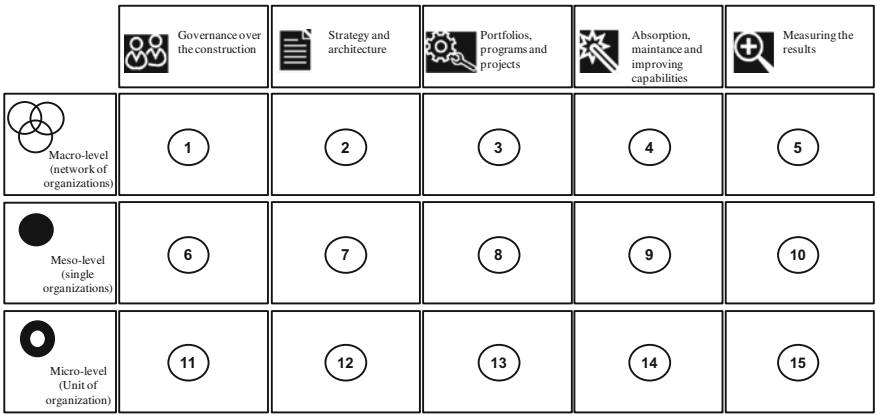

Fig. 3 Structure of the authorial model of the construction management of a smart city (*source* own work)

They can be analyzed in the context of particular rows—then, the capability to manage the development of a smart city at particular organizational levels, i.e. networks of organizations, particular organizations constituting a network, organizational entities composing a given organization, is considered. The second way of the analysis is considering particular columns (aspects). Then, information about the potential for particular areas (described above) is obtained.

Below, the characteristics of the contents of particular cells of the model of the construction management of a smart city have been presented.

- Cell 1: development and implementation of mechanisms of the supervision over the development of a smart city, including defining roles and responsibilities, and mechanisms of reporting and escalation.
- Cell 2: formulating the purposes of the development of a smart city, defining architecture principles, designing strategic architecture at the level of a network and developing a framework strategy of the development of a smart city.
- Cell 3: defining portfolios of programs and projects of the development of a smart city and implementation of mechanisms of the management of their realization.
- Cell 4: design and implementation of mechanisms enabling absorption, maintenance and improvement of the capabilities provided to a network of organizations through implemented portfolios of programs and projects.
- Cell 5: development and implementation of mechanisms measuring the achieved results at the level of a network of organizations and planning improvement actions on this basis.
- Cell 6: development and implementation of mechanisms of the supervision over the development of a smart city implemented within particular organizations, including defining roles and responsibilities, and mechanisms of reporting and escalation.

- Cell 7: formulating strategic purposes of the development of a smart city at the level of particular organizations composing a formed network, designing segment architecture for organizations, and creating a framework plan of the development of a smart city.
- Cell 8: defining programs and projects of the development of a smart city and implementation of mechanisms of the management of their realization.
- Cell 9: designing and implementing mechanisms enabling the absorption, maintenance and improvement of the capabilities provided by programs and projects of the development of a smart city implemented at the level of particular organizations.
- Cell 10: development and implementation of mechanisms measuring the achieved results at the level of an organization and planning improvement actions on this basis.
- Cell 11: implementation of mechanisms of the supervision over the development of a smart city within a single organizational unit including defining roles and responsibilities, and mechanisms of reporting and escalation.
- Cell 12: designing capability architecture on the basis of segment architecture and detailing the plan of the development of a smart city.
- Cell 13: implementation of projects of the development of a smart city and implementation of monitoring mechanisms.
- Cell 14: designing and implementing mechanisms enabling the absorption, maintenance and improvement of the potential provided by implemented projects of the development of a smart city.
- Cell 15: development and implementation of mechanisms of measuring the achieved results within the implementation of the smart city concept at the level of a single organizational unit and planning improvement actions on this basis.

Below, the characteristics of the contents of particular cells of the model of the construction management of a smart city, referring to architectural aspects (marked respectively 2, 7, 12) have been presented. The presented approach is based on the concept of architectural cascade—i.e. a collection of consistent architectural models prepared at different levels of detail and deliberately divided in such a way so it is possible to take into account the needs of very diverse recipient groups.

Cell 2. Strategy and architecture at the macro-level.
Within the actions planned at this level it is projected to formulate strategic courses of the development of a smart city, design of strategic architecture (for base and target state, and optionally intermediate states in four architectural domains—business, data, application and technology architecture) at the network level and development of a framework transformation strategy. Strategic architecture is the basis for making key decisions concerning establishing the courses and scope of the development of a smart city. It is used for communication between key stakeholders. At this level, architecture principles are also formulated, applicable to the development of a smart city. Key decision-makers responsible for the course of the

development of a smart city are the recipients of architecture models created at the macro-level.

Cell 7. Strategy and architecture at the meso-level.
In the framework of actions planned at this level, it is projected to formulate detailed objectives of the development of a smart city at the level of single organizational units (through cascading strategic objectives from the macro-level), design of segment architecture for particular units—for base and target state, and optionally intermediate states in four architecture domains—business, data, application and technology architecture—(on the basis of strategy architecture and defined principles), and create a framework plan of the development of a smart city. It is worth mentioning that at the level of technology architecture common infrastructure—including several segments—can exist.

People responsible for the development of a smart city at the level of particular units are the recipients of architectural models created at this level (usually they are unit managers or their deputies).

Cell 12. Strategy and architecture at the micro-level.
In the framework of actions planned at this level it is projected to design capability architecture—for base and target state in four architecture domains—business, data, application and technology architecture—on the basis of segment architectures (the created models have to be compliant with architecture principles), and create a detailed plan of the development of a smart city. People responsible for the implementation of particular projects (usually they are project managers) and IT architects in particular offices are the recipients of architecture models created at this level.

The developed architectures will be the basis for defining respectively:

- portfolios of transformation programs and projects—on the basis of strategy architecture;
- transformation programs and projects (included in portfolios)—on the basis of segment architecture;
- implementation projects in the area of the development of a smart city—on the basis of capability architecture.

In order to maintain consistency between architecture models created at these three levels and ensuring that they will be respected at the stage of the implementation of programs and projects, it is essential to implement proper supervisory mechanisms (they are created and used within the “Oversight over transformation” aspect).

6 Conclusion and Further Works

In Poland, a major barrier to systems thinking in the development of smart cities is posed by financial issues. The economic condition of Polish local governments does not facilitate launching smart city projects. On the other hand, under the EU's the 2014–2020 Financial Perspective, it will be possible to obtain European Union funds for this type of projects.

Another impediment is about competences and the approach taken by technology companies in Poland, usually looking at the development of a smart city through the prism of a specific IT system or technological product. Therefore, they are rarely interested in engaging with a city in a dialogue about its overall functioning. Moreover, they do not aim to find an optimal path for achieving desired results.

Attitudinal aspects must not be dismissed, either, especially the resistance among officials, most of whom have yet to adapted to work in a digital environment, which is a natural environment for initiatives associated with a smart city.

On the other hand, local governments should and can exchange good practices for implementing the smart city idea. Cities with low expertise in the management of complex projects (including transformation projects and programs) can benefit from this exchange.

The authorial model of the construction management of a smart city presented in this article can, drawing on the architectural approach, provide a basis for launching intercity cooperation and exchanging experiences in the pursuit of the smart cities concept. However, further methodological and verification effort is essential. It means, in particular, constructing a prototype of Enterprise Architecture Repository that includes reference models related to the construction of a smart city. Thanks to that, structured knowledge could be obtained about the practical methods of the implementation of this concept.

References

1. Bakici T, Almirall E, Wareham J (2013) A smart city initiative: the case of Barcelona. J Knowl Econ 4(2), 135–148
2. Bernard S (2004) An introduction to enterprise architecture. AuthorHouse
3. Cempel C (2005) Teoria i inżynieria systemów. 6 edn, Poznań, Wielkopolska Biblioteka Cyfrowa, www.wbc.poznan.pl/dlibra/ (on-lin access: 20 września 2014)
4. Chief Information Officer Council (2001) A Practical Guide to Federal Enterprise Architecture, version 1.0, February 2001
5. Fehskens L, The Open Group, https://blog.opengroup.org/2011/03/10/enterprise-architecture%E2%80%99s-quest-for-its-identity/
6. Giffinger R, Fertner C, Kramar H, Kalasek R, Pichler-Milanovic N, Meijers E (2007) Smart cities. Ranking of European medium-sized cities. Centre for Regional Science, Vienna University of Technology. http://www.smart-cities.eu/download/smart_cities_final_report.pdf. Accessed 11 Aug 2016

7. Goikoetxea A (2004) A mathematical framework for enterprise architecture representation and design. Int J Inf Technol Decis Making 3(1)
8. Gontarz A (2005) Być dobrze poinformowanym. Computerworld 4
9. Gontarz A (2014) Smart city: technologia czy zarządzanie? In: Materiały z konferencji Miasto—hologram świadomości, http://westival.szczecin.art.pl/aktualnosci/smart-city-technologia-czy-zarzadzanie. Accessed 30 May 2016
10. Hakanson H, Snehota I (2005) Developing relationships in business networks. Routledge, London
11. IBM Smarter Cities Technology Centre, Smarter Planet Project, http://www.ibm.com/smarterplanet/us/en/smarter_cities/overview/
12. Jabłoński A (2014) Myślenie systemowe i sieciowe w konstruowaniu modeli biznesu. Kwartalnik Nauk o Przedsiębiorstwie Oficyna Wydawnicza SGH, no 2(2104):43–49
13. Kieżun W (1997) Sprawne zarządzanie organizacją. SGH, Warszawa
14. Komisja Europejska (2011) Miasta przyszłości Wyzwania, wizje, perspektywy. Bruksela październik
15. Kotarbiński T (1958) Traktat o dobrej robocie. Zakład Narodowy im Ossolińskich, Wrocław-Warszawa
16. Lankhorst M (2005) Enterprise architecture at work. modelling, communication and analysis. Springer, Berlin
17. Martin R, Robertson E, Springer J (2004) Architectural principles for enterprise frameworks. Technical Report, no. 594, Computer Science Department, Indiana University, Bloomington, April
18. McKinsey Global Institute, Urban World: Mapping the economic power of cities, http://www.mckinsey.com/global-themes/urbanization/urban-world-mapping-the-economic-power-of-cities
19. Piekarczyk A, Zimniewicz K (2010) Myślenie sieciowe w teorii i praktyce. PWE, Warszawa
20. Stawasz D, Sikora-Fernandez D, Turała M (2012) Koncepcja smart city jako wyznacznik podejmowania decyzji związanych z funkcjonowaniem i rozwojem miasta. Zeszyty Naukowe Uniwersytetu Szczecińskiego, 721(29), 97–109
21. Stefanowicz B (2007) Informacyjne systemy zarządzania. SGH, Warszawa
22. Szczech-Pietkiewicz E (2015) Smart City—próba definicji i pomiaru. Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu 391:71–82
23. The Institute of Electrical and Electronics Engineers, Inc. (1998) IEEE recommended practice for software requirements specifications, IEEE Standard 830–1998, 20 Oct
24. Wegmann A (2003) On the systemic enterprise architecture methodology. In: Proceedings of the international conference on enterprise information systems, Angers
25. Yu E, Strohmaier M, Deng X (2006) Exploring intentional modeling and analysis for enterprise architecture. In: Proceedings of the 10th IEEE on international enterprise distributed object computing conference workshops
26. Zook C, Bain & Company, http://www.bain.com/about/people-and-values/our-team/profiles/chris-zook.aspx

The Impact of Novel, Innovative Architectural Information Systems Using Balloon Technology on Public Understanding of Air Quality in Urban Areas, with Specific Regard to Transport-Related Decisions

Magdalena Filcek, Jerzy Zwoździak and Szymon Fierek

Abstract This chapter presents the concept of a breakthrough architectural design named the Balonodrom Project and the balloon-oriented technology which indicates the real-time atmospheric air pollution in urban areas. Using an innovative system of ground sensors and wireless data-transmission, the balloon displays different colours: red, yellow and green corresponding to the quality of the air. The authors investigate the impact of this illumination on the behaviour of residents, politicians, and city users (including business organisations) concerning mental, educational, environmental, and travel behaviour and mobility. The balloon acts as a smog/pollution alarm that should change certain municipal policies and influence the natural routine habits of residents. It forces authorities to introduce changes and improve the overall quality of life in the metropolitan area. The central objective of this project is to assess and improve upon existing methods of disseminating information to the public at large in regard to the state of air pollution, in real time.

Keywords Balloon · Balonodrom project · Air pollution · Citizen behaviour · Political decisions

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1 Introduction

In recent years, the problems of air pollution and pollutant emissions have been widely discussed in various reports [14–16, 68, 69]. The atmosphere, especially in urban areas, deteriorates fast with the growth of human activity and the number of cars, and in particular growing mobility. Car passenger transport was responsible for 43% of all transport GHG emissions in the EU (including bunkers) and 60% of road transport emissions in 2013 [16]. The main obstacle to changing this situation is the lack of citizen awareness of the existing danger. In this chapter, the following is addressed: How best to draw the attention of society to the problem of air pollution (and associated health issues), the aspect of mental and educational influences on the travel behaviour of people (especially in urban areas) with a view to improving air quality and the resulting standards of living.

Based on several reports that demonstrate an increasing awareness that our travel behaviour, and alternative travel choices in particular, generate positive and negative effects on air pollution and our individual and collective wealth, health and wellbeing, the authors analyse the impact of air pollution, making it possible to create a visualization of the behaviour of travellers. We investigate to what extent a helium balloon operating in a large metropolitan area can serve as an eco-diagnostic public awareness tool that influences the behaviour of travellers.

The proposed approach is based on the idea of the Balonodrom Project [5] and the technology of an air quality balloon [4]. The system indicates real-time air pollution by use of an innovative lighting system LED that illuminates in purple, red, orange, yellow and green colours corresponding to extremely, highly and moderately polluted air, as well as clean and very clean air, respectively, according to the European index CITEAIR. The condition of the air strongly depends on the traffic volume in the analysed metropolitan area; thus the illuminated colours correspond to the current traffic flow levels in the city. The balloon tested in the Paris metropolitan area is visible day and night from a distance of 20 km.

Within a generation, our lifestyles have been disrupted by demographic explosion, urban concentration and the development of transport. Globalization has led to both global warming and the accumulation of pollution in the atmosphere. Cities are particularly vulnerable to poor air quality.

Effective and reliable transportation, especially in urban areas, is crucial for the needs of society, thus provoking expectations of a further expansion of transportation systems. However, the unlimited development of roads creates more vehicles and air pollution as a consequence. Road vehicles are major contributors to emissions of nitrogen oxide (NO_x), carbon monoxide (CO) and black smoke. Besides air pollution, the adverse impact of transportation means (private cars in particular) include human health effects, global climate change, and noise pollution. In many metropolitan areas, smog alarms force the authorities to seeks ways of changing citizens' travel behaviours, such as switching from private cars to mass transit. The package of possible actions is wide, and in the opinion of many authors only these actions will draw the attention of society to the problem of air pollution

and influence the travel behaviour of people in order to improve air quality and the resulting quality of life.

The inventor of the Balonodrom Project would like to gain this attention by using the giant helium balloon as a signal of air quality in the centre of the city and as an educational tool to change and show traveller behaviour by using a method of feedback and gamification [30].

2 The Need for Better Urban Air Quality

In January 2012 in Brussels, it was announced that "The beginning of 2013 marks the start of the European Year of Air". At a high-level conference on the future of EU air policies in Europe titled "Blowing the Winds of Change into European Air Policy", the European Environmental Bureau (EEB) called for a tightening of EU air policies to protect human health and the environment. A recently released Euro-barometer poll shows that air pollution is a key concern for EU citizens—72% say that public authorities are not doing enough to promote good air quality and 87% think respiratory diseases are a serious problem. According to a recent study by the European Topic Centre on Air and Climate Change (ETC/ACC), conducted on behalf of the European Environment Agency (EEA) [17, 18], poor air quality causes nearly half-a-million premature deaths in Europe each year and is associated with high economic costs in hospital admissions, lost working days, and damage to ecosystems.

Air pollutants may cause a number of problems in normal body functioning, and we must deal with an increase in both the frequency of certain symptoms and their severity. Cities are particularly vulnerable to poor air quality. The principal source of air pollutant emissions in most cities is combustion, especially from motor vehicles (e.g. [35, 43]). A number of all types of vehicles are expected to increase in the future. Therefore, they will continue to be the primary source of nitrogen oxides (NO_x), carbon dioxide (CO) and directly emitted particulate matter (PM). It follows that people living in close proximity to busy streets are more vulnerable to the impact of air pollution as compared to residents living far away from the roads. Other pollutant sources, such as domestic heating, may also locally contribute to high atmospheric PM concentrations in cities. Numerous studies on air quality in cities indicate that the maximum acceptable pollutant levels, particularly in the case of PM10, PM2.5 and NO_2, are often exceeded.

Outdated transport systems—such as narrow streets, especially in city centres, with throughput close to capacity—tight buildings and small green areas compel the urgent need for changes in city transport systems. Construction of urban bypasses leads to reduced traffic congestion; however, it moves the problem of air pollution to other regions of the city. The problem continues to be the movement of vehicles in city centres, not because of the possible formation of traffic congestion, but of the noise and air pollution.

A reduction in traffic intensity, the speed of vehicles, and their age are achievements in emission control technologies that have a significant impact on

pollution levels. Additionally, weather conditions and the spatial structure of the city also affect air quality. There are generally unfavourable conditions for air pollution dispersion in city centres due to the compact settlement and lower wind speeds. This makes it necessary to control the concentrations of pollutants in those parts of the city and develop a risk management strategy to deal with high concentrations. This in turn involves conducting a number of public activities to increase awareness of health risks during high concentrations and communicate the need to reduce traffic and avoid using cars.

One of the most important sources for fine (less than 2.5 μm in diameter) and ultrafine (less than 0.1 μm in diameter) particles in traffic are vehicle emissions, which may contribute up to 85% of the PM number in urban areas [52]. They are especially important because of their ability to penetrate into the alveoli of lungs [10]. Deeply deposited fine particles are removed very slowly, with more chances to damage healthy cells [50, 61]. During a standard day, Parisians breathe about 200,000 particles per litre of air (1 breath = 1⁄2 l of air).

These emissions also contain trace metals (As, Cd, Co, Cr, Zn, Ni, Pb, Se), some of which are considered human carcinogens [62]. Furthermore, it has been suggested that ultra-fine particles are more toxic because of the large surface area available for biologic interactions with lung cells [11]. Thus, it is presently under discussion whether PM mass should be the only criterion for PM toxicity or whether PM number distribution, surface area or composition are more important.

Because fine aerosol particles have been pointed out as being especially hazardous for health, it was good motivation to undertake long-term research projects on the relationship between PM size and composition on the one hand and specific health endpoints on the other. Many studies have been carried out within Europe, such as the Air Pollution and Health (APHEA) project, the EXPOLIS project (Exposure Studies of City-dwelling Volunteers), the Health Effects of Air Pollution on Susceptible Subpopulations (HEAPSS) project and the PEACE study (The Pollution Effects on Asthmatic Children in Europe).

However, our current understanding of the role of ambient air PM on health is still far from complete [51, 59]. The findings from epidemiological studies are controversial, with statistically significant relationships between PM mass and various aspects of respiratory health demonstrated in some studies [9, 31–33, 53] and with either no or small effects recognized in other research [10, 41].

In spite of all this, many studies confirm that motor vehicle emissions involve adverse health outcomes such as coughing, wheezing, runny nose, asthma and allergic sensitization [23, 26, 28, 35, 55, 65]. For example, children living within 500 m of a freeway in Los Angeles are more likely to have reduced lung function compared to those who live at least 1,500 m away [20, 21]. A study carried out in England and Wales showed excess risk of mortality from stroke when living near busy roads [45]. T. Nicolai [55] showed associations in children between living within 50 m to a high traffic street and respiratory symptoms.

Particulate matter emissions from vehicles are the consequence of both combustion-derived exhaust emissions and non-exhaust emission. Pb, Fe, Cr, Ni, Cu (Pt, Pd and Rh from catalytic converters) have been suggested as markers for

exhaust emissions [47]. The composition of automotive exhaust particles varies according to PM size [49]. The larger particles consist of carbonaceous material with condensed hydrocarbons and sulphate, and the smallest consist almost entirely of hydrocarbons and sulphate [52]. Other components can be generated from brake wear (Sb, Cu, Zr and Ti), tyre wear (Zn, organic zinc and degradation products of rubber) and roadway wear (maltene and asphaltene compounds). In re-suspended dust from roadway surfaces, crustal elements Si, Fe, Ca, Al, and K, and elements associated with exhaust and non-exhaust emissions including Cu, Zn, Sb, Pb and S [47] can be found.

In a review paper, T. Grahame and R. Schlesinger [23] concluded that all types of fine PM have relatively equal toxicity, because total PM mass has been positively correlated with rates of mortality, hospital admissions, etc. Some species of PM are more toxic than others; however, it is difficult to determine which component is the most dangerous, as all are highly correlated.

The current EU standards [19] for ambient air quality are weaker than those recommended by the World Health Organization (WHO), with a view to minimizing the health effects of air pollutants [67].

3 Air Pollution: How Big Is the Problem for Polish Cities?

The Balonodrom Project could be implemented in Wroclaw, the fourth-largest city in Poland. The population of Wroclaw was approximately 634,000 in 2014. An urban agglomeration, it stretches over 16 km (ca. 250 km^2). As in many other urban agglomerations in Poland and Europe, the city residents are exposed to high levels of air pollution, as measured by concentrations of PM. The exceedances take place both in terms of the daily standard of PM10 and the annual standards of PM10 and PM2.5 and pertain in particular to downtown areas of the city (Figs. 1 and 2).

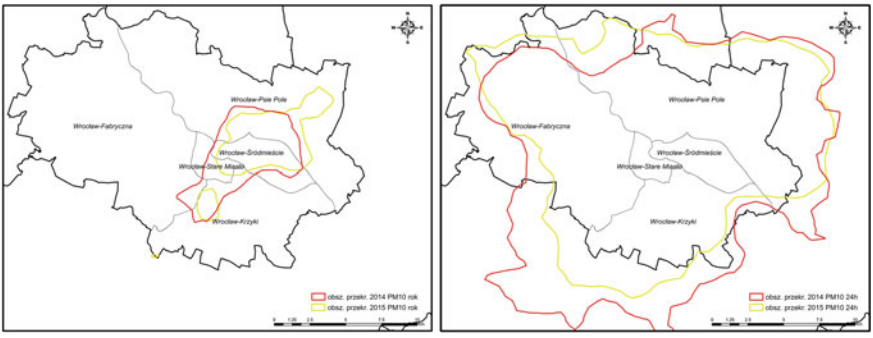

Fig. 1 Model outputs from the CALMET/CALPUFF modelling system from the area of Wroclaw. The maps for PM10 are generated at annual averages (*on the left*) and 24 h (daily) averages (*on the right*) for 2014 and 2015

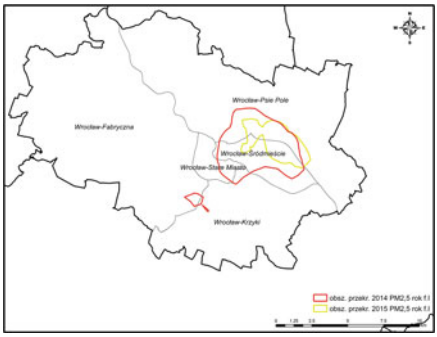

Fig. 2 Model outputs from the CALMET/CALPUFF modelling system. The maps for PM2.5 are generated at annual averages for 2014 (*red*) and 2015 (*yellow*)

The data presented in Figs. 1 and 2 was obtained through dispersion modelling [71]. Most of the air quality modelling systems in use today consist of three models: meteorological, emissions inventories, and chemical transport dispersion (air quality model). The meteorological data covering the Polish territory were obtained using the Weather Research and Forecasting model at 5 km grid resolution. Next, the CALMET model was used to prepare the gridded meteorological fields for driving the CALPUFF dispersion model [60].

Based on the modelling results [71] the contribution of the emission of PM from heating of individual buildings was higher than the emission from road transport in 2014 than in 2015 (Fig. 3). Vice versa, in 2015, road transport dominated in PM10 annual concentrations. The higher contribution of road transport in 2015 was the result of better meteorological conditions in the cool season of 2015 (in relation to the previous year). Higher temperatures and lack of long-lasting inversion conditions did not stimulate emission of PM from heating devices. "European legislation

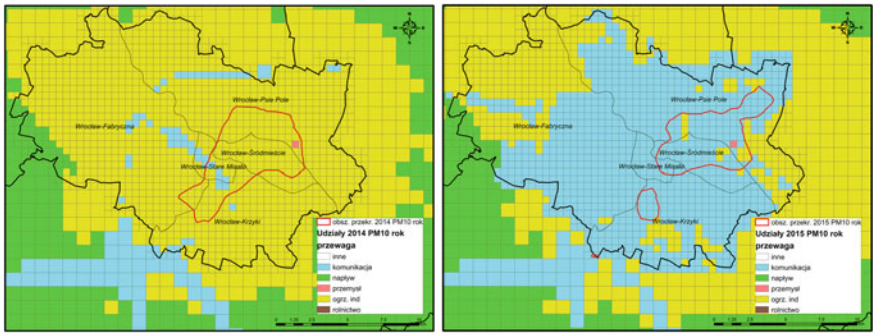

Fig. 3 The contribution of different emission sources in annual concentrations of PM10 in 2014 (*on the left*) and 2015 (*on the right*): *green* regional emission; *yellow* heating of individual buildings; *blue* road transport; *red* point industrial sources

on air quality is built on certain principles. The first of these is that the Member States divide their territory into a number of zones and agglomerations. In these zones and agglomerations, the Member States should undertake assessments of air pollution levels using measurements and modelling, and other empirical techniques. Where levels are elevated, the Member States should prepare an air quality plan or programme to ensure compliance with the limit value before the date of the limit value formally entering into force. In addition, information on air quality should be disseminated to the public" [19].

The large areas of exceedances of daily PM10 and annual PM10 and PM2.5 standards, and the significant share of road transport show that air pollution is a key concern for Wroclaw citizens, and that implementation of the Balonodrom Project seems to be the right and necessary decision.

4 The Impact of Traveller Awareness on Transport

Transport plays a crucial role in metropolitan areas providing access for citizens to their activities. A well-functioning transport system supports the spatial, economic and social development of urban areas and provides residents with a high quality of life. At the same time, transport is one of the biggest sources of environmental pollution, mainly due to the use of combustion engines in vehicles.

Many cities struggle with urban sprawl, which is accompanied by the expansion of transport infrastructure. Unfortunately it is often focused only on the re-construction of local roads, leading to a car-oriented transport system. It causes an undesirable shift in the modal split for individual transport, which in turn leads to overloading of the road network. As a result, transport generates high costs, increased exhaust emissions and noise pollution in areas of intense traffic, which contributes to a progressive degradation of the environment [6, 7, 24, 27, 48]. In this context, actions to balance the transport system are crucial [20, 54].

Public transport offers many advantages over individual ways of moving by private transport means, including lower transport costs, lower utilization of space per person travelled, lower energy consumption and lower pollution. Public transport increases overall mobility of the local community, especially those without private cars. It also improves accessibility to different destinations, including places of employment, business activity centres, points of interests and recreational areas. For these reasons, municipal authorities in many cities are vividly interested in providing a satisfactory level of public transport services, resulting in an overall increase of urban livability.

Residents of urban areas are becoming increasingly conscious of the importance of creating a more liveable and sustainable community. In order to reach this goal, communities are developing plans to outline ideas for improving mobility. People are beginning to look for alternative modes of travel as the price of gasoline goes up and the awareness increases of the environmental footprint of motor vehicle travel.

It is important for urban areas to provide adequate facilities for non-motorized travel.

Livability is about tying the quality and location of transport facilities to broader opportunities, such as access to good jobs, affordable housing, quality schools and safe streets. Sustainable transport provides exceptional mobility and access to meet development needs without compromising the quality of life of future generations. Livability and sustainability can be addressed together since a strategy for pursuing one will often be appropriate for the other.

Harmful effects of climate change can affect the quality of life and sustainability of a local region, state, and community. However, in addition to climate change, livability is inclusive of many factors that influence a community and its residents' quality of life. Similarly, sustainable development is closely associated with livability, and the ideals and terms are used interchangeably.

Livable communities are those in which people have multiple, convenient transport and housing options, as well as destinations that are accessible to people travelling in and out of cars. Livability is improved when various groups coordinate the quality and location of transport facilities with broader opportunities such as access to good jobs, affordable housing, and quality schools, while balancing environmental sustainability.

Thus, actions taken by municipalities should promote the development of transport options that support livability and sustainability by including non-automobile modes in their projects. This is available through changing the behaviour patterns of travellers. Authorities should maintain activities to reduce the demand for single-occupancy car travel and to redistribute car users to public and non-motorized modes.

As more scientific evidence supports the climate change phenomenon, various groups in the public and private sectors are paying more attention to its long-term harmful effects on both the natural and human environment. P. Schiller et al. [58], P. Newman and J. Kenworthy [54], N. Geroliminis and C. Daganzo [22] have described efforts to achieve a sustainable transport system and real-world examples of their use (Brussels, Berlin, Rotterdam, Zurich, Munich, Barcelona, Paris, Rome, New York, Tokyo, Amsterdam and Venice). They pointed to directions of urban and transport planning, and development of transport policy as necessary tools to minimize the negative impacts of transport (e.g. reduction of harmful impact on the environment, human health and life, reduced cost) while maintaining the possibility of satisfying daily human needs and activities.

In addition to changes in land-use and transport planning, it is necessary to take steps to encourage citizens to change their habits and behaviours. The most effective are actions with fast and measurable effects, so citizens can observe in real time the consequences of their transport decisions [20]. Thus, the Balonodrom Project carries a huge promise.

In psychology, behaviour is the way in which a person, organism, or group responds to a specific set of conditions. Usually, behaviours are the mixed function of the internal features of individuals (personal values and norms, attitudes) on the

one hand, and external factors (incentives, societal norms, institutional constraints) on the other.

In transport, while planning travel, each traveller makes multiple decisions and answers many questions related to the location, timing, and duration of their activities. Answers and decisions strictly depend on characteristics of individuals, including their feelings, but also on external factors such as features of the transport system, traffic conditions and knowledge and predictions about them [66].

Technological progress in recent years has facilitated the spread of, and provided information on, traffic conditions in real time. There is rising interest in the potential of increased ICT use to change the location, timing, and duration of the activities of people [13, 34, 39, 40, 42]. The Balonodrom Project could thus play the role of an information medium.

The authors propose to implement the Balonodrom Project in Wroclaw, one of the biggest cities in Poland. Like many other cities, it has to cope with a too large share of private cars in modal split, and an overwhelming dominance of single occupancy journeys (only drivers).

Based on data from a transportation study undertaken by the municipal authorities of Wroclaw, the authors have established who travels in Wroclaw—and also why, how and when. A special analysis also provided information regarding freight transportation and the implications of special events for transportation systems. Based on the above-mentioned research, one can specify basic characteristics of trips performed by citizens of Wroclaw:

- Average number of trips taken by citizens of Wroclaw is 1.87.
- Members of households with more people, workers, income and vehicles generate more trips. Residents in three urban zones make more trips than those in other areas (Fig. 4).
- The most frequent daily trip pattern is home-work-home and home-other-home. "Other" includes pick-up, drop-off and accompany trips.

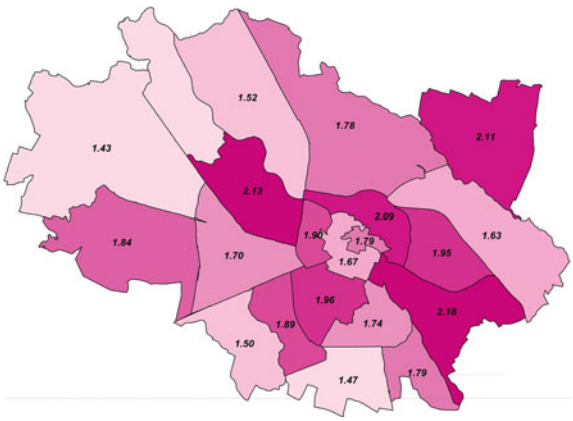

Fig. 4 Average number of trips carried out by citizens of different zones of Wroclaw (*darker pink* represents a higher number)

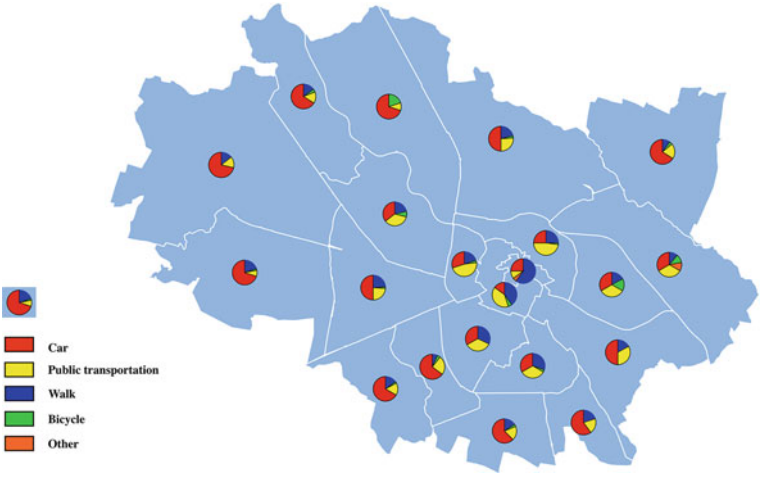

Fig. 5 Modal split in particular zones of Wroclaw

- The predominant mode, by far, is use of a private automobile (41.5%). Public transport is the second most-popular mode (35.2%) and walking is third (18.7%) (Fig. 5).
- Bike trips only account for 3.5% of total trips.
- Peak travel times are for trips departing between 7:00 and 8:00 a.m. and between 3:00 and 5:00 p.m.
- Limits for cars in the centre of the city are highly important because up to 93% of members of household live in this area.

There is a great space for implementing resolute, innovative projects, which support sustainability (e.g. the Balonodrom Project, as previously mentioned). Municipal authorities would need to provide additional publicity to advance changes in traveller behaviours. Such efforts would need to occur in cooperation with local governments and public and private service providers. Such engagement will lead to more consistency between priorities and needs identified through the authorities and expectations of citizens.

5 The Balloon as a Visual Medium for Better Understanding

In the year 1783, Pilâtre de Rozier was the first person to fly in a balloon on his own. After a number of successful flight trials of balloons, he began to think about using them for the purpose of diagnosis, the observation of artillery, and as a means of reconnaissance. The balloons helped in battle by providing a view of an approaching enemy. Today, we need them to provide us with a view of a normally invisible enemy—air pollution.

The balloon is an interesting medium because through use of the changing colours it provides information on, and explains, what's happening in the air, which breaks from the alarmist speech that we have known for years [25]. "Every city in Europe is facing big challenges to meet air quality regulations", says Karine Leger from Airparif (the French-recognized organization approved by the Ministry of Environment for air quality monitoring) [2]. The quality of the air we breathe affects our health and our environment. Even though the impact of poor air quality in Europe is not always visible, air pollution can damage plants, trigger respiratory diseases, and result in a shorter life expectancy for humans. We are all affected by air pollution.

In 2012, the European Environment Agency announced "ImaginAIR", its photo story competition that gave people the chance to show the impact of air quality and pollution in Europe. The balloons can help with pollution. For example, when it comes to air pollution, Paris is not much different from any other European city. It has its good days and its bad days, but unlike elsewhere, you do not need to be a scientist to tell them apart—all you need to do is look up into the air. A giant tethered helium balloon floats 150 m above Paris's public park "Parc Andre Citroen" and displays real-time reports of air pollution using an innovative lighting system, which can be seen from more than 20 km (12.4 miles) away. The balloon tells Parisians how good or bad the air quality is. Air quality is measured using data from dozens of sensors that monitor levels of nitrogen dioxide, ozone and particles around the city [12]. Airparif has about sixty traffic measurement stations in the background and close to traffic in the Paris area that measure in real time the quality of the air and the concentration of pollutants [1]. Since 2008, this data has been sent to the *Ballon de Paris*, then "translated" as colours, readable by everyone. The balloon measures 22 m wide and 32 m high. Examples of colours: red signifies highly polluted air, orange for polluted, yellow for moderate, light green for clean, and green for very clean. The Aérophile balloon will display two measurements in pixels: the top half of the balloon will show the ambient air quality and air pollution produced by auto emissions, which is measured at major traffic junctions, and the bottom half of the balloon will show the decisions of travellers who are not using a car by sending the information via phone application. The balloon's colour signifies the ambient air quality using a system that consists of a thousand small PLED or OLED diodes or perovskite LEDs [36, 46, 63].

Thanks to thousands of diodes, air pollution displays will be visible day and night. The newest balloon, which is filled with 6,000 m^3 of helium, will serve as both an eco-diagnostic public awareness tool as well as a tourist attraction. As a tourist attraction, the balloon will provide non-polluting rides (7–10 min in duration) for up to 30 passengers at a time. Flight aboard a tethered gas balloon is a unique and sensational experience for the passengers. Silent and without vibration, the gondola is open to the air, allowing passengers to experience the sensation of being on a flying balcony 150 m in the sky. A 360° panorama unfolds before them, and in a single look they can take in the whole landscape. The balloon itself is a sign of respect for the air; of nature. The balloon is very eco-friendly, as there is no noise, no motor, no fuel is burnt, and it remains airborne naturally, with a natural force. More importantly, gathered information is used to determine pollution alert levels for people who suffer

from breathing problems, and to guide the imposition of restrictions on driving, should they be needed [29, 72]. Anne Hidalgo, mayor of Paris, has made sustainable improvement of air quality a priority. By partnering with this one-of-a-kind scientific experiment, Paris wants to foster a collective awareness of the dangers of air pollution, especially of fine and ultrafine particles from road traffic.

After obtaining the opinions of citizens of Paris during citizen conferences, Parisian city representatives consult with stakeholders, and announce comprehensive plans to combat air pollution [4].

6 The Balonodrom for Cities—A Landmark to Improve the Air

Technically, the proposed observation balloon, known as the AERO30NG (Air de Paris, Ballondeparis), is a tried-and-tested product, manufactured to stringent aviation standards by a company called Aérophile and normally operates from an open field site. In order to do this, a complex restraint and tethering system is required for times when wind and weather conditions preclude operations. The Balonodrom Project removes the requirement for a tethering system because the balloon is protected within the centre of a building when at rest on the ground, becoming a feature of the building. An iris-type roof-covering completes the security of the atrium. BALONDROM is designed to serve the purpose of a tethered ballooning base for stops, take-offs and landings of balloons throughout the year. The surrounding building is a 14,000 m^2 area. Apart from its main functions of balloon flights and displaying air quality, the building offers a hotel, restaurants, cafes, a modern art gallery, a museum of aviation and balloon sports, a tourist information centre, an Institute of the Air, and 3D simulators of balloon flights over different cities of the world. Thanks to a mobile platform inside the building, it is possible to organize experimental theatrical performances and concerts (Fig. 6) [5].

Fig. 6 The Balonodrom project—view from outside (*on the left*) and inside (*on the right*) of the building

The project has both leisure and practical uses in its unique viewing tower, which does not interrupt a city's panorama, and ballooning leisure activities and functions in a building for public use. This unusual tourist attraction, however, takes on a significance for citizens, becoming a unique and spectacular tool to inform residents of air quality through colour changes, and the interior Institute of the Air serves to educate the public on issues of air quality. A permanent exhibition will help the general public to be aware of major air pollutants and actions that can be taken to reduce the danger. Children are especially targeted by this environmental message. The education of children will be carried out through a program titled "Red Balloon, Green Balloon, Sensors in the Sky" [38].

The Balonodrom Project brings together scientific knowledge for determining pollutant levels with the dissemination of the information to policy makers, the public and regulatory aspects, in order to formulate a city's reaction to air pollution problems. Reliable monitoring of ambient concentrations, as well as keeping the authorities and public informed of short term changes in air quality are basic items for air quality management strategies. An educational site and mobile tools will be developed for this purpose.

The upper and lower halves of the balloon will inform citizens of air quality in the city through use of colours. The upper half will display current issues pertinent to air pollution. The lower half will consist of thousands of LED pixels that will change colour depending on decisions made by citizens of the city.

A green LED lights up when citizens are asked to travel by foot or bicycle, yellow and orange light up when travel by public transport is recommended (tram and bus, respectively), and the colour red lights up to show a car can be used for transport.

Each resident who decides to not travel via their private vehicle may use an application (Fig. 5) that is coupled with the lower half of the balloon to obtain a free e-ticket for a mode of transportation (bicycle, tram, bus) that correlates to the colour displayed on the balloon (Fig. 7) [37].

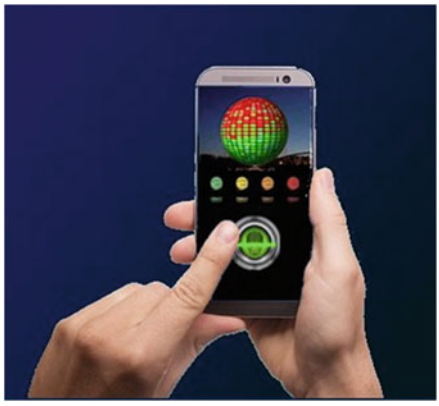

Fig. 7 Visualization of the smartphone application for changing status of a trip

Fig. 8 Different states of balloon illumination based on air pollution levels

Through the application, when hundreds or thousands of people do not use their car, one can see the progress in the size of the green and yellow area on the balloon, which will give citizens a sense of the real impact of their individual decisions on protection of the air they breathe in the city.

Consequently, the strength of the green parts of the balloon (through lack of the large number of cars on the streets in the city) will change the colour of the upper part of the balloon from red to green because the quality of the air will change for the better (Fig. 8).

The above-described idea works by giving feedback that is used as a tool to encourage the recipient to analyse their activities and to make possible improvements of behaviour. Through this system, we learn how we are perceived by the environment, by authorities, and how we can change their actions, behaviour and attitude [56].

Today, as we share a vast network of dependencies, only with feedback and cooperation with others can we achieve more of our aims [57].

The most important stimulus motivating people to take action is feedback on their performance. It is essential to setting goals because feedback is information about their implementation [8]. With multiple repetitions of this situation, the behaviour becomes habit.

We can strengthen feedback and cooperation by adding gamification "as the instrument relating to the objectives to change the behaviour of people through use of mechanisms known from games" [30]. Games are helpful to lead people through the experience in a safe environment, and to allow people to grow and learn, overcome mental barriers, provide direct and immediate feedback, to see how their behaviour affects others, to develop motivation, and to help in learning and acquiring new skills.

The method used in games provides an opportunity for adults to revisit the joy of childhood and to participate in the learning process, unlocked and engaged in the game, less fearful of unveiling emotions, easier to express their behaviour, follow themselves, their reactions to others and how they are perceived.

This technique is based on the pleasure that comes from overcoming the next achievable challenges, competition, cooperation, status, altruism, community

collaboration, etc. Gamification can engage people in activities that are in line with the expectations of the author of the project, even if they are considered boring or routine [30].

Business can use gamification to drive desired user behaviours that are advantageous to their brand.

Why should we do this? P. van Riel [64] studied a characteristic feature of the philosophers Plato and Aristotle, and found they had a comprehensive and holistic vision of happiness that not only focused on individual states, but also on taking into account the conditions in which man lives. Despite differences in the perception of the world and people, both philosophers drew attention to the need to understand the factors enabling fulfilment of that which is the happiness of man. One of these factors, as noted philosophers shaped policies in human life, was to transfer attention from a single unit to the whole of social relationships surrounding the man.

Human life in the biological dimension depends on whether it will be surrounded by favourable external conditions together with nutrition, shelter for some time, just as emotional life also depends on the shape of a city and, among other things, its natural spiritual environment. The bad form and bad actions of a city may prevent a person from attaining a good life and fulfilment, and even, in extreme cases, lead to death. Aristotle put the welfare and happiness of the individual on a par with the individual's city. It is known that a sense of community is beneficial for the common good; therefore, the implementation of this is good for the happiness of citizens. A sense of community leads to a situation in which citizens feel inclined of their own volition to pursue a life of virtue, and for procedure to be set by both politicians (the ruling class) and by the citizens in the city. Hence, it is clear that the wishes and desires of citizens must be right if the city is to fulfil its purpose and existence, and is to be justified.

This is why it is highly important that the utmost care and dedication, as Plato and Aristotle paid, is used to look at the nature of a city and to understand it on each level, and so include it in the design of its operation in order to best serve the conquest of virtue, understood as fulfilment of happiness of man [64].

Regarding the question of how to create a landmark which can help in our project, A. Wlostowska has noticed that in many places in Europe there are several examples of solutions that reinforce their perception by people from the characteristic points on the map and, most importantly, have a positive influence on human behaviour. A pattern can be found in the composition of these places. It should be noted that the designs of entire cities with a global reach, in terms of individual districts and regions, are constructed in a similar manner to the interior space. It is always easy to determine the outline keynote. By putting these elements together, a kind of scheme can be created at the beginning of the signature space; a space code.

Each space can be described with similar issues, of which there are of course many. However, among the most important are a clearly defined idea and keynote in space, which should be expressive, clear and easy to read by the user, a landmark

easy to describe and identify, a distinctive element in space that is so strong it can be easily described in a few words, clearly defined functions in a given area, their orientation relative to each other, the mutual relationship between them and dependencies, an adopted clear base composition in space, both in the spatial and flat human ratio (i.e. the size adapted to be comfortable and safe), and easy access to the proposed or existing space. Highly important in the process of identifying a place in a given space is the point of reference, such as a landmark, which has been mentioned in Lynch's [44] and Arnheim's books [3]. This landmark can be a representative building or monument, but in this case it would be the Balonodrom, which is a helium balloon visible from far away.

However, the code space is always a factor in support of the synergy between nature, man, and our cultural, scientific, and technical achievements. This gives it its shape; a kind of cornerstone. As Edward Hall has written [25], echoing Plato, one of the most important and difficult tasks given to man is to know himself. The significance of this statement, especially in these times, should be broadly interpreted through the prism of an in-depth understanding of the relationship between man and the environment, and the total interdependence between these elements. These harmonious and holistic approaches to the subject fully underline the statement that "no man can exist without the environment, no species can exist in the environment completely created by it, and no species can survive other than as a member of an ecological community" [70].

The positioning of the Balonodrom at a key location will offer a unique venue serving a dual function as a secure weather resistant port for the air quality observation balloon and a themed location steeped in the culture and heritage of flight and tourism—in addition to creating a feature landmark building as a part of public awareness on environmental issues that have a significant impact on lifestyle. Raised and lowered by a small electric winch, the balloon would be one of the city's least polluting transport systems. But its operators say its real value is raising public consciousness about pollution [12].

7 Conclusion: Balonodrom Project Can Help the City of Wroclaw (and Other Cities, Too) to Improve the Air Quality Regarding to Traveller Behaviour Based on Understanding of Air Quality in Urban Areas

The central objective of this project is to assess and improve upon existing methods of disseminating information to the public at large in regard to the state of air pollution, in real time, and help to bring about a better quality of air and of life. Everyone who live in the city can be a part of this good change.

Current methods of communicating the levels of air pollution are not effective enough. When displayed on the Internet or light boards, most people pass by

indifferently. There is a need for a stronger impact on the behaviour of the residents of cities. Nowadays, a growing challenge is with bringing this information home to policy makers and the public rather than with the availability of relevant air pollution data. We contribute to this work by introducing a technology that can be assembled by non-experts to make information about air quality not only measurable and visible, but also compelling and hard to ignore. Although none of our participants are activists per se, they saw opportunities to use air quality balloons as a catalyst for change.

The balloon received a lot of attention and almost instant awareness, with reactions of "Wow!" and "That's concerning!" especially if it was red at the time it was seen. Children are particularly targeted by this environmental message.

Permanent exhibition will allow the general public to be aware of major air pollutants and actions that can be taken to reduce the danger. The measurements made by the LOAC will guide public decisions regarding urban policy and urban transport and can change the behaviour of drivers by reducing their use of cars.

What makes people change their behaviour? This is a basic question well worth reflecting on. It is important to remember that government, local or central, cannot change the behaviour of people, even if it wanted to. People change their own behaviour in response to other changes in the world around them, in their understanding of the world and in their perceptions—including their perceptions of themselves. In order to successfully enable change, new behaviours should seem more advantageous (e.g. perceptions of costs and benefits change), more "me" (e.g. behaviour fits in with perceptions of self or aspirations, more prevalent (e.g. increased awareness of who else is doing it), more doable (e.g. increased confidence in ability to change).

Some examples of barriers to behaviour change are reluctance to change lifestyle, lack of peer and political action, lack of knowledge, scepticism, distrust in information sources, climate change perceived as a distant threat, inconvenience of switching travel patterns, feeling of helplessness, and that other things are more important. Some examples of potential changes are reducing unnecessary trips; opportunities to combine journeys and reduce the number of journeys by planning better, particularly for shopping trips; online shopping; using local shops and services. An example of an adjustment to daily routines is trip-chaining. Examples of mode shifts are walking or bicycle trips for short-distance (to use local facilities and shops).

Denis Baupin, Paris's deputy mayor is in charge of environmental policy in Paris and the city is taking steps towards improving air quality and constructing more eco-friendly public transport, such as trams, cycle routes and reducing cars on the city's roads by a quarter.

Based on the information from the Balonodrom Project, one can answer the following questions: Do I really need to travel? What time of day for travel is suitable for me? Which transportation mode will I use? Which route is the best to reach my destination point? Which destination point is the best for me?

References

1. Airparif (2016) Air quality in Ile-de-France. http://www.airparif.asso.fr. Accessed 20 May 2016
2. Airparif (2016) International comparison of air quality monitoring systems. Paris
3. Arnheim, R. (1969) Visual thinking. University of California Press, Berkeley
4. Ballon de Paris (2016) http://www.ballondeparis.com. Accessed 20 May 2016
5. Balonodrom Project (2006) http://www.balonodrom.com. Accessed 20 May 2016
6. Banister D (2008) The sustainable mobility paradigm. Transp Policy 15(2):73–80
7. Beirao G (2007) Understanding attitudes towards public transport and private car: a qualitative study. Transp Policy 14(6):207–220
8. Blanchard K, Johnson S (1982) The one minute manager. Berkeley Books
9. Brauer M et al (2002) Air pollution from traffic and the development of respiratory infections and asthmatic and allergic symptoms in children. Am J Respir Crit Care Med 166:1092–1098
10. Brunekreef B, Holgate ST (2002) Air pollution and health. Lancet 360:1233–1242
11. Chio CP, Liao CM (2008) Assessment of atmospheric ultrafine carbon particle induced human health risk based on surface area dosimetry. Atmos Environ 42:8575–8584
12. CNN (2010) Balloon helps parisians breathe easy. http://edition.cnn.com/2010/WORLD/europe/09/19/paris.balloon.air.quality/index.html). Accessed 20 May 2016
13. Dijst M (2004) ICT and accessibility: an action space perspective on the impact of new information and communication technologies. In: Beuthe M, Himanen V, Reggiani A, Zamparini L (eds) Transport developments and Innovation in an evolving world. Springer, Berlin, pp 27–46
14. EEA (2015) Can transport come to TERMs with its environmental impact? European environment agency. http://www.eea.europa.eu/articles/can-transport-come-to-terms). Accessed 20 May 2016
15. EEA (2015) Evaluating 15 years of transport and environmental policy integration. European environment agency. (http://www.eea.europa.eu/soer). Accessed 20 May 2016
16. EEA (2015). Evaluating 15 years of transport and environmental policy integration—TERM 2015: transport indicators tracking progress towards environmental targets in Europe. European environment agency, Report no 7/2015
17. EEA (2015). Overview of reported national policies and measures on climate change mitigation in Europe in 2015. European environment agency technical report No 21/2015
18. EEA (2015) Technological solutions and behavioural change needed to decarbonise transport European Environment Agency. http://www.eea.europa.eu/highlights/technological-solutions-and-behavioural-change. Accessed 20 May 2016
19. European Commission (2015) Air quality standards. http://ec.europa.eu/environment/air/quality/standards.htm. Accessed 20 May 2016
20. Fierek S et al (2012) Multiple criteria evaluation of the mass transit systems in European cities. Logistyka 2(2012):509–522
21. Gauderman WJ et al (2007) Effect of exposure to traffic on lung development from 10 to 18 years of age: a cohort study. Lancet 369:571–577
22. Geroliminis N, Daganzo CF (2008) A review of green logistics schemes used in cities around the world. Department of Civil and Environmental Engineering, Institute of Transportation Studies, University of California, Berkeley
23. Grahame T, Schlesinger R (2005) Evaluating the health risk from secondary sulphates in eastern North American regional ambient air particulate matter. Inhalation Toxicol 17:15–27
24. Gwilliam KM (2002) Cities on the move: a world bank urban transport strategy review. Washington DC
25. Hall ET (1966) The hidden dimension. Doubleday, Garden City, N.Y
26. Heinrich J et al (1998) Traffic at residential address, respiratory health, and atopy in adults: the National German Health Survey. Environ Res 98:240–249

27. Hensher D (2008) Climate change, enhanced greenhouse gas emissions and passenger transport—what can we do to make a difference? Transp Res Transp Environ 13(2):95–111
28. Hoek G et al (2002) Association between mortality and indicators of traffic related air pollution in the Netherlands. Lancet 9341:1203–1209
29. Helium balloon in paris displays air pollution levels. PHYSorg.com. http://aerophile.com/. Accessed 20 May 2016
30. Huotari K, Hamari J (2012) Defining gamification—a service marketing perspective. In: Proceedings of the 16th international academic MindTrek conference 2012, tampere, Finland, October 3–5
31. Hwang BF et al (2005) Traffic related air pollution as a determinant of asthma among Taiwanese school children. Thorax 60:467–473
32. Ibrahim MF (2003) Improvements and integration of a public transport system: the case of Signapore. Cities 20(3):205–216
33. Janssen NAH et al (2003) The relationship between air pollution from heavy traffic and allergic sensitization, bronchial hyperresponsiveness, and respiratory symptoms in Dutch schoolchildren. Environ Health Perspect 111:1512–1518
34. Kenyon S, Lyons G (2007) Introducing multitasking to the study of travel and ICT: examining its extent and assessing its potential importance. Transp Res Policy Pract 41 (2):161–175
35. Kim JJ et al (2004) Traffic-related air pollution near busy roads: the East Bay Children's Respiratory Health Study. Am J Respir Crit Care Med 170:520–526
36. Kim Y-H et al (2015) Multicolored organic/inorganic hybrid perovskite light-emitting diodes. Adv Mater 27(7):1248–1254
37. Kühn F, Kauv J (2000) The service quality of urban public transport networks. In: Diaz O, Gonzalez P, Jamet C (eds) Urban transportation and environment. Balkema, Rotterdam
38. Kuznetsov S et al (2011) Red balloon, green balloon, sensors in the sky. In: UbiComp'11—Proceedings of the 2011 ACM conference on ubiquitous computing, pp 237–246). doi:10.1145/2030112.2030145
39. Kwan MP (2002) Time, information technologies and the geographies of everyday life. Urban Geograph 23:471–482
40. Kwan MP et al (2007) The interaction between ICT and human activity-travel behavior. Transp Res Policy Pract 41(2):121–124
41. Lee L et al (2011) Effects of ambient air pollution on pulmonary function among schoolchildren. Int J Hyg Environ Health 214:369–375
42. Lenz B, Nobis C (2007) The changing allocation of activities in space and time by the use of ICT "Fragmentation" as a new concept and empirical results. Transp Res Part A Policy Pract 41(2):190–204
43. Lim J et al (2011) The analysis of PM2.5 and associated elements and their indoor/outdoor pollution status in an urban area. Indoor Air 21:145–155
44. Lynch K (1960) The image of the city. MIT Press, Cambridge Massachussettes
45. Maheswaran R, Elliott P (2003) Stroke mortality associated with living near main roads in England and Wales. Stroke 34:2776–2780
46. Malinkiewicz O et al (2014) Perovskite solar cells employing organic charge-transport layers. Nat Photonics 8:128–132
47. Marjamäki M, Keskinen J (2001) Particulates—characterisation of exhaust particulate emissions from road vehicles, final version. European commission, directorate general transport and environment
48. Mastens K (2007) The bicycleas a feedering mode: experiences from three European countries. Transp Res Part D Transp Environ 9(4):281–294
49. Mejía JF et al (2007) Trends in size classified particle number concentration in subtropical Brisbane, Australia, based on a 5 year study. Atmos Environ 41:1064–1079
50. Miller FJ (2000) Dosimetry of particles: critical factors having risk assessment implications, inhalation. Toxicology 12:389–395
51. Moolgavkar SH (2006) Fine particles and mortality. Inhalation Toxicol 18:93–94

52. Moore K et al (2011) Toxicological assessment of particulate emissions from the exhaust of old and new model heavy- and light-duty vehicles. METRANS project 09–07, Final project report, University of Southern California
53. Morgenstern V (2007) Respiratory health and individual estimated exposure to traffic-related air pollution in cohort of young children. Occup Environ Med 64:8–16
54. Newman P, Kenworthy J (1999) Sustainability and cities: overcoming automobile dependence. Island Press, Washington DC
55. Nicolai T et al (2003) Urban traffic and pollutant exposure related to respiratory outcomes and atopy in a large sample of children. Eur Respir J 21:956–963
56. Poulos A, Mahony MJ (2008) Effectiveness of feedback: the students' perspective. Assess Eval Higher Educ 33(2):143–54
57. Przygocka-Haraszczak K (2012) Feedback—takie proste, żeaż trudne. http://kontekstthr.pl/feedback-takie-proste-ze-az-trudne/. Accessed 20 May 2016 (in Polish)
58. Schiller P et al (2010) Introduction to sustainable transportation: policy, planning and implementation. Earthscan, London, Washington DC
59. Schlesinger RB et al (2006) The health relevance of ambient particulate matter characteristics: coherence of toxicological and epidemiological inferences. Inhalation Toxicol 18:95–125
60. Scire JS et al (2000) A user's guide for the CALPUFF dispersion model (Version 5)" Earth Tech, Inc
61. See SW, Balasubramanian R (2008) Chemical characteristics of fine particles emitted from different gas cooking methods. Atmos Environ 42:8852–8862
62. Shi Z et al (2004) Oxidative stress on plasmid DNA induced by inhalable particles in the urban atmosphere. Chinese Sci Bull 49:692–697
63. Tan ZK et al (2014) Bright light-emitting diodes based on organometal halide perovskite. Nature Nanotechnol 9(9):687–692. http://dx.doi.org/10.1038/nnano.2014.149
64. van Riel P (2000) Pleasure and the good life: plato, aristotle, and the neoplatonists. Brill
65. van Vliet P et al (1997) Motor vehicle exhaust and chronic respiratory symptoms in children living near freeways. Environ Res 74:122–132
66. van Wee B (2002) Land use and transport: research and policy challenges. J Transp Geogr 10:259–271
67. WHO (2013) Ambient (outdoor) air quality and health. World Health Organization. http://www.who.int/mediacentre/factsheets/fs313/en/index.html. Accessed 20 May 2016
68. WHO (2013) Review of evidence on health aspects of air pollution REVIHAAP Project. Technical Report World Health Organization, European Centre for Environment and Health, Copenhagen
69. WHO (2016) Air pollution levels rising in many of the world's poorest cities. World Health Organization. http://www.who.int/mediacentre/news/releases/2016/air-pollution-rising/en/. Accessed 20 May 2016
70. Włostowska A (2015) Codes space, signature interior space planning based on selected areas of European cities, pp 162–182
71. Zwoździak J, Paciorek M (2016) Ograniczanie niskiej emisji z indywidualnego ogrzewania węglowego na terenie Wrocławia w latach 2016–2020. Report to the Institute of Meteorology and Water Management, Warsaw (in Polish)
72. Zyga L (2008) Helium balloon in paris displays air pollution levels. http://phys.org/news134841402.html. Accessed 20 May 2016

Part II
Building Social Capital—Citizen Focus

Satisfaction Benchmark for Smart Cities

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Abstract In order to enhance and improve the quality of "public services", a sound and clear quality management concept is needed. From the process perspective, "high quality" means that a process must deliver satisfaction—the ultimate output variable of any process. A smart city uses information and communication technologies (ICT) in order to increase the quality of its services—which should result in the high satisfaction of the inhabitants. In this chapter, we present a literature overview of benchmarking municipalities and our own primary research of benchmarking satisfaction in over 41 municipalities in Switzerland. As a case study, we show also a benchmarking project conducted in 2013–2014 with the cities of Lublin (Poland) and St.Gall (Switzerland). This chapter will show a framework of a performance dashboard for benchmarking municipalities and how to implement best practice from other municipalities. The key finding of the benchmarking process is to learn from best practice municipalities (the "between analysis") and identify the variables which drive satisfaction in a municipality (the "within analysis"). The chapter ends with a discussion on how a smart city can employ the data derived from ICTs to refine the aforementioned benchmarking process. Our conclusion is that it is vital to embed the smart city concept in a management system that helps decision makers to steer the municipality in a complex environment. To illustrate this point, we show synergies of traditional quality management and smart government approaches in fostering the value of benchmarking outcomes.

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1 Introduction

From the perspective of management, municipalities are organisations that need to adapt to their environment just like any other organisation if they want to be successful in the long-term. According to Beer [1], an organisation does not only need to adapt to the present but also needs to predict the future in its decisions. This chapter focuses on the first aim, namely the present or in Beer's phrase: "The here-and-now". What kinds of decisions does an organisation—and more specifically a municipality—need to take today in order to increase the quality of its services. Quality systems serve the goal of increasing the quality of output variables. For this purpose, diverse performance indicators need to be deployed [2–6]. In our case, the output variable is "inhabitant satisfaction", or more precisely, as we will show later, it is the gap between "inhabitant satisfaction" and "importance for inhabitants". We call this difference "The Delta".

We write this chapter with the assumption that the most important stakeholders of a municipality are its inhabitants. With this assumption, inhabitant satisfaction needs to be taken into account when prioritising decisions in general, and in particular for decisions on which smart city initiatives should be launched. On purpose we do not discuss the holistic concept of "quality of life" for inhabitants, rather we only focus on "quality of the public service". The danger with smart city concepts is that municipalities are inclined to proceed with projects that are technologically elaborate or that have become standard in other municipalities, without questioning whether the decision to implement the concept is derived from an overarching management system. As we will show, "inhabitants" is a very broad term as there are lot of socio-demographic groups within the "inhabitant" stakeholder group. Therefore, it is also a waste of resources if a smart city concept is implemented unnecessarily to all stakeholders and yet it is also a wasted opportunity if a concept is implemented too narrowly. A smart city concept is not an ends in itself, but must address the specific needs of specific stakeholders. In this chapter we show that if you do not embed a smart city concept within a management system, you most likely end up implement projects at random. Steering—be it a car, a plane or an organisation—with randomised actions will get you nowhere at best and will result in a crash at worst.

This chapter shows how municipalities in Switzerland prioritise projects in order to increase the satisfaction of current inhabitants. This is not only part of an overarching quality system, but once the structure for quality maximisation is provided, it will have a deep impact on the culture of a given municipality ("culture follows structure"). It also shows how this management system can be applied to making better decisions on whether to adopt a smart city concept and, if so, what the goals of the smart city concept should be. In Sect. 2, we will provide a literature

review on smart cities. In Sect. 3, we do the same for quality systems for municipalities. In Sect. 4, we explain our method for how to measure "The Delta". Section 5 shows the results of between-analysis (41 municipalities in Switzerland and an international case study) as well as results of a within-analysis (how to address specific stakeholders within a municipality). Section 6 provides a discussion and critique on our method. Section 7 offers a conclusion.

2 Smart Measures for Smart Cities

Based on a literature review, this section focuses on the approaches and limitations to managing and benchmarking the performance of smart cities. The analysis starts with a description of fact-based performance management enabled through ICT supported processes and analytics. These integrated and automated management systems are widely used in companies today. Section 2.2 discusses the use of performance indicators and complex indexes in public sector environments. Sections 2.3 and 2.4 focus on performance management and benchmarking for smart cities. They explore how existing literature and current practice offer differing approaches to the definition of the smart city and measuring its performance. The section concludes with some critical thoughts on the benefits and risks of fact-based management and benchmarking concepts for the organisation of complex environments such as smart cities.

2.1 Fact-Based Performance Management with ICT Enabled Analytics

Whereas in public organisations performance management and benchmarking is just taking off, commercial enterprises have been implementing indicator-based methods for planning, controlling and managing their performance for a long time. The basis for measuring performance are benchmarks comprising of indicators that allow conclusions to be drawn about the status and development of a company, individual business area or selected business processes, from a variety of perspectives [7]. These benchmarks are usually differentiated and determined according to the parameters of time, cost and quality, and are often condensed into complex indicators. The raw data for the measurement of performance can be derived from internal sources (e.g. business processes, ERP systems or machines) or can be obtained externally. The data and indicators are compiled not only for the specific company, but are also often linked to similar indicators and parameters of other companies in the same sector or for particular business areas or processes in other sectors. They are then integrated into the management and control systems of the company seeking performance assessment. This form of performance comparison is

referred to as benchmarking. Companies whose processes, methods, etc. are considered best-in-class, and whose indicators are therefore regarded as a yardstick for the companies under comparison, are often used as benchmarking partners [7]. With increasing digitisation, performance management has become an integral aspect of IT-controlled processes in commercial enterprises and has been integrated into high-performance and semi-automatic ICT systems. Most companies now have the technical facilities that enable the various indicators and raw data to be evaluated almost automatically and therefore make it possible to monitor the current status and draw insights on future developments. In order to activate this potential, the benchmarking organisations require analytical information systems that automatically gather data on business processes, corporate activities, the performance of comparable companies and the development of the area in question as illuminating indicators. These must be made available to the appropriate personnel quickly and in a form that is easy to interpret. One can identify various stages and objectives of corporate performance management according to their development phase [8, 9].

Descriptive analyses use data to answer the questions "What is happening?/What happened?" To do so, ad hoc or periodic reports are compiled that can also be dynamic and interactive. Predictive analyses seek to identify clarifying patterns (e.g. trends, connections, preferences, clusters) by means of data and mathematical methods, which can then be used to make forecasts. The central question is: "What will happen and why?" The result of the predictive analytics are projections and explanations thereof. Predictive analyses use mathematical methods to set out different courses of action. The goals, requirements and framework conditions are determined and data and/or expert knowledge are applied in accordance with the theory of rational decisions and action. This results either in a recommended course of action or in a comprehensive report that supports those involved [8, 9].

2.2 *Performance Management in the Public Sector—Managing Complexity Through Intelligent Measures*

Social and economic benchmarks are increasingly being used in public administration for control and analysis. Since the beginning of the twentieth century, administrations have been using highly aggregated indicators such as the Gross Domestic Product or the Consumer Price Index in order to measure the performance of individual nations. After the Second World War, supranational organisations such as UNDP, WHO or OECD started to measure the performance of nations and regions from various perspectives (e.g. health, the economy, public administration) and to provide data and benchmarks for the purposes of comparison [10]. Today it is not only nations and regions that generate and use benchmarks and performance data, but increasingly cities and their administrative bodies as well. Due to increasing digitisation and technical possibilities, this data is sometimes sourced in

real time (e.g. by means of sensors, cameras or social media analysis) and quickly processed to create informative indicators [10, 11].

These indicators are usually quantitative measurements made over a particular time period and are designed to make selected social, economic or political phenomena within the city measurable and comparable. Kitchin et al. [10] distinguish between single urban indicators such as unemployment rates or the number of patent applications, which quantitatively present an isolated phenomenon within a particular urban space, and on the other hand composite indicators that amalgamate various indicators into a complex and multidimensional benchmark. Examples of complex benchmarks include deprivation indicators, which are composed of various indicators such as household income, health status and access to certain services, and which take into account the interrelationship and multidimensionality of socio-economic phenomena [10].

These simple and complex benchmarks can also be used in public administration for purely descriptive, predictive or even prescriptive purposes, and can be integrated into the analysis and management of cities and regions. Furthermore, they can be supplemented by benchmarking data from other cities and regions. Kitchin et al. [10] use three terms—descriptive indicators, diagnostic and target indicators, and predictive and conditional indicators—in the context of city benchmarking and performance measurement. As cities and regions are increasingly competing to attract companies, an innovative workforce and visitors, they are beginning to use benchmarking as a tool for continuous learning and improvement. Huggins [12] distinguishes between three forms of benchmarking in relation to living space: performance benchmarking, process benchmarking and policy benchmarking. Performance benchmarking compares the performance of different regions based on predefined indicators (e.g. number of patent applications, the establishment of new companies in the innovative and creative sector, CO_2 emissions). Process benchmarking analyses and compares the processes and structures of public administration, while policy benchmarking measures and compares the public administration of cities in terms of the implementation and activation of processes for achieving set targets [12].

With regard to the selection and combination of benchmarking partners, Luque-Martınez and Munoz-Leiva [13] distinguish firstly between competitive benchmarking, whereby cities or regions are assessed without participating actively, and secondly cooperative benchmarking, whereby the individual cities and regions work with the benchmarking organisation and deliver the required information actively. Thirdly, they identify collaborative benchmarking. In this most elaborate form of city benchmarking, the various cities work together, jointly develop standardised indicators and exchange information and experience with regard to improving their performance. Moonen et al. [14] report on at least 150 ongoing benchmarking projects in various cities and regions worldwide, in which several hundred cities and regions are compared with each other. In some cases, the organisers concentrate on isolated aspects such as economic performance or the availability of mobile networks [10]. Other initiatives provide additional complex indicators that integrate and evaluate various parameters.

The AT Kearny Global Cities Index [15] integrates benchmarks from five different fields (business activity, human capital, information exchange, cultural experience, political engagement) into a weighted index. As part of the Global City Indicators Facility project (http://www.cityindicators.org), performance indicators from 255 cities in 82 nations are gathered and compared using 20 characteristics. In 2014 this developed into an International Standard (ISO 37120 Sustainable Development of Communities—Indicators for City Services and Quality of Life) for measuring urban living environments, which is the first global standard of its kind. The individual performance indicators are divided according to aspects including health, safety, transportation, wastewater, urban planning, finance, technology and innovation and are presented in a standardised form (e.g. number of higher education degrees per 100,000 or number of new patents per 100,000 per year in the area of technology and innovation, or greenhouse gas emissions measured in tons per capita in the field of the environment) [10, 16].

2.3 *Managing and Benchmarking Smart Cities' Performance*

As the Smart City concept has become increasingly widespread, many new initiatives and methods for measuring performance and for comparing smart cities have emerged. Over the course of these developments, the parameters and measured values have also evolved and been extended to meet the needs of the smart city, and have been incorporated into various performance indicators and benchmarking initiatives [17].

The Smart City concept has not been universally defined, but there are some common points of focus such as sustainability, technology, innovation, mobility and infrastructure, which can be regarded as the basis of most models and benchmarking initiatives [18]. Depending on the understanding of the term Smart City and the focal points within the city under analysis, the parameters and phenomena to be measured vary, as well as the choice of benchmarking partners. We will now offer a number of definitions of the Smart City, which are followed by an introduction to some selected differing models for defining and benchmarking smart cities.

Some authors (e.g. Bakici et al. [19], Chen [20]) emphasise the use of the latest technologies and view the application of technology as a significant determining characteristic of the term 'smart city'. Other authors (e.g. Giffinger et al. [21], Harrison et al. [22]) address the interplay between the various city subsystems, information flows and processes for enhancing quality of life. Further attempts at definition concentrate on investments in higher education and on initiatives in learning and innovation, or on the real-time analysis (monitoring) of the urban infrastructure by means of high-performance information and communication technology [23]. These different approaches are reflected in the various attempts to

measure and benchmark smart cities. Mahizhnan [24] distinguishes between the four dimensions of IT Education, IT Infrastructure, IT Economy and Quality of Life and focuses strongly on the technological aspect of the Smart City concept, while place a greater emphasis on aspects of governance and organisation (with core aspects such as management and organisation, governance, policy context, people and communities, technology). Other models address the environmental aspect to a greater extent (e.g. Thuzar [25]) or opt for a weighted approach such as Kourtit et al. [26], who differentiate a Smart City according to various types of capital (human capital, infrastructure capital, social capital and entrepreneurial capital). Further models for defining and measuring the performance of smart cities are the IBM Nine Pillar Model [18], the Smart Sustainable City Key Performance Indicators of the ITU [27], the Dimensions of City Prosperity [28], or the Framework for Smart City Analysis [29], which all offer benchmarks for the evaluation of smart cities by means of indicators arranged by subject area.

Many of these approaches, indicators and parameters can be found in current benchmarking approaches within the field of smart cities. The Global Power City Index, developed by the Japanese Institute for Urban Strategies, compiles raw data from various cities and supplements it with subjective evaluations by various stakeholders [17]. Based on rankings and analyses, the strengths and weaknesses of the individual cities can be evaluated and compared to other cities. The Index's organisers focus their efforts on the attractiveness of cities for creative people and innovative companies (magnetism) [17].

The University of Vienna has compared 70 medium-sized cities, based on the proposals by Giffinger et al. [30] and Albino et al. [17], and has analysed their data according to various parameters. In their study, Anthopoulos et al. [18] compare varying approaches to benchmarking smart cities and show the focal points of the different models. One can differentiate approaches according to focal points such as Sustainability [26], Performance [31], Resilience [32], Local Government Effectiveness [33], Urban Competitiveness [28] or Good Urban Governance [28]. Lombardi et al. [34] have proposed a framework based on a comprehensive literature review and a modified version of the triple helix model for analysing knowledge-based innovation systems. The framework consists of 60 indicators and is designed to provide a comprehensive overview of smart cities. The 60 indicators are divided between the aspects of Economy, People, Governance and Living and bring together different approaches put forward by numerous research programmes and scientific essays [34].

Anthopoulos et al. [18] describe different approaches to measuring, rating and benchmarking smart cities and identify six parameters that are used by many researchers and organisations and approaches a conclusive definition: People, Governance, Mobility, Economy, Environment and Living. Many of the existing benchmarking proposals refer to these aspects and follow this basic model. Despite this, it should be noted that there are many individual benchmarks, complex indicators and frameworks for measuring and benchmarking smart cities that are used by an array of worldwide initiatives for measuring and improving performance.

2.4 *Smart Comparison for Smart Cities—Managing Performance in Complex Environments*

The benchmarks and indicators that are used and the benchmarking partners that are selected depends on the objectives and the initial situation of a particular initiative. Kitchin et al. [10] are carrying out an epistemologically-orientated analysis of benchmarking approaches in the context of smart cities and are demonstrating the typical incorrect assumptions that underpin many of the applications. In particular, they criticise technocratic approaches that attempt to depict complex situations using simplistic indicators and then use these inadequate or one-sided indicators to manage complex living environments. Instead of a real ontological understanding of performance management and benchmarking, which regards the gathered data, benchmarks, indicators and comparative values as representations of an ontologically stable reality, they instead propose a constructivist, normative approach that primarily reflects the objectives of the benchmarking and the initial status of the city and then selects the appropriate tools in pursuit of mindful construction and sensible management of the urban environment. They describe the following weaknesses of instrumental benchmarking approaches: (a) the reduction of complex circumstances to singular, quantitative values that do not do justice to the complexity of the reality that is being measured and managed, (b) the de-contextualisation of the smart city from its historical, political, cultural and economic framework, (c) a universalism that assumes the comparability of different benchmarking partners [10].

Various proposals and best practices for performance management and benchmarking in the context of the public sector and smart cities are available and can be replicated and combined in order to build effective, custom management systems for Smart Cities. Furthermore, mature technologies for automated data collection and information processing are available and are already in place in many firms. Public authorities can combine these different approaches and adapt them to their own specific needs. An important consideration is that the responsible authorities recognise the specific situation and history of their area and select the appropriate instruments, technologies and partners for managing the complex system in a smart way. New technologies including sensor networks, wireless infrastructure or social media analysis can help to derive significant real-time measurements and indices for fact based analysis and proactive management.

Thus, there are plenty of possibilities for a city to become “smart”. You can measure anything. The challenge for the public administrator is what to measure and then what to do with the information. These decisions can only be taken within the framework of an overarching management system. For the “here-and-now” [1], the management system of choice is a well-implemented quality system. The next section examines the diverse quality systems that are available for municipalities to adopt.

Beside the above mentioned data sources and methodologies companies and public organizations are using increasingly big data and open data for ICT based performance management. Especially Big Data is a vaguely defined term which

needs some specification. Normally three moments of determination used for definition: volume, variety and velocity. While volume in terms of storage size is a rather traditional factor of modern ICT solutions, velocity and variety are addressing more sophisticated aspects of information management. Variety means the increasing heterogeneity of data and information types like social media data, sensor data, documents or machine data. The concept velocity is addressing the speed of change and updates of data and information, e.g. streaming data, news services or data from smart buildings or traffic management systems. Altogether the three Vs of big data raises system complexity and creating a need for smart control and measurement systems for the participating organisations. On the other hand new and highly efficient forms of performance management raises through the extensive use of big data in analytical operations. For performance management and benchmarking of public sector organisations or cities the following data sources could be of interest and useful for improving quality of their services:

- Open Government Data: Most countries, areas and cities around the globe providing lots of structured government data electronically to the public (e.g. https://opendata.swiss/de/ for Switzerland). These platforms are helpful resources for analysing and comparing specific aspects of the scope of interest. Due to the in most instances standardized and structured form the data can automatically integrated in analytical information systems.
- Internet of Things Data: Traffic management systems, smart homes, sensor networks, video cameras and machines deliver lots of fine granular data which can improve the decision and control in public management.
- Social Media Data like twitter feeds or feedback systems can deliver real time analysis of actual situation and mood of citizens or tourists and can use as a feedback mechanism for continuous service improvement.

3 Management and Quality Systems

This section provides an overview of quality systems. It shows which quality systems exist and categorises them into systems one to six. These systems are then described in more detail in the next subsection. The section will then discuss how quality systems are assessed and argues for a stakeholder-centric view when selecting a quality system to provide service quality. Finally, the section examines how the quality systems can be implemented in a smart city.

3.1 Quality and Its Dimensions in Public Organisations

The concept of quality has changed during the last few decades [35, 36]. As mentioned in the section above, the public sector was and is still influenced by the

private sector. Private and public organisations may differ in strategy, structure and culture, but when it comes to efficiency and effectiveness these organisations converge. Public organisations cannot define their own quality levels, standards or behaviour anymore. The requirements are now influenced by a broad range of stakeholders.

Several approaches to measuring quality indicators have been discussed. We only consider the following aspects, because they are most relevant to the end recipient (consumer, inhabitant). Thus, we do not consider input here:

1. Quality as an obvious feature, characteristic of a product or a service (output quality)
2. Quality as a process of production or service delivery (process quality)
3. Quality as an outcome of a process (outcome quality—impact of a set of outputs)
4. Quality as perceived by the recipient (quality perception and expectation)
5. Quality as a construct of its context (circumstances and timeframe quality)
6. Quality as an object of stakeholders (expertise quality)

Next, we discuss the state-of-the-art quality systems that aim to measuring these indicators.

1. **Output quality**: To define quality at a basic level, technical conformity with norms and standards or minimum specifications are an obvious start. You cannot produce a car with only two wheels, because your output is then a bike and not a car. As ISO 9000:2015 [37] states "The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs". Quality is given when it "complies with the requirements specified by the client." In terms of quality, the goal is to produce a specified level of quality meeting the specified needs at the lowest cost.
2. **Process quality**: We are living in an era of processes, which all need to be effective and efficient. In this context, the relationship of output to input has become vitally important. To maximise quality and reduce waste, all the components of the corporate or public organisation must meet the quality requirements of the client or customer. Methodologies geared towards process improvement, such as process modelling and optimisation as well as quality assurance instruments (such as six sigma), are used to improve and re-engineer business processes and business communications. These methods identify and reduce opportunities for defects, which reduce the quality of process outcomes. Process indicators such as average production time, number of failures, and waste figures are common.
3. **Outcome quality**: This basic perspective was expanded by Juran's [38] concept of "Fitness for use". This approach changed the perspective from a seller's position to a buyer's position (or, the customer's or user's perspective). Features and characteristics of the product or service have to be of value to the process. Product quality is improved continuously and adapted to the changing needs of customers if there is a marginal benefit. Additionally, impact assessment is a

continuous process to help decision makers fully consider and understand the consequences of any financial and operational initiatives (e.g. commissioning decisions, business cases, projects and other activities/business plans). Including impact assessments while developing business plans would result in continuous review by project managers. It would mean reviewing the plan's impact throughout the implementation stage and also following the business plan's implementation. Risk indicators should be included as part of these impact studies.

4. **Quality perception and expectation**: With the concept of Delivering Quality Service [39], further dimensions to quality have been added. The authors stressed two issues: the difference between services and products and the difference between customer expectation and perception. Services differ greatly from products. Products can be described by their physical attributes. Ownership rights are easily established as products are tradable. Services, however, are intangible, heterogeneous, inseparable and perishable. They are based on the interaction of the provider and the customer [40]. The second dimension concerns customer psychology. Depending on the 'perception gap'—the difference between what the customer expected and what they received—the customer might return or might not. The authors have developed ten determinants of service quality as a result of their focus group studies with service providers and customers: access, communication, competence, courtesy, credibility, reliability, responsiveness, security, understanding and tangibles [39]. This was later named the SERVQUAL approach, and has been adapted to public organisation's requirements [41, 42].
5. **Circumstances and timeframe quality**: Quality context depends on the level, the timing and the actual circumstances at the point at which the process takes place. Scheerens [43] suggests that the "context" could be embedded in the direct environment, local municipality and local/regional administration on the one hand and the national context on the other. Additional factors such a country's affluence, demographic trends and culture and values that influence functionality and infrastructure can all be regarded as aspects of the context.
6. **Expertise quality**: When it comes to assessing the quality of any organisation, the role of the key participants is particularly relevant. Bovaird and Halachmi [44] suggest that key stakeholders must be involved. Their expertise, their experience and their common sense enhance and add value to discussions of quality indicators.

Walsh [45] specifies these key participants, which in public organisations he categorises as personal and social services, at different levels of complexity. For each of these categories he recommends specific people. As personal services are delivered to a single user, that user might be in a position to assess quality. This is true as long as the service provided is simple. When the service becomes complex, Walsh recommends involving front-line employees. Unlike personal services, social services, are public, common, and non-exclusive. No one can be excluded from the benefits of the service. When it comes to measuring the quality of these

"social" services, Walsh states, depending on the complexity of the service provided, expert knowledge may be required to assess quality otherwise the assessment might be left to politically motivated politicians. Gnan et al. [46] argue that we should move toward a stakeholder-conscious governance model, with broader stakeholder input and ongoing engagement. This would result in better corporate governance in public sector organisations. Not surprisingly accreditation agencies recommend assessing and managing quality in public organisations by applying accepted standards or requirements as determined by internal audit and review (first-party assessment or approval scheme). They also use second-party assessments, where external customers assess against either the public organisation's own, or national or international standards. Managing quality can also be conducted with a third-party assessment scheme led by an independent organisation, not connected with either the customer or public organisation, but acceptable to them both.

3.2 Quality Assessment and Quality Management

We now briefly discuss managing quality in public organisations, including relevant tools and instruments.

According to ISO 9000:2015 [37] quality management can include establishing policies, objectives and processes to achieve quality objectives through quality planning, quality assurance, quality control and quality improvement. Löffler [35], summarises the following instruments:

- Quality inspection
- Statistical quality control
- System-oriented quality assurance
- Company-wide quality-control
- Total quality management and Quality Management (e.g. EFQM, CAF, ISO 9001, ISO 14001 etc.)

In addition to the TQM philosophies, there is also the Total Quality Service (TQS) approach, which is itself based on the EFQM and SERVQUAL models. This approach focuses more explicitly on the customer, and has 12 components, which are: (a) top management commitment and visionary leadership, (b) human resources management, (c) technical systems, (d) information and analysis systems, (e) benchmarking, (f) continuous improvement, (g) customer focus, (h) employee satisfaction, (i) union intervention, (j) social responsibility, (k) serviscapes, and (l) service culture [47]. In fact, this model appears to be more a blending of the elements of EFQM and SERVQUAL rather than a truly unique model.

Common to all approaches and models mentioned above is that there is one core stakeholder right at the centre: the customer. As a result, when it comes to quality, the customer must be involved. Andreassen [48] and Al-Ibrahim [49] state that

"service quality models can be seen to place the need to satisfy the customer as a central theme, and to include mechanisms by which efforts to create such satisfaction, and levels of satisfaction reported, are constantly monitored to ensure a high level of quality and performance."

3.3 Quality Management in a Smart City

ISO TMB Smart Cities Strategic Advisory Group has established the following working definition of a smart city: "A 'Smart City' is one that […] dramatically increases the pace at which it improves its social economic and environmental (sustainability) outcomes, responding to challenges such as climate change, rapid population growth, and political and economic instability […] by fundamentally improving how it engages society, how it applies collaborative leadership methods, how it works across disciplines and city systems, and how it uses data information and modern technologies […] in order to provide better services and quality of life to those in and involved with the city (residents, businesses, visitors), now and for the foreseeable future, without unfair disadvantage of others or degradation of the natural environment" [50]. The group argues that there are simple and complex models of smart cities. A simple model depicts a Smart City in a single "picture" from a particular viewpoint. Complex Models systematically describe all the elements in a Smart City at many levels of granularity "by describing all of stakeholders, the activities, the relationships, the outcomes etc., of a city in a consistent way, no matter what city system or sector they belong to" [50].

In order to develop the requirements of a quality management system, processes, outputs and outcomes must be considered. The requirements have to be formalised. Features and functionalities of this objective then have to be stated and clearly formulated. The processes subsequently implemented should fulfil the objectives within the constraints of the framework, boundaries and resources available. Whereas outputs of smart city activities are more or less obvious, the outcomes are far more complex as they reflect the net impact of one or more outputs. To develop a quality management system, a smart city is advised to identify the relevant stakeholders (of which city inhabitants are a crucial constituency), describe its processes, build up and qualify relevant resources to effectively and seamlessly achieve the goals and fulfil the purpose it has set itself.

As we have seen in this and the previous subsection, there is a whole array of what might constitute smart city instruments and quality systems that allow a municipality to steer itself as an organisation. Evidently, it is no simple task for authorities to decide what to do and what not to do. The section has also shown that the common denominator to all quality systems is a focus on the consumer. In the next section, we will introduce our own tool that helps decision makers prioritise what needs to be done. In common with the existing literature on quality systems, the tool is based on the satisfaction of the inhabitants of a particular municipality.

4 Methodological Procedure for Satisfaction Benchmarking

The following section explains the steps we are taking in our own inhabitant satisfaction analysis for municipalities. The procedure is drawn on our practical experience of conducting several dozen inhabitant satisfaction analyses. There are various success factors that must be taken into consideration for an optimised and user-orientated procedure when carrying out an inhabitant satisfaction analysis. Apart from professional project management, from planning and execution to the evaluation and resulting presentation to those responsible for the project, public relations work specific to target groups is also essential [51].

4.1 Purpose/Use of the Inhabitant Satisfaction Survey

For many citizens of municipalities and cities in Switzerland, the management policy of the municipality or city has rarely been the only attractiveness criterion when choosing where to live. Social and demographic change is leaving its mark on the systems in municipalities and cities. Many citizens make residential decisions based on the quality of life on offer, as well as infrastructural facilities such as childcare, welfare services and the general quality and quantity of services [52]. If these expectations are not fulfilled, then inhabitants are quick to relocate, at a considerable cost to the abandoned municipalities and cities. However, these are just two of many criteria that determine the attractiveness of a municipality or city to mobile citizens. An inhabitant satisfaction analysis is a suitable tool for a more comprehensive understanding of the attractiveness of a municipality or city. The following are cited as central objectives of such an analysis in practice. An inhabitant satisfaction analysis provides citizens with the opportunity to participate and to actively contribute to future planning, for example with regard to legislative goals. The citizens feel that they are taken seriously and are included in the political process. This is shown by the average return rate of 40–60% for our surveys [53, 51].

Another benefit of a satisfaction analysis is the ability to monitor success. Inhabitant satisfaction analyses subject services and administrative initiatives to an objective performance control, which can provide very important indicators or control mechanisms for leading political authorities, especially in combination with procedural evaluations [51]. Also, we should not neglect the fact that inhabitant satisfaction analyses provide a representative sample that enables appropriate and objective conclusions to be drawn on the population of the municipality or city as a whole [54]. Location promotion has a central purpose. If a municipality or a city performs significantly better than comparable communities in an inhabitant satisfaction analysis, it means that the municipality has processes which are more

adaptable to the need of its inhabitants. This was defined as quality in the preceding section.

These indicators can provide insights on critical areas such as the quality of life, safety or the school system. This information can then be communicated actively to assist the re-election of political bodies, as well as to attract new residents.

4.2 The Basics of Public Surveys

An inhabitant satisfaction analysis usually takes four to five months, from setting out the task with project managers to the workshop with the local or city council to discussing findings and appropriate follow-up measures. There are several possible ways to carry out public surveys. The first step is to decide whether a full census or a sample survey is to be conducted. In a full census, opinions are gathered from all people within the whole municipality or city, while in a sample survey only a section of the population of a municipality or city is questioned. According to our studies there is a tendency to favour a full census, so that all opinions are represented. However, in many cases a sample survey is more appropriate. For example, if the total population is very large (in major cities) the organisation can save a lot of money by carrying out a sample survey, or, in extreme cases, a full census may not even be possible [55]. Another crucial decision at the beginning of a project is what form the questionnaire should take. There is a basic distinction between quantitative surveys (with a standardised questionnaire) and qualitative surveys (e.g. telephone interviews). Both forms have advantages and disadvantages. We mostly use the quantitative form of survey. This is so that all age groups and layers of society can be reached. The advantages of quantitative surveys using physical questionnaires for a inhabitant satisfaction analysis currently outweigh the disadvantages (lower costs, minimal time needed, precisely quantifiable results, and high external validity) [51]. Online surveys look promising. However, researchers must recognise that municipalities and cities do not currently have complete e-mail data sets and not all inhabitants have an e-mail address or access to online services yet. Furthermore, multiple entries (which are possible in anonymous surveys) should be prevented. With regard to the number of questions, our experience has shown that 50–60 questions are the ideal number, this helps to achieve a maximum response rate.

4.3 Project Phases of an Inhabitant Satisfaction Analysis

Before launching any inhabitant satisfaction analysis, a project plan with various milestones and individual project phases should be set out. The project plan consists

primarily of three phases. These are (1) conception, (2) the survey itself (including evaluations), and (3) the presentation and a follow-up workshop. In the following chapters the project phases of a traditional inhabitant satisfaction analysis are individually described:

4.3.1 Survey Procedure (1)

It is not necessary to carry out a full census in the context of an inhabitant satisfaction analysis. It has been mathematically proven that a precisely calculated or structured sample of completed questionnaires allows valid general conclusions to be drawn, on the condition that the sample has been selected randomly. There are, however, certain research techniques that require a full census (e.g. sociometric testing, but this is not practical in communal and urban research [56]). In order to select a sample population, the decision makers in a municipality first have to define socio-demographic criteria. In most cases, seek a sample divided by gender, age, district and length of residence that is as realistic as possible, corresponding to the socio-demographic data. Of course, additional criteria such as family status, size of household etc. are possible [57]. In the next step, mathematical formulae and the expected response rate are used to calculate the required size of sample population, which is selected randomly and is then sent written correspondence. For example, if a city has 20,500 inhabitants (basic population) and the assumed response rate is 40%, about 1000 inhabitants have to participate in the survey in order to receive the required number of around 400 completed questionnaires.

4.3.2 Compiling a Questionnaire (1)

Apart from extracting a random sample population, compiling the questionnaire is a key success factor for written surveys. According to Mattmüller [58], composing the questionnaire is often regarded as an art. Practice has shown that it is surprisingly difficult to formulate generally comprehensible and straightforward questions. The most efficient way to put together a questionnaire is with the help of a sample question catalogue. If this is not available, one should refer to a framework model such as the Kano Model or the confirmation-disconfirmation paradigm when formulating the questions, in order to cover all the important aspects of a municipality [59, 60]. It should be noted that different countries can have differing focal points in a inhabitant satisfaction analysis. Experience has shown that the following eleven areas have emerged as important in Switzerland:

- Local government
- Supply
- Health

- Local council
- Waste disposal
- Schools
- Taxes
- Transport
- Safety
- Information/communication
- Municipality life

When the areas relevant to a municipality or city have been identified, individual questionnaire items have to be formulated, taking account of various principles that apply to the formulation of questionnaires. The central principles, according to Mattmüller [58], include the following:

- Use simple and comprehensible language (suited to the target group)
- Formulate neutral questions (avoid judgmental questions)
- Clear and precise questions
- No convoluted questions

For example, some standardised items for schooling are listed here:

1. The school cultivates an open information policy
2. Children with learning difficulties are aptly supported
3. Gifted children are supported adequately
4. The offer of special activities (school camp, special event weeks) is adequate
5. The infrastructure of the school (way to school, schoolyard, classrooms etc.) is adequate
6. Routes from my home district to school are secure
7. The teachers in the school are competent and friendly
8. The employees of the school office are competent
9. The employees of the school office are friendly
10. The children feel secure in their schools
11. The transfer to further and higher education institutions (grammar school, university) is well prepared
12. The quality of teaching in the school is high
13. The availability of places in pre-schools is adequate
14. The availability of places in kindergartens is adequate

In order to choose from the array of statistical evaluation options, it is recommended to formulate two-dimensional questions. We also enquire about the importance and the degree of satisfaction of the questions. The section “Carrying out the survey” provides details on evaluation and the optimal, practice-orientated representation options. After compiling the questionnaire, it is subjected to a comprehensive pretesting procedure. We use this to examine the validity and

reliability of the individual questions, as well as the choice and weighting of the individual focal areas, in cooperation with selected test people at the municipal administration, and if necessary we include some citizens of the relevant municipality or city.

4.3.3 Carrying Out the Survey (2)

The postal addresses for the sample population must be provided by the municipality. The local administration must hand out the data protection regulations specific to the municipality, as well as the predefined sample criteria (gender, age etc.) to the independent executive body. Based on the defined criteria, we carry out a random sample selection and prepare the written communication to the individual citizens. The printing and posting of the questionnaire documents (incl. reminder) is handled by the local administration in a customised envelope with a municipal emblem in order to achieve the highest possible response rate. It is also important that a prepaid reply envelope is included. The survey itself usually takes place within a timeframe of three to four weeks, and, ideally, a reminder is sent after two weeks. The questionnaires are returned directly to us in the reply envelopes. This ensures the anonymity of those surveyed. Names are not stated on the questionnaires, only demographic data such as age, gender etc. for selected specific evaluations and correlation calculations. The evaluation of the questionnaires and of the data should be presented in an independent concluding report. As already mentioned in the section above two dimensions should be taken into consideration (importance and satisfaction). This enables the results to be represented as shown in Fig. 1, so it is evident at first glance that points above the diagonals represent savings potential (importance is smaller than satisfaction) and, vice versa, points below the diagonals require investment (importance is greater than satisfaction).

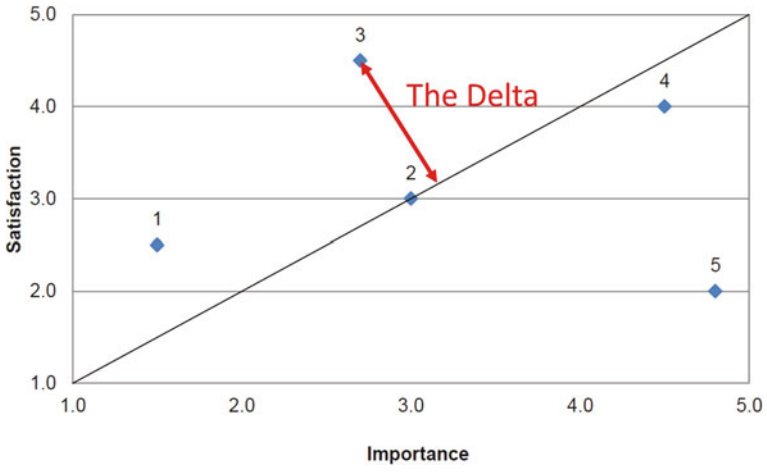


Fig. 1 The "Delta" is the difference between satisfaction and importance

4.3.4 Statistical Analysis: The Delta (2)

Next, we attempt to calculate the "Delta". The Delta is the orthogonal difference between the diagonal and the location of a specific item (in most cases, the mean value). If the distribution of the answers for a specific item is skewed, you can also calculate using the median values. If the delta is negative, a municipality has underinvested in an item (satisfaction lower than importance). If it is positive, the municipality has overinvested. You can also calculate if the delta is statistically significant from zero using the t-test.

4.3.5 Workshop/Courses of Action (3)

The next step in the method is the development of remedial measures. But before we proceed, we need to take a look what we have done so far. What did we measure exactly? How should we use the statistical material for a more fundamental analysis?

4.4 Discussion on "The Delta" and on Satisfaction

As we will see in the next section, we use this information for diverse statistical tests. Please note that satisfaction as well as the importance (and therefore also our "Delta") of specific items are quality perception and expectation variables, belonging to **quality system four** which was described in Sect. 2.1. It might the case that the exact same processes with the exact same degree of key performance indicators (**quality system two**) will lead to different outcomes in two otherwise identical municipalities. Satisfaction and importance are thus not objective variables (like speed of light in a vacuum). They are dependent on the cultural setting, on the timing and on many other cultural aspects. While a number of smart city concepts have been criticised for "decontextualisation" (see Sect. 2), there is perhaps too much context in our variables. These might differ, though objectively measured variables are the same. A decision maker of a public body must take this into account: He might be tempted to increase satisfaction because it is the output variable in any quality system. However, as we define satisfaction, it is a completely subjective feeling about a certain item on the questionnaire. We follow the lead of Zeithaml et al. [39], where service quality is measured by a questionnaire that collects both the customer expectations of service quality and their perceptions of the service they receive. Let us take the item "The offer of public parking space is adequate" as an example. Whereas young boys who like to impress girls with roaring sport cars might think the more parking space, the better, some environmentally conscious citizens might not agree with them at all. The objective variable would deliver the same value for both, for example: "On average, there are 1000 free parking lots available at 9 pm". Nonetheless the perception of this objective

fact is quite different for these socio-demographic groups and so, therefore, is the satisfaction. We must recognise that it could be very dangerous to advise a municipality on the basis of perception alone. The interviewees do not express objective satisfaction. Rather they return what they feel about the question item. This data represents gut feeling rather than objective value. What they feel and declare on a survey might not be what they obtain from the public service provider in practice.

5 Empirical Evidence as a Base for Benchmarking

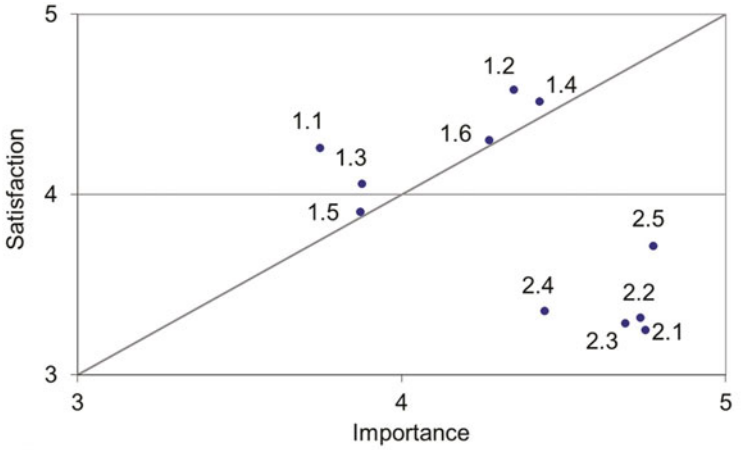
In this section we will present some of our analytical findings. Our database consists of 41 municipalities, some of which have been measured with the method described above at regular intervals. Thus, we are able to make cross-section analysis with aggregated data. First, we will show the aggregate Swiss data. Next, we explore a specific case in which we compare two international municipalities, identifying a benchmark and best practices. This is the in-between analysis, because the statistics compares the same performance indicators between different municipalities. In the final subsection we show the stakeholder-specific measures that can be developed using the data within a municipality (the within-analysis).

5.1 The Aggregate Data

In this subsection, we would like to present some of the data in order to illustrate what is possible with the dataset. As described above, the data is gathered using a number of items with two dimensions: satisfaction and importance. These variables are supplemented with socio-demographic variables. The latter can serve to specify recommendations to specific stakeholders. In Fig. 2 we present the top five and bottom five items of Swiss municipalities:

The top five items represent opinions of where the municipality has invested too much and has therefore wasted resources. The bottom 5 are items where the municipality should invest more. The number indicates how many municipalities have been surveyed for this specific item.

As you can see, the inhabitants in Switzerland (based on the sample) think the municipalities invest too much in the aesthetics: beautiful buildings, cultural offer and musical education. The location of the municipal is too central as well: According to the inhabitants the municipal buildings should be used for other purposes (which is in line with any smart city concept if the municipal administration turns virtual). Interestingly, according to the perception of the inhabitants, the internet site is an overinvestment as well (which questions many smart city concepts as well). Inhabitants were dissatisfied with issues relating to tax; inhabitants of this sample do not like to pay taxes.



	Top 5
1.1	The rooms of the local administration have a friendly appearance.
1.2	The location of the local administration is easy and fast accessible.
1.3	The internetsite of the local administration is user friendly.
1.4	The relationships between the departements are clearly and well comprehensive.
1.5	The cultural offer is appropriate.
1.6	The offer for musical education is appropriate.

	Bottom 5
2.1	The tax burden seems to be too high compared with other municipalities.
2.2	The tax burden seems to be too high for the service offered.
2.3	The authorities do whatever possible to increase the tax attractiveness of the municipality.
2.4	The recreational offer for the young and young adults is sufficent.
2.5	The municipal council is responsive to the concerns of the inhabitants.

Fig. 2 Top 5 and bottom 5 items of the aggregate dataset for Switzerland. *Source:* Own database

It seems that using aggregate data simply states the obvious, and substantiates existing prejudices. It leads to hasty conclusions, ad-hoc decisions and activism. You should not aggregate apple with oranges, nor small mountain villages with industrialised regions. You need to compare apple one to apple two. This is done with the in-between analysis and the next subsection will address this subject.

5.2 *Between Analysis: Case Study on Process Benchmarking*

Let us now leave the aggregate data and turn to a specific case: In 2013 the cities of Lublin (Poland, population 340,000) and St.Gall (Switzerland, population 75,000) compared each other in the Benchmark at the same time. The results were as follows:

Table 1 shows a comparison between Lublin and St.Gall regarding the satisfaction level of the inhabitants. The biggest five discrepancies between the analysed

Table 1 Comparison of Lublin/St.Gall—satisfaction level

Question	Satisfaction level Lublin	Satisfaction level St.Gall	Difference
The winter service of the street is conducted in time	2.71[a]	4.26	−1.55
The offer of social services is adequate	2.72	4.08	−1.36
The winter service of the walking zones and cycling paths is conducted in time	2.58	3.93	−1.35
Parks and green zones are clean	2.93	4.27	−1.34
The amount of old people homes is sufficient	2.60	3.86	−1.26

Source Own database

[a]Satisfaction levels on a 1–5 Likert scale where 1 corresponds to low and 5 to a high satisfaction

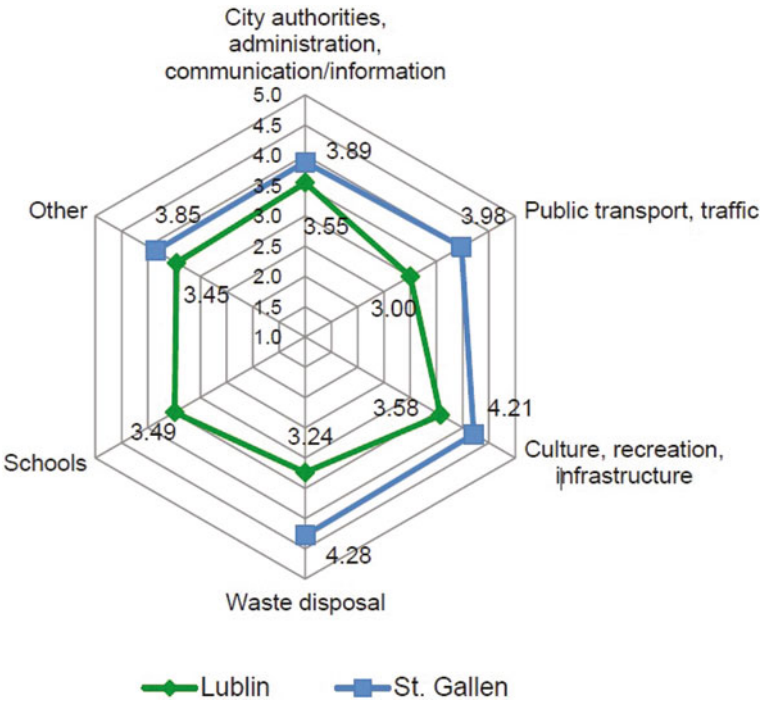


Fig. 3 Comparison Lublin St.Gall in terms of satisfaction. *Source:* Own database

cities arised from the topic winter service (streets, walking and cycling paths). This result was used from the responsive people of Lublin to identify best practice methods from a Swiss city.

Overall, it seems that St.Gall (N = 163) performed better in the perceived satisfaction of its inhabitants than Lublin (N = 1058) (Fig. 3). In particular, public transport and traffic is an area where Lublin could adopt best practice from St.Gall.

As you can see, St.Gall performed better on average than the city of Lublin. To be fair, St.Gall has used the survey and benchmark method for a long time and on a regular basis. These surveys helped the city authorities to allocate its investments accordingly, which resulted in improved public services over the years. In contrast, Lublin tested the method for the first time and the performance of the public service in the city was rather low as a result.

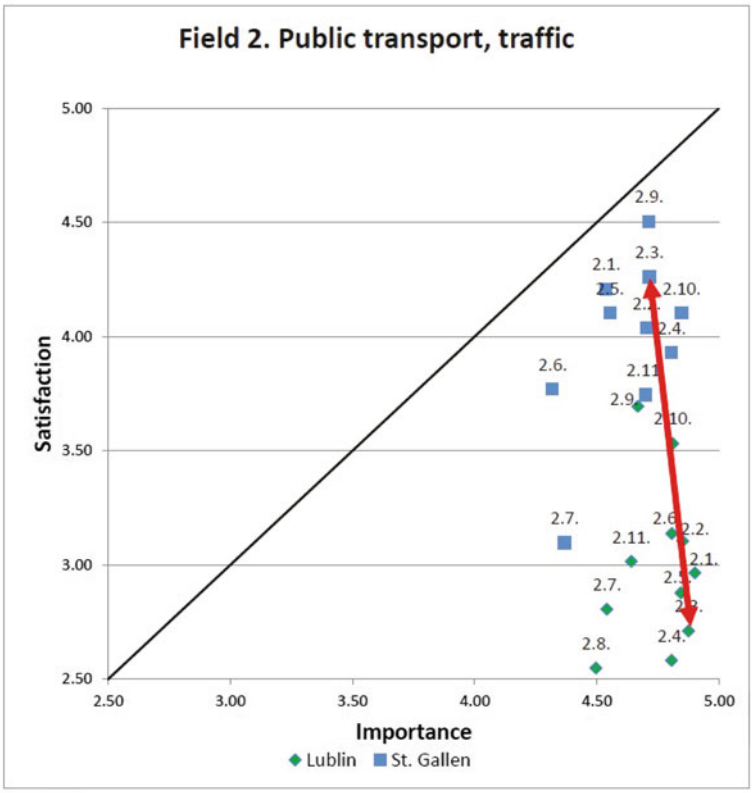
The learning curve is of course not the only argument between the differences between Lublin and St.Gall. Other factors might be different expectations of the services, and indeed other levels of quality of public services (including the budget available). At this point, the method can rightly be criticised for not accounting these factors. We will respond to the critique in chapter six and propose how the method can be developed in a smart city concept.

As shown in Table 1 and Fig. 4 traffic and public transport is an issue that could be addressed in Lublin. You will recognise that point 2.3 in particular (winter service in the streets) is of interest for a best-practice exchange. The interviews that followed showed that St.Gall outsourced the winter service to private subcontractors (farmers, small craft industries), which is a very effective way to organise a service of this kind, and measured their performance using inhabitants complaints. Now the Lublin authorities can adapt this best practice where it aligns with their strategy, structure and culture. Put simply, now Lublin administrators know that winter service needs to be improved and they know how.

The items in the survey of the municipalities St.Gall and Lublin. As you can see, Lublin can learn from St.Gall regarding the organisation of the winter service in particular.

In summary, the methods permits a city to decide on investment priorities and also provides the city with information how to do it. Interestingly, note that St.Gall did not perform well at point 2.7. (parking space). According to the president of the city this was a deliberate policy designed to create incentives for the population to use public transport (point 2.9. performs the best of all) and thus reduce air pollution and increase safety. The survey, it is clear, helps you to act strategically.

Besides the consideration of a specific topic like public transport in Fig. 4, there are several further methods to analyse insights between and within cities. One of these possibilities is the analysis of age-based differences among the inhabitants perception concerning the quality of life. Table 2 shows an example of age-based differences in the city of St.Gall with the focus on improvements for people between ages 18–40. The table illustrates, how these particular age-clusters can be used to prioritize action plans to improve the satisfaction level for specific target groups.



Legend

2.1	The roads and streets are well maintained
2.2	Pavements, squares and cycling paths are well maintained
2.3	The winter service of the street is conducted in time
2.4	The winter service of the walking zones and cycling paths is conducted in time
2.5	The streets of the city ensure easy flow of traffic between districts
2.6	The measures taken to ensure a calm traffic are adequate
2.7	The offer of public parking space is adequate
2.8	The amount and length of cycling paths is adequate *(in SG not asked)*
2.9	The offer of public transportation in the municipality corresponds to my needs
2.10	The security for pedestrians is given

Fig. 4 Comparison of Lublin/St.Gall in terms of satisfaction. Field 2: public transport, traffic. *Source:* Own database

5.3 Within Analysis: Target-Specific Measures for Stakeholders

It is often the case, however, that a single variable might satisfy a certain group of people (e.g. the elderly) but not satisfy another (e.g. the younger generation). In order to address this problem, more advanced statistical methods need to be applied

Table 2 City of St.Gall—age-based differences

Question	Age 18–40	Age 51–70	Difference
There are enough collection points available (disposal of waste)	3.51	4.37	−0.86
Schools: the offer of special activities (school camp, special event weeks) is adequate	2.92	3.73	−0.81
The offer of recreational activities for the elderly population is adequate	3.69	4.38	−0.69
I am being sufficiently informed about the possibilities of waste disposal in my municipality	3.90	4.54	−0.64
The arts in the city are well provided (museums, theatres, libraries, etc.)	3.49	4.11	−0.62

Source Own database
[a]Satisfaction levels on a 1–5 Likert scale where 1 corresponds to low and 5 to a high satisfaction

than just a mean or median comparison. For this purpose, we usually perform a factor and regression analysis [61] over the satisfaction items. The purpose of the factor analysis is to identify the proxy variables which best correlate the most with other variables and can be used to measure it. For example, in the educational category of the survey in St.Gall the item "Image of the public school" served as a proxy for the overall quality of the school (other items which described the quality correlated with this variable). Another proxy variable turned out to be "I know the contact person of the school". The variable correlated strongly with other variables concerning the general partnership between parents and school. Once you have identified the proxies of your sample, you now are able to regress the socio-demographic variables on the identified proxies. After you have done this, you will see which socio-demographic groups turn out to be crucial for improving the quality of your municipality. In St.Gall, for example, two stakeholder groups have been identified who—if their concerns are addressed—would be able to improve the satisfaction level of your city:

- Stakeholder 1: If you like to improve the overall quality of your schools, you need to include well-educated mothers with German-speaking background and at least one child in the primary school into the design of measures.
- Stakeholder 2: If you like to improve the partnership between parents and school, you need to include foreign-speaking parents (both mother and father) into the design of school policies.

An analysis of this kind serves thus the purpose of stakeholder-specific development of measures but it is also a tool to identify and to act on deeper trends in the environment of the municipality. For example, if there is a huge dissatisfaction with the migration policy in general and the numbers of the survey show that the dissatisfaction is increasing over time (regular surveys are essential as stated in the St.Gall-Lublin example above), it is of vital importance to know the particular driving forces of this change. Hence if you observe these changes in a specific

socio-demographic group you are more likely, timely and stakeholder-specifically able to act on this development before a movement (like currently Pediga in Germany) develops bottom-up and affects a broader range of the society, thereby disrupting the political culture. If you thus apply the survey correctly, you will end up with a tool which builds consensus, bridges diverting views by rooting a not-yet-existing-problem to specific items in a survey. This leads to a fact-based dialogue with relevant stakeholders before the situation becomes a problem. Name the socio-demographic groups as you like: "conservatives", "z-generation" or "naturalists". The classification is important for further research in other fields. For our purpose, the statistics behind the naming are of much higher significance.

6 Criticism of the Methodology

As you can see, the method measures subjective perceptions. Based on this perception, the municipality will target specific socio-demographic groups to develop appropriate measures in order to increase the overall satisfaction of a municipality's inhabitants. In our experience, the method outlined above can be critiqued and some questions need to be answered:

1. Perception Problem: Is perception more important than reality? As stated above, it is now possible to gather the data with sensors, which gives a more objective representation of the real problems. Is the method we've described out-dated?
2. Fluctuation Problem: Does not perception fluctuate over time (seasons, political hot topics, etc.)? Are the survey results biased by short-term fluctuations of a specific satisfaction issue?
3. Complexity Problem: Is society too complex and thus the reduction to a two dimensional model an oversimplification? What are the risks of deluding ourselves that we know what we cannot know?
4. Comparative Problem: Is the comparative analysis of two municipalities that belong to very different cultures biased and therefore misleading? Take the example of Lublin versus St.Gall as described above.

We believe that those problems can be overcome by applying smart city concepts to the analytical method. A combinational approach is the future for the continuous improvement of quality in public services.

In order to illustrate this idea in more detail, let us address the problem of Lublin's winter service. If you are aware that the problem exists, you might install sensors in the streets (or visual cameras) which measure the extent of the problem with objective variables (e.g. is there snow?). In this way, you measure objective indicators (the real and not the perceived data). You can then measure these objective indicators in different municipalities in the same way. Let us assume that the satisfaction level in city A is lower than in city B, though both the objective parameters are the same. This fact can be represented by extending our model with

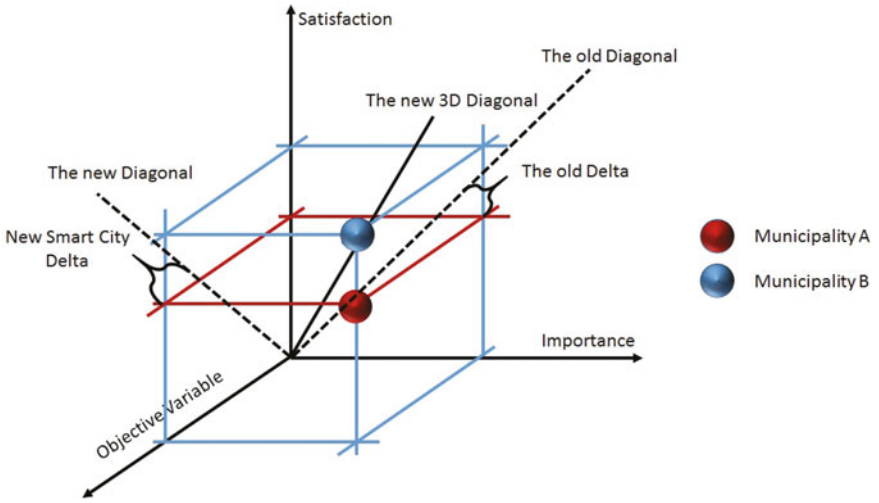


Fig. 5 Smart city Delta. *Source:* Extension of our own model

a third dimensions, namely we add an objective dimension (amount of snow in the street over a specific time) to the perception dimensions "satisfaction" and "importance" as shown in point 2.3 in Fig. 4.

What is available now is an additional "Delta". We spoke of the "Delta" as the orthogonal difference for an item in the satisfaction/importance matrix (Fig. 1). Now that you have a smart city, you can extent the model with the objective third dimension. As a result, you now have two deltas in your model, and of particular interest is the second delta, namely the difference between satisfaction and the objective data. We call it the "Smart City Delta" (Fig. 5). As already indicated in the chapter above on big data, the objective variable does not only need to include sensor data, but might also draw on the collections of data from open governance, social media or internet of things. The danger is not a too small dataset, but rather how to make the choice which data needs to be taken into account for the objective variable.

Municipality A and B are benchmarked against each other. The subjective data (satisfaction and importance) suggests that municipality A lags behind municipality B. Based on this analysis, you decide to upgrade your model with objective smart city parameters (like sensors). It may be indeed the case that the problem is perception and not reality, because the objective variable is the same. This is critical information to determine what kind of decisions you take to steer your organisation in your own unique environment.

What is the "Smart City Delta" for? It can be used to counter the objectives to our method. If you combine the satisfaction survey with a smart city concept, you have some answers to the critique we offered above:

1. **Perception Problem**: It could indeed be the case that the subjective data is "wrong" if you consider the objective data to be "right", because the inhabitants in city A are generally more sceptical about everything. But in this case, it is very easy to test this hypothesis if the difference between the subjective and objective variables of the two cities are statistically the same over all the measured items. If so, inhabitants of city A are of a "grumpy" disposition and you need to deal with this problem anyway. One option that we have applied when developing measures is not to make recommendations to the city authorities on how to increase the satisfaction level. Instead, we recommend adapting communications with inhabitants, thereby having an effect on perception.
2. **Fluctuation Problem**: Whereas the subjective variables might be due to unobservable fluctuation because of single time point data gathering, these fluctuations can be observed in the objective variables gained from sensors that deliver real-time data over long periods of time. If you have objective variables in your dataset that fluctuate and those that do not, you can test whether this fluctuation has a statistically significant effect on the level of satisfaction in your city. If so, you will know that you need to correct the subjective variables for the fluctuation which is achievable with a *ceteris paribus* analysis in a multivariate statistical model [61].
3. **Complexity Problem**: In complex systems it is very difficult to assess which variables should be measured and which should not. In order to answer this question, let us consider a quality model from process perspective. In models that are aimed at delivering good quality, you measure the output variable of a process. The output variable of the process is most commonly the satisfaction of your consumer—a difficult, but not a complex indicator to assess. Therefore, the assessment of the subjective variables should come first, and, based on the findings of the subjective analysis, objective variables that are worth the effort to measure can be determined. This is a "pull approach" and not a "push approach". The downstream process determines what has importance in the upstream process. If you do it vice versa, you end up measuring things that are not important but you neglect the issues that need to be addressed for specific target groups. This is because the process performance indicators that suggest satisfaction are too simple and cannot address the actual complexity of generating consumer satisfaction.
4. **Comparative Problem**: As for the cultural context, it is true that in our example Lublin performed badly whereas St.Gall performed well, though in the interviews it turned out that some of the processes looked exactly the same (e.g. optimisation of the bus schedule at point 2.9 in Fig. 4). Obviously, inhabitants of Lublin are much more critical of their authorities than those in St.Gall. The objective data is in fact the same for both sets of inhabitants. Thus, the appropriate answer to this point is the same as in point 1, namely you need to compare the differences in subjective and objective data over all of the items that are measured.

To conclude, our subjective data (satisfaction and importance) should be gathered and then analysed statistically. In doing so, you identify the need for action in certain areas. You avoid making random decisions. A good decision is to implement smart cities concepts for the subjective and specific items which perform poorly for two specific reasons. Firstly, because you are able to determine whether a problem stems from reality or from perception, and secondly, because you need to decide which upstream process indicators are required. There are simply too many options for process indicators in a municipality to decide randomly which should be measured. If you measure the process indicators that lead to an unsatisfying result (namely poor satisfaction), the upstream process indicators as well as the downstream satisfaction will improve over time. If you follow this advice, over time you will develop an overarching management system which is rooted in a quality system. So, before you set out to implement fancy smart city concepts, make sure that you have a management system or, at the very least, a quality system in place.

7 Conclusion

To conclude, we have explored the existing research literature on smart city concepts. The analysis of different measurement and benchmarking approaches in the Public Sector in general and for Smart Cities in particular showed that a variety of measurements, indices and benchmarking instruments are available. The challenge for the management of Smart Cities is the appropriate selection, combination and implementation of measurements, indices, and benchmarking partners as well as how to find the right balance between automated (fact-based) data collection and more people-focused (subjective) approaches. Whereas fact-based collection delivers objective data for management and analysis, people-focused collection incorporates the human factor and the perception of subjects and groups on the issue under observation. The combination of both approaches alongside proactive management systems could give Smart Cities instruments for the smart management of complex environments. We also showed that Benchmarking is increasingly being used to improve the quality of public services by continuously learning about and improving relevant processes. But Sect. 2 explored the drawbacks of the Benchmarking trend: As more and more objective variables are being measured, there is a risk that these variables cannot be directly compared. This incompatibility of variables makes benchmarking more difficult. As a result, Benchmarking can be misleading when it does not use standardised methods.

Another critique is that the socio-economic systems that a city or a municipality represents are far too complex to measure with mere objective variables. It is therefore extremely important to integrate the smart city concept into a management system. Management systems are created to help steer an organisation in a complex environment. One set of management systems we have referred to are quality systems. They start by measuring the output variable—or, if necessary, many output variables—that in the next step is summarised using factor analysis. It is

only in the second step that the relevant objective (process) variables that need to be measured are determined.

We then proceeded to present our own tool (the inhabitant satisfaction survey) which has been used in over 40 municipalities in Switzerland. These municipalities use the data gathered to decide which issues need prioritisation and which already receive a high level of satisfaction.

We have shown that the inhabitant survey offers solutions for both problems mentioned above. First, it is a standardised tool that has been proven in over 40 municipalities. The subjective data is comparable, in particular if you add objective process variables to your statistical model. A significant advantage is the measurement of the output variable, namely satisfaction. If satisfaction is high for a certain item, then there is no action required and you do waste investment in sensors that deliver objective data. On the contrary, if satisfaction is low you can visit the municipalities which perform better and review their process: Ask your peers what they think is the driving force behind the high satisfaction in their municipality! Once you have completed the comparable analysis, you are well-positioned to decide which objective variables need to be considered. As Lord Calvin put it: "What gets measured, gets done." If you measure satisfaction, the satisfaction of your inhabitants will increase over time.

References

1. Beer S (1979) The heart of enterprise. John Wiley & Sons, Chichester
2. Anderson R, Klaassen H (2012) The fallacy of the context: an empirical study of the influence of the context on the use of performance management in the public sector. Int J Prod Perform Manag 61(5):483–501
3. Bovaird T, Loffler E (2002) Moving from excellence models of local service delivery to benchmarking good local governance. Int Rev Admin Sci 68(1):9–24
4. Parka SM, Raineyb HG (2012) Work motivation and social communication among public managers. Int J Hum Resour Manag 23(13):2630–2660
5. Wisniewski M, Stewart D (2004) Performance measurement for stakeholders: the case of Scottish local authorities. Int J Public Sect Manag 17(3):222–233
6. Lin J, Lee P (2011) Performance management in public organizations: a complexity perspective. Int Public Manag Rev 12(2):81–96
7. Oehler K (2006) Corporate performance management mit business intelligence Werkzeugen
8. Davenport T (2007) Competing on analytics: the new science of winning. Harvard Business Review Press
9. Siegel E (2016) Predictive analytics: the power to predict who will click, buy, lie, or die. John Wiley & Sons
10. Kitchin R et al (2015) Knowing and governing cities through urban indicators, city benchmarking and real-time dashboards. Reg Stud Reg Sci 2:1–28
11. McCarthy F, Vickers M (2008) Digital natives, dropouts and refugees: educational challenges for innovative cities. Innov: Manag, Policy Pract 10(2–3):257–268
12. Huggins R (2009) Regional competitive intelligence: benchmarking and policy-making. Reg Stud 44(5):639–658
13. Luque-Martinez T, Munoz-Leiva F (2005) City benchmarking: a methodological proposal referring specifically to Granada. Cities 22(6):411–423

14. Moonen T, Clark G (2013) The business of cities 2013: what do 150 city indexes and benchmarking studies tell us about the urban world in 2013? Jones Lang LaSalle. http://www.jll.com/Research/jll-city-indices-november-2013.pdf
15. Kearney AT (2012) Global cities index and emerging cities outlook. AT Kearney http://www.atkearney.com/research-studies/global-cities-index
16. International Standards Organization—ISO (2014) ISO 37120:2014—Sustainable development of communities—indicators for city services and quality of life
17. Albino V et al (2015) Smart cities: definitions, dimensions, performance, and initiatives. J Urban Technol (Routledge)
18. Anthopoulos L et al (2015) Comparing smart cities with different modeling approaches. In: International world wide web conference committee (IW3C2). May 18–22, 2015, Florence, Italy
19. Bakici T et al (2012) A smart city initiative: the case of Barcelona. J Knowl Econ 2(1):1–14
20. Chen TM (2010) Smart grids, smart cities need better networks [Editor's Note]. IEEE Netw 24(2):2–3
21. Giffinger R et al (2007) Smart cities: ranking of European medium-sized cities. In: Centre of regional science (SRF), Vienna University of Technology, Vienna, Austria
22. Harrison C, Eckman B, Hamilton R, Hartswick P, Kalagnanam J, Paraszczak J, Williams P (2010) Foundations for smarter cities. IBM J Res Dev 54(4):1–16
23. Hall RE (2000) The vision of a smart city. In: Proceedings of the 2nd international life extension technology workshop, Paris, France
24. Mahizhnan A (1999) Smart cities: the Singapore case. Cities 16(1):13–18
25. Thuzar M (2011) Urbanization in South East Asia: developing smart cities for the future? Reg Outlook 96–100
26. Kourtit K et al (2014) A multi-actor multi-criteria analysis of the performance of global cities. Appl Geograp 49:24–36
27. International Telecommunications Union—ITU (2014) Overview of key performance indicators in smart sustainable cities. http://www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx
28. United Nations (UN) Habitat (2014) Urban Governance Index (UGI): a tool to measure progress in achieving good urban governance. http://mirror.unhabitat.org/downloads/docs/2232_80907_UGIndex.doc
29. Lee JH et al (2013) Towards an effective framework for building smart cities: lessons from Seoul and San Francisco. Technological Forecasting & Social Change
30. Giffinger R, Gudrun H (2007) Smart cities ranking: an effective instrument for the positioning of cities? ACE Arch City Environ 4(12):7–25
31. Da Cruz NF, Marques RC (2014) Scorecards for sustainable local governments. Cities 39:165–170
32. Desouza KC, Flanery TH (2014) Designing, planning, and managing resilient cities: a conceptual framework. Cities 35:88–89
33. Singhal S et al (2013) Application of a hierarchical model for city competitiveness in cities of India. Cities 31:114–122
34. Lombardi P et al (2012) Modelling the smart city performance. Innov: Eur J Soc Sci Res 25 (2):137–149
35. Löffler E (2013) Defining quality in public administration. In: NISPAcee conference Riga 10–13 May
36. Melpomeni A et al (2013) Implementing CAF in public administration best practices in Europe—obstacles and challenges. Benchmarking: Int J 20(6):744–764
37. ISO 9000:2015 (2015) Quality management systems—fundamentals and vocabulary
38. Juran JM (1980) Quality planning and analysis: from product development through use 629
39. Zeithaml VA et al (1990) Delivering quality service. Balancing customer perceptions and expectations

40. Parry G et al (2011) Goods, products and services. In: Macintyre M et al. (ed) Service design and delivery 20ff
41. Shiu E et al (1997) Service quality: New horizons beyond SERVQUAL—an investigation of the portability of SERVQUAL into the voluntary and local government sectors. Int J Nonprofit Volunt Sect Mark 2(4):324–331
42. Brysland A, Curry A (2001) Service improvements in public services using SERVQUAL, managing service quality. An Int J 11(6):389–401
43. Scheerens J (2011) Measuring educational quality by means of indicators. In: Scheerens J et al (ed.), Perspectives on educational quality. Springer Briefs in Education
44. Bovaird T, Halachmi A (1999) Community scorecards. The Role of stakeholders in performance asssessment. In: Halachmi A (ed), Performance and quality measurement in government. Issues and experiences, pp 145–155
45. Walsh K (1991) Quality and public services. Public Adm 69(4):503–514
46. Gnan L et al (2011) Corporate governance and management practices: stakeholder involvement, quality and sustainability tools adoption—evidences in local public utilities 929
47. Sureshchander GS et al (2002) The relationship between service quality and customer satisfaction: a factor specific approach. J Serv Mark 16(4):363–379
48. Andreassen TW (1994) Satisfaction, loyalty and reputation as indicators of customer orientation in the public sector. Int J Public Sector Manag 7(2):16–34
49. Al-Ibrahim A (2014) Quality management and its role in improving service quality in public sector. J Bus Manag Sci 2(6):123–147
50. ISO/IEC JTC 1 (2015) Information technology, smart cities 2–9
51. Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg (LUBW) (2011) Bürgerbefragungen in kleineren Kommunen 6–9
52. Ladner A, Steiner R (2003) Die Schweizer Gemeinden im Wandel: Konvergenz oder Divergenz? 233–234
53. Jordan D, Kressig C (2013) Die Einwohner sind das Kapital der Gemeinde.Schweizer Gemeinde 36–37
54. Glück M (2007) Vertrauen und Legitimation durch Bürgerzufriedenheit 94
55. Mosler K, Schmid F (2006) Beschreibende Statistik und Wirtschaftsstatistik (3):15–16
56. Mayntz R et al (1978) Einführung in die Methoden der empirischen Soziologie (5):68–69
57. Haufe.de (no date) Marktsegmentierung und Zielgruppenbestimmung, Kriterien/2.2 Soziodemografische Merkmale. https://www.haufe.de/unternehmensfuehrung/profirma-professional/marktsegmentierung-und-zielgruppenbestimmung-kriterien-22-soziodemografische-merkmale_idesk_PI11444_HI2114382.html
58. Mattmüller R (2000) Integrativ-Prozessuales Marketing – Eine Einführung 36–107
59. Müller-Martini M (2008) Kundenkompetenzen als Determinanten der Kundenbindung 36
60. Marx D (2014) Das Kano-Modell der Kundenzufriedenheit: Ein Modell zur Analyse von Kundenwünschen in der Praxis 11–16
61. Backhaus K, Erichson B, Plinke W, Weiber R (2000) Multivariate analysemethoden. Springer Verlag, Berlin, Heidelberg

Role of Public Government Units Within the Framework of the Smart City Concept

Anna Brdulak and Halina Brdulak

Abstract The tenets of the concept of building smart cities are focused on the technological and social development, which is ultimately expected to enhance the city dwellers' quality of life. Local government units play a key role in this context. The way local government units manage the cities bears on what they look like and determines the dwellers' quality of life. Hence, it is of paramount importance for the municipalities (gmina) and districts (powiat) to take into account and implement the sustainable development concept, which builds i.a. on an open stakeholder dialogue. Actions of this kind contribute to building the social capital in the long run. The paper is aimed at elaborating on the notions related to the smart city idea, as well as the notion of the quality of life in the light of the roles assigned to local government units. The issues in question will be discussed on the basis of results of surveys conducted among the municipalities in Poland.

Keywords Smart city · Sustainability · Sustainable development · Sustainable strategy · Local government units · Social capital

1 Introduction

The smart city concept is inextricably linked with the city dwellers' quality of life. A. Caragliu from the Polytechnic University of Milan defines the smart city as a city which invests in social capital, as well as in infrastructure: the traditional, transport-related, along with modern infrastructure, based on ICT technology [1]. Being catalysts of sustainable economic growth, the investments contribute to the

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enhancement of the quality of life paired with prudent management of natural resources through participatory governance.

Local government units, i.e. municipalities and districts, are entities which are responsible for managing the cities on behalf of local communities. Local authorities are responsible for stimulating local growth by creating favourable conditions for sustainable development of economic entities in the relevant territory, for the establishment of new ones and for the enhancement of the level of living of municipality or district inhabitants.

In order to effectively satisfy the diverse needs of various stakeholder groups and solve social, economic, environmental or spatial issues with limited financial means, the tasks undertaken by the local government must follow a defined and legitimate course, be planned in time and space, and last but not least, their implementation requires a certain amount of funds. Therefore, local governments are expected to pursue a long-term strategy, coherent both with the intentions of specific units and with the strategies of local governments cooperating with the units, also at higher levels.

This matters to the extent that governments at a local level are not bound by the law to comply with the principles of cohesion; as a result, the quality and legitimacy of the prepared development plans and the approach to the strategic building blocks including sustainability is entirely up to the local authorities.

2 Sustainable Development of the Cities in Europe

Sustainable development is, apart from knowledge- and innovation-based economic growth and fostering a high-employment economy, one of the three priorities of the Europe 2020 strategy, which was formulated by the European Union and is about delivering economic growth in EU member states.

The matters of sustainable development were first discussed within the EU at the turn of the 1980s and 1990s. Several documents and programs related to this area have been created since, by the European Commission, representatives of the European Council and the Council of the European Union. In this context, the report *Our Common Future*, also known as the Brundtland Report, released by the World Commission on Environment and Development (WCED), deserves particular attention. G.H. Brundtland, in charge of the Commission's work at that time, was the then Prime Minister of Norway. The report provides one of the first and oft-quoted definitions of sustainable development. According to the concept, sustainable development aims at 'meeting the needs of the present without compromising the ability of future generations to meet their own needs' [2]. The central principle behind sustainable development is intra- and intergenerational equity. Ensuring equity is key to the societies achieving the ability of sustainable development [3].

The aforesaid definition indicates the need for economic and social development of the human population, taking account not only of the environment, but also

current problems, such as poverty, human rights violations, lack of access to education or inadequate health care systems. It also comprises proposals on rational use of natural resources. It can thus be inferred that development may not take place at the expense of other people and the natural environment. This philosophy ought to be reflected in the management of urban resources.

The course of action of the World Commission on Environment and Development was continued during the Rio de Janeiro Earth Summit held in 1992. The Rio Summit is a major conference dedicated to the promotion and implementation of the idea of sustainable development.

The following five key documents were produced during the Rio Summit:

- The Rio Declaration on Environment and Development consisting of 27 principles. According to them, long-term economic growth can be achieved exclusively by associating it with environmental issues. This will be feasible once individual countries establish new and fair relations based on partnership. Hence, they must work out international agreements to protect the integrity of the global environment and development system;
- Agenda 21 (Global action programme);
- Forest Principles;
- Convention on Biological Diversity
- Framework Convention on Climate Change [4].

Agenda 21 is a key document adopted at the Rio Summit. It is a comprehensive action agenda which refers to the 21st century and is addressed to the United Nations, individual governments and social groups in each area where human impact on the environment can be observed. At the heart of the document lies the thought that if the current policy is pursued, the economic hiatus will increase in the societies and between countries, and poverty, hunger, diseases and illiteracy will become more and more widespread. These problems are additionally aggravated by continued deterioration of the natural environment. According to the Agenda, in order for the problems to be counteracted, collaboration is mandatory under a global sustainable development agreement, which is also referred to in the Rio Declaration.

Agenda 21 was signed by 172 states, including Poland. Agenda 21 has been grouped into four sections. The first one is directed towards social and economic issues, the second one revolves around conservation and management of resources for development, the third one includes the roles that should be played by social groups in the process of implementation of Agenda 21, and the fourth section indicates the means of implementation.

It should be noted that the document encompasses not only general solutions aimed at improving the environment at a global level, but it simultaneously offers inspiration on how to approach local issues with relation to the global situation.

Actually, in accordance with the formulated recommendations for the implementation of Agenda 21, since 1996 local authorities along with the inhabitants have been expected to take steps to draw up the so-called Local Agenda 21 (LA21),

i.e. local environmental programmes. An additional incentive to take action in the area of sustainability in Poland is the Local Government Act and the Environmental Protection Act. Under the latter, municipal authorities are obliged to formulate environmental protection and sustainable development programmes, as well as to implement them accordingly.

According to the recommendations of Agenda 21, the methods and principles of work on the programme ought to first of all guarantee that the representatives of the local community will be able to take an active part in the formulation of the programme, and ultimately in its implementation. As a result, the very process of formulation of the document is of paramount importance for the building of social capital based i.a. on the establishment of civic society and social dialogue focused on reaching compromises and a responsible decision-making process [5], which is a decisive success factor for the actions taken.

Interestingly enough, the recommendations of Agenda 21 provided a basis for the formulation of the Fifth Environmental Action Programme covering the environmental agenda, sustainability issues and several EU directives. Moreover, Agenda 21 underpins the OECD Sustainable Development Programme (document by Secretary-General of the OECD from 1998) and several recommendations by OECD.

The 1990s saw the specification of problem areas related to cities, as well as the initiation of the debate on the Urban Agenda for the EU. The first communication of the European Commission entitled *Green Paper on the Urban Environment*, 1990 [6], raising the issues of urban policy, was released in 1990. The study *Urbanization and the functions of cities in the European Community* was published two years later. The EC Expert Group's policy report *European Sustainable Cities* was released in 1996 and the communication of the Commission entitled *Towards an urban agenda in the European Union* was published a year later. Statistics on European cities were included in 1992 Eurostat report, and in 1997 a study was released on the idea to establish ESPON [7], European Observation Network for Territorial Development and Cohesion, which continues to exist.

A document of particular significance for Polish cities, entitled *Kompendiu systemów i polityki planowania przestrzennego* UE, was published in 1997 [8]. According to the definition contained in the document, territorial development is a decision-making process by which a choice is made between meeting social, environmental and economic needs. Hence, this is a control and regulatory tool which directly affects the city dwellers' quality of life and meets the following objectives:

- stimulation of the economic development of the society,
- drive for ensuring sustainability in environmental terms, inclusive of care for the inhabitants' safety,
- levelling regional disparities,
- stimulation of development and permanence of resources [9].
- EU documentation and programmes related to urban topics revolve around three types of challenges faced by a city in the context of its dynamic growth:

- social such as unemployment, social exclusion and low level of social engagement,
- economic—uneven development of urban space, high-poverty districts,
- environmental—air pollution, protection of green areas.

The studies led to a series of informal meetings at ministerial level, initiated by states holding the EU Presidency in the period 2000–2010. As a result of the debate, general objectives of and common rules for development policies targeted at European cities were formulated and included in the 2004 policy statement *Acquis Urban*. Among the listed priorities is the call for balancing economic competitiveness, environmental protection and last but not least, social cohesion. A city is assumed to be the space which integrates local communities, where the inhabitants have a sense of well-being, which makes it possible to maintain the dwellers' cultural identity and which offers an adequate level of the quality of life.

Within the framework of intergovernmental cooperation, the Leipzig Charter on Sustainable European Cities was adopted in May 2007, and the Toledo Declaration—in 2010. The Leipzig Charter describes the role of the city with particular emphasis on *unique cultural and architectural qualities*, which cities possess, as well as *strong forces of social inclusion* and *exceptional possibilities for economic development*. The Toledo Declaration, which combines the key issues of the Leipzig Charter and the guidelines of the Europe 2020 strategy, indicates smart, sustainable, cohesive, inclusive urban development as the primary goal of urban policy [10].

For the needs of this paper, the authors are going to narrow down the analysis of the guidelines on urban development and the suggested course of development to the aforementioned documents.

As can be concluded from the selected studies, the development potential of the cities as knowledge centres and sources of innovation growth has been identified on the one hand. On the other hand, they are an area which magnifies demographic issues, such as a shortage of cheap and adequate housing, environmental issues, social inequality or social exclusion of some groups, also the elderly. Hence, local governments are primarily tasked with taking a holistic look at the city's development strategy in such a way that it becomes multifaceted and takes account of the described issues.

3 The Notion of the Quality of Life

Deliberations on the links between the impact of the policy followed by local government units on the city dwellers' quality of life ought to be preceded by a definition of the quality of life.

The term 'quality of life' is said to have been introduced by US President Lyndon B. Johnson in 1964. The notion soon gained popularity as it entails an important value for contemporary humans—it is not about survival; it is about life 'at an adequate level'. It became popular among the representatives of various fields

of science, social, economic and medical alike, with reference to various aspects of life [11].

Research on the quality of life often uses value judgement with reference to quality, i.e. terms like higher, lower quality rather than the descriptive interpretation, i.e. a different quality, various qualities. T. Borys indicates two fundamental courses of research and discussions in the light of potential methods of conceptualization and operationalization of the 'quality of life' category. The first one makes a distinction in the quality of life both in a subjective and objective sense, similar to the phenomenalist and normative understanding of the quality of life. The second one arises from the differences in value systems, ethical attitudes and the implemented development concepts [12].

Rabenda-Bajkowska [13] proposes two approaches towards the notion of the quality of life in terms of its scope: broad and narrow. Due to the varying nature of the indices, as well as the level of analysis, she calls for considering the quality of life from an objective and subjective point of view, as well as emphasizes the associations between the quality of life and the axiological system. She also points out two different interpretations of the needs of value systems. The first one, created on the basis of Maslow's hierarchy of needs, revolves around shortage-related matters. The second interpretation focuses on the development needs of both an individual and the society as a whole. It is based on prognostic tenets underpinned by [14] specific human concepts and personality.

A narrow understanding of the notion of the quality of life can be found in Allardt's study, where two pairs of notions are juxtaposed: 'well-being' and 'happiness' versus 'level of living' and 'quality of life'. The first notion, objective in its nature, pertains to the level of satisfaction of one's needs. On the other hand, happiness or the quality of life are subjective feelings. The level of living is associated with the satisfaction of the need for material resources within formalized social systems, whereas the quality of life refers to the needs that cannot be satisfied with material assets, but e.g. by strengthening social bonds.

The methods of measuring the quality of life deserve to be mentioned in this context. Traditional indices related to the GDP increase or to per capita GDP were deployed to determine the quality of life in the 1980s and 1990s.

In 2005, the UK weekly 'The Economist' developed a quality-of-life index which explains the level of living and life-satisfaction scores in various countries. It was based on a methodology linking the outcome of subjective life-satisfaction.

surveys to the objective determinants of quality of life in different countries worldwide. The measures selected for the index are as follows:

- Material well-being—per capita GDP in US dollars whilst maintaining the purchasing power parity
- Political stability and security [15],
- Family relations—divorce rate (per 1000 people), on a scale from 1 (the lowest divorce rate) to 5 (the highest divorce rate) [16],

- Community life—this variable takes the value of 1 if the country has a high rate of church attendance or trade-union membership; otherwise the variable equals 0 [17],
- Health—the average life expectancy, in years [18],
- Job security—unemployment rate, % [15],
- Gender equality—ratio of average male and female earnings [19],
- Political freedom—average of indices of political and civil liberties. Scale of 1 (completely free) to 7 (unfree),
- Climate and geography—latitude, to distinguish between warmer and colder climes [20].
- The quality of life is also measured by the Central Statistical Office (GUS) in Poland, on the basis of a multifaceted approach. The index includes not only a person's objective living conditions, but also the subjective experience of the quality of life, referred to as subjective well-being.

When it comes to examining objective living conditions, apart from the measures factored in by 'The Economist', such as material well-being or health, the Central Statistical Office in Poland also takes into account the economic activity, leisure time, social relations, personal safety, the quality of the state, fundamental rights or the quality of the natural environment at the place of residence.

In the process of measuring subjective well-being, the Central Statistical Office uses satisfaction surveys to find out to what extent people are satisfied with various aspects of subjective well-being and with life as a whole, as well as examines the elements pertaining to the experienced emotional states and value system [21].

4 The Role of Local Governments in Creating a Smart City

Local governments in Poland have existed for almost a quarter of a century. The first local government elections took place on 27 May 1990. This is when a three-level administrative division was introduced. Until then, a dual administrative division had been in force, involving local government authorities and state administration 'in the field'.

Launched in 1990, the first local government reform was based on a pre-war model. It restored local government and was temporary [22]. The subsequent act, adopted in 1998, formed and introduced two new public entities: district and voivodeship (województwo) [23]. The fundamentals of the political system and local government in Poland are defined in The Constitution of the Republic of Poland of 2 April 1997 [24].

According to the principle of subsidiarity, public power is exercised at the most immediate local level. Hence, tasks and competences are first of all assigned to lower-tier authorities, i.e. to municipalities, so that they can be delegated to a higher

level, i.e. to districts or voivodeships, if the competence of lower-tier bodies is insufficient.

The principle of independence states that local government units operate independently, they have legal personality and are protected by courts. The principle of presumption of local government's ownership states that when the performance of a task is not reserved by law to state administration, the task is within the remit of local government units [25].

According to Z. Leoński, the structure of the local government is based i.a. on the provisions of law which secure the following: the interests of specific social groups, the bodies running the affairs pertaining to these groups and elected by them, as well as the possibility of interfering with the way in which the local government functions exclusively in statutory forms, and obligatory participation by law of the said social groups and their bodies in the exercise of self-government and performance of tasks to be completed by public administration [26].

Local government units are entities enjoying a certain scope of freedom in making decisions on the way of development of the territory they are in charge of, disposing of the common property or performing public tasks. The fundamental duty arising from Article 7 of the Local Government Act and Article 4 of the Act on the local government of the district is to satisfy collective needs of the inhabitants on a municipal and supramunicipal level in the following areas: *social, economic, environmental, municipal housing and spatial development* [27].

Thus, the role of local governments might be said to consist in creating the living environment for their inhabitants. To this end, under the principle of presumption of general competence of the municipality and district, the legislator confers upon the local governments a broad range of authorizations, benefits and entitlements. As a result, local governments can handle all public affairs that are not reserved by law to other local government units (voivodeships) or government administration. Local governments' own tasks, defined in Article 166 of the Constitution of the Republic of Poland, are as follows […]: *public duties aimed at satisfying the needs of a self-governing community shall be performed by units of local government* […].

Local governments may also be requested by government administration to perform tasks. The tasks can be divided into those that are compulsory and arise from special acts, and those that are optional and are assigned as a result of agreements with government administration bodies; in such a case, adequate funds are allocated for their performance [25].

According to the Constitution, the municipality is the basic unit of local government. Being closest to the citizen, local authorities are able to suit their actions to the inhabitants' actual needs [28]. Constant monitoring of the social, economic and environmental situation requires excellent organization and speed of action on the part of local governments. The authorities must demonstrate a proactive approach which enables them to take preventive action fast and to approach the challenges of their strategic policy in a flexible manner. Thus educational, investment or promotional actions ought to build on a formulated municipality development strategy, which captures elements of sustainable development. The same goes for tasks vested in the district.

The district performs specific tasks, supramunicipal by nature, on its own behalf or in sole responsibility, not reserved to other local government entities. The district's tasks are governed by the Act of 5 June 1998 on the local government of the district. The district is supplementary to the municipality and plays a compensatory role. It can form organizational units, enter into agreements with other entities, as well as conduct economic activity solely within the scope of public benefit.

In the social realm, the municipality is responsible for social services including assistance provided to the unemployed, taking care of families, taking care of the homeless, health care and culture. The municipal authorities are also responsible for security, as well as law and order. Their basic tasks in this respect are as follows: ensuring order in the municipality, fire and flood prevention and municipal guards. Spatial development, construction, land management and other environment-related tasks also deserve to be mentioned.

As mentioned before, the municipalities, apart from their own tasks, are also expected to perform tasks commissioned by government administration bodies. They include the registration obligation, responsibility for civil registration and other tasks in the area of social services.

The districts are responsible i.a. for technical infrastructure, such as supervision and construction of district roads and provision of collective transport. This area is of particular significance in the context of the sustainable development concept, especially visible in the strategies aimed at creating smart cities.

In order to ensure the local community a high quality of life, the local government ought to attach considerable weight to the integral development or elimination (if negative) of all areas being part of this quality: health, social conditions, employment, income poverty, education, family, active participation in the life of the community and society, housing, transport and communications, leisure time and culture, life satisfaction, safety and the environment (the first European Quality of Life Survey was conducted in 2003 by the European Foundation for the Improvement of Living and Working Conditions, established by the European Commission).

Undoubtedly, the quality of the action taken by the local governments is impacted by the existence of the development strategy, which structures and renders coherent the programmes in various subject matter areas created by local authorities [29]. Being a basis for the activity of local governments, the strategy is expected to capture a long-term planning perspective and at the same time to provide a set of rules of conduct for local authorities, a set of determined objectives and ways to achieve them, tailored to the situation of the more immediate and more distant environment. The strategy must provide for all socio-economic phenomena within the remit of the local government, thus phenomena that the local government has an impact on and bears responsibility for [21].

It can be concluded from the surveys conducted by the author in nine selected local government units (municipal and district councils) in the period 2013–2015 that the city dwellers' quality of life is conditional upon successful implementation of the principles of the sustainable development concept; the principles should be contained in the aforementioned strategic documents. Successful implementation

relies primarily on civic activity, which is the result of proper education, environment, tolerance and respect for others. These aspects are inextricably linked with the social capital whose building process must be a priority both for the legislators and executive bodies, for local authorities and businesses alike [30].

Under the sustainable development concept, socio-economic development must be characterized by self-support, stability and sustainability. Thus, economic growth is intended to support actions aimed at preventing social marginalization and discrimination, as well as to have a positive impact on the environment. At the same time, the overarching objective is sustainable quality of life. The achievement of sustainable quality of life requires the instruments of socio-economic and environmental development to be constantly reviewed and broadened.

This is why it is so important to seek diversity, freedom and equality with reference to the social world, as well as to maintain difference of form and processes typical of the environment.

In this context, sustainable development requires a multifaceted approach towards the process of solving global issues related to ageing societies, shortage of food and raw materials, poverty, migration, crime, international conflicts or environmental pollution [31, 32].

As a consequence, the following are the key structures which prepare individuals to take conscious and active steps for the sake of development in broad terms and simultaneously permit the implementation of these steps:

- primary and secondary education during which knowledge, skills and social competencies of significant influence on social attitudes are gained,
- various organizations, including youth organizations and NGOs, which offer individuals the ability to cooperate in order to reach common goals, and where individuals are taught a responsible attitude not only towards themselves, but also towards the others, in this way gaining the experience necessary in their further professional careers,
- organizations and local government structures which strengthen people's identity with a specific area, shape the sense of responsibility for the decisions that are being made and last but not least, contribute to the creation of the region's development policy within the scope of cooperation with other individuals,
- employee and professional organizations which hone teamwork skills, the ability to solve conflicts in a constructive manner, as well as lay emphasis on the organization's impact on the environment in a broad sense, while at the same time taking account of stakeholder expectations,
- scientific and technical organizations, including R&D centres, which have a positive effect on both personal and technological development,
- a family which creates open attitudes towards others including the ability of liaising and cooperating with other people, socio-cultural and environmental sensitivity, and which stirs up activity and creativity development-wise.

It is the local government, the institution being the closest to the citizens' affairs, that has an immediate impact on shaping the quality of the aforementioned realms.

In pursuit of an efficient policy of improvement of the quality of life in various areas, municipalities and districts ought to focus their activity on a policy adhering to the principles of sustainable development and of social dialogue in particular.

As things are, Poles have little confidence in the state institutions. According to the authors, there is an opportunity ahead of local governments to change this negative perception by active engagement of local communities.

Following an integrated local policy permits rational management of resources available for the unit, as well as integration and engagement of the local community in order to pursue common goals, and the sense of the inhabitants' belonging to the territory where they live and run their businesses. This aspect is key for the success of the sustainable strategy and thus for improving the quality of life of smart city dwellers by integrated and tailored action taken by local governments.

In the light of the above, it should be noted that from the current perspective the local government is one of the best structures of the administrative system. The paradigm of local government as an independent unit, which makes decisions suited to the inhabitants' needs and expectations, has provided an incentive for the country's modernization and development alike. The more local government there is in democracy, the smaller communities are self-governing by nature and the more decisions depend on local governments, the better it is for democracy and for the conditions for building the social capital [26].

Yet, after more than 25 years of functioning without any significant change, local government units require sweeping reforms, not only in the light of the legal or financial system, but also in terms of the obligations assigned to local authorities [33]. Hence, a debate on how to repair local governments' structures and introduce significant modifications to their operation becomes ever more urgent.

There are several barriers to self-sufficient existence of the local government. Apart from financial matters, the structure of the local government system is one of the key obstacles. Local governments are structured in such a way that operational guidelines for them are actually established by state administration. As a result, they are deprived of their self-governing powers provided for by the reform.

Local governments were intended to provide the foundations and support for building a civic society [28]. The inhabitants of a territory became administrators and guardians capable of defining the needs and objectives, of exercising control over administration and public utilities; administrators and guardians capable of managing the finances at the disposal of the local government, and managing other assets. In this way, a structure with a strong council was established. The council appointed a 'management board' that could be removed at any time.

Later on, the role of the council was weakened by way of amendments, and a direct election of the head of the commune (wójt) or mayor was introduced. Elections to the local government took into consideration strong political parties which were expected to boost the creation of programmes and navigate the course of action for local government units.

Nevertheless, politicization of local governments plays an adverse role and is becoming a serious problem for the organization. Political parties refuse to support units where the election is won by a candidate put forward by a different party.

Groups of conflict were created, often used by politicians as catalysts for career growth. A question arises how local communities can set up a council able to fulfil the functions that are required.

Another barrier to effective development of local governments is a shortage of management staff with appropriate backgrounds. As opposed to the US, Poland does not have a compulsory education system for councillors that would provide them with specialist management skills. In the US, there are state training programmes for local politicians who acquire relevant competencies for their office.

The amendments proposed in the Local Government Bill, intended to support the society in co-deciding, seem to be insufficient for the local government's self-organization or for creating well-considered projects, based on the submitted initiatives.

The inhabitants' local government, which currently fails to fulfill its role, must also be revamped. Hence, the civic cooperation platform or a mechanism making it possible to select community leaders are non-existent.

Effective and efficient management seems to require local authorities to identify the drivers for growth in a specific territory. Information about local needs would be gathered in this way, and further on a plan would be formulated to take the needs into consideration in the action taken.

In fact, the contacts between local governments and business are insufficient for proper interaction. Local authorities do not pay enough attention to the economic potential, while at the same time going to every effort to manage their budgets and meet the expectations of the central government, which tends to increase the scope of mandatory tasks assigned to local governments.

There are still too few local government units with a development strategy based on a comprehensive analysis of the development potential of the territory and available resources. Local governments fail to attach sufficient weight to the sustainable development concept whose principles appear to be essential from the vantage point of implementation of the tasks to be completed.

Set up over 25 years ago, local government structures are currently in need of radical reforms, boosted by concerted conceptual, organizational and financial efforts [5]. Due to these changes, local government, which plays a key role in satisfying the city dwellers' needs, will be able to plan and navigate the course of action so as to make it as efficient and effective as possible.

Being close to the citizens, local governments have a share in deciding about the quality of the inhabitants' lives. As an integral part of the state structure, they participate in the exercise of public democratic authority and contribute to building the social capital [34]. Their participation in the exercise of authority consists in governance, engagement and social control. Their functioning ought to build on partnership based on cooperation and trust.

They also provide evidence of the willingness to decentralize the state. In fact, decentralization has never been fully achieved in spite of conferring upon local governments legal personality, their own bodies and administration, and granting them their separate assets and budgets.

Owing to the aforementioned elements, regardless of the difficulties, local authorities play a significant role in the process of satisfying social needs and in managing public affairs [29]. Hence, a closer look needs to be taken at their functioning mode.

Although local governments are embedded in a market environment and are organizations themselves, they are by no means market-regulated mechanisms. Therefore, the efficiency of their functioning relies not only on the competence of the authorities, by also on the level of politicization of a local government unit.

All of the above confirms the need for change as regards the scope of functioning of local authorities, mainly in the social, economic and legal areas. At present, local government structures demonstrate several gaps and inconsistencies, which form a major barrier to the fulfillment of the imposed duties. As a result, local authorities lose out on transparency. Yet, transparency and responsibility towards the inhabitants are prerequisites for local governments to operate in an efficient manner, including efficient fund management.

This matters because EU funding will be reduced from 2020 onwards. Until then, local governments need to work out a management system to enable them to support themselves on the available resources and local funds alone. This is currently quite a challenge, though. Therefore it is mandatory that a broad debate be initiated in connection with the upgrade of local governments; the debate should end with specific solutions to be implemented as soon as possible in the structures of local government units.

5 Conclusions and Areas for Further Research

The conducted surveys have demonstrated that local governments deploy a tool for dialogue: social consultations. Nevertheless, a low level of civic participation is still a source of concern. The inhabitants' passive attitude may result from lack of confidence in public institutions, which proves the low level of social capital in Poland. Low civic engagement is also caused by limited access to information, insufficient transparency of the steps taken by local governments, lack of interest and time or fear of losing a job.

As the authors see it, this area requires special attention, including particular focus on civic governance. Only by civic governance will a strategy suited to local issues be formulated, with a focus on sustainable development of the municipality or district; a strategy being the outcome of mutual confidence between the authorities and local community.

The need to include the city dwellers in the governance processes does not mean that they will be obliged to decide about public affairs. The local government reform must be focused on building confidence in institutions. In the long run, the citizens will gain a natural sense of responsibility and a sensation of agency in the

territory they live in. Nevertheless, in order to prevent potential issues, the impact of the society on the local governments' functioning mode must be strictly defined. For instance, in the process of drawing up the development strategy, the moment of consultations and their number must be provided with utmost precision.

Although local government units should be entities with a high level of independence, their freedom is very much restricted by legal regulations. This freedom has been greatly eroded by the imposed bans, adverse conditions for conducting economic activity, restricted ways of performing the tasks which continue to multiply without new funding, voting systems and the methods of financing public tasks. Therefore, the proposed change should seek to expand economic freedom to an adequate extent and within rational boundaries.

Particular weight must be attached to the way public funds allocated to local governments are used, which is also an element of sustainable development management. As local government units are part of the public sector, they are characterized by lower management effectiveness compared to business. As a result, the use of public funds involves less rational management of funds, and the rational aspect is even more reduced owing to lack of transparency and coherence of the action taken, and an ineffective funds reconciliation process paired with embezzlements owing to defective legal regulations.

Despite the above, local authorities are obliged to manage their local government unit as efficiently as possible, benefiting from the available resources. Good management is reflected in the aforementioned sustainable strategy which provides for action in three fundamental fields: social, economic and environmental.

The conducted surveys indicate that local governments cannot do without a strategy. The strategy is an essential planning instrument which renders it possible to take coherent action not only outside, but also inside the organization. If the strategy is properly set up and pertains to the actual needs and issues existing in the municipality or district, it is possible to plan the tasks that are necessary for the development of the unit, as well as to make use of the available resources in the best possible way, which can be seen in the steps taken by Dzierżoniów and Zielonki municipalities or Kłodzko district. The elements of sustainable development must also be taken into account in this context. Their presence in the local government strategy provides proof that the local government unit has increased awareness in this respect, which is key to effective management.

Local government units which have failed to provide for sustainable development in their day-to-day functioning operate in a less effective manner and more chaotically compared to local governments with a sustainability concept. The quality of the actions taken by the municipality or district decreases as well, along with the use of funds. For instance, one of the surveyed municipalities benefited from EU funding and began the implementation of CAF methodology, yet without completing the project and without feedback to the staff, which provoked numerous conflicts among the workforce.

An efficient process of sustainable development planning at a municipal level must be reflected primarily in two prerequisites:

- relevant strategic and planning provisions in the output materials, drawn up mandatorily or voluntarily by local authorities,
- planning of municipal and district spending on actions related to sustainable development, including environmental management issues [35].

If the prerequisites are complied with, there are foundations for the implementation of the principles of sustainable development, and efficiency can be evaluated by properly selected sustainable development indices in the following areas: socio-economic, environmental, spatial and areas related to institutional and political governance. Social consultations with the inhabitants and businesses on the perception of the level of development of a specific unit might be added to the aforesaid evaluation.

Sustainable development is also fostered by EU authorities and Poland's government. This can be seen in strategic documents such as Long-term National Development Strategy or National Spatial Development Concept. Compliance with the principles of sustainable development means seeking harmonious development in three fundamental areas: economic, social and environmental, which is a direct reference to the smart city concept.

It must be underlined though that the proposals largely remain in the sphere of wishful thinking in Poland and are far from being put into practice. What is more, there are no coherent tools or best practices for the implementation of the aforementioned proposals already at the level of local government units.

In this context, the following steps are, among other things, attempts of the municipalities which adhere to the principle of subsidiarity and socialization to create the tools for the implementation of the sustainable development policy:

- formulation of the development strategy,
- spatial development planning,
- issuing location decisions and permits to use natural resources and make changes in the environment.

These tools might constitute the basic element for the reconciliation of economic processes and infrastructure for these processes if they were worked out together with the inhabitants and next subjected to an in-depth analysis. Practically, social consultations are held primarily in the process of strategy development.

Fundamental duties of local governments include providing education and health care in their territories. Owing to their assigned functions, local governments are capable of reconciling the social and environmental dimensions with the local economic and infrastructural policy, and thus contribute to the creation of smart cities. Nevertheless, their activity associated with building a smart city, in which the city dwellers' level of living reaches an optimal score, hinges upon adequately formulated and implemented reforms on a national scale.

Although they will incur high social and financial cost, reforms of local governments are a prerequisite for further economic development of specific regions and the entire country. First of all, they ought to be preceded by a comprehensive analysis in order to develop a coherent and long-term action plan, which will enable

the local governments to function independently and liaise with the local community in a manner based on mutual confidence.

The surveys conducted by the author pave the way for further research into the subject matter related to the local government strategy and the functioning of the local government units in the context of sustainable development. Local governments require well-prepared reforms. In order to prepare them properly, current difficulties should be faced in various areas of functioning of local governments:

- non-existent development strategies—not every unit has the aforementioned strategic document in place. The strategies that are available frequently fail to capture the actual needs of the local government unit and are used as a tool to apply for EU grants;
- inadequate experience of the management in the area of running development projects;
- insufficient information sharing and cooperation between local governments in spite of the existence of benchmarking platforms;
- no data exchange or standardized ICT systems (in spite of the attempts of the Ministry of Administration and Digitization to launch the ePUAP platform) and the resulting inability to make a reliable evaluation of the effectiveness of development and self-control actions.

The aforementioned issues are likely to curb the socio-economic development of the local government and have a negative impact on the quality of life of the inhabitants of a municipality or district, thus thwarting the implementation of the sustainable development policy.

Explorative research provides a basis for posing questions that can be answered by further, in-depth analyses:

- how can local governments participate in creating the central strategy and at the same time regard their participation as an obligation to implement the strategy;
- how to involve the inhabitants in creating a sustainable strategy at the municipal level to shape civic attitudes and increase confidence in the institutions.

The analyses constitute a convenient point of departure for further studies in the area of local governments.

References

1. Caragliu A, Del Bo C, Nijkamp P (2011) Smart cities in Europe. http://dspace.ubvu.vu.nl/bitstream/handle/1871/15296/20090048.pdf?sequence=2. Accessed 19 March 2016
2. Borys T (ed) (1999) Wskaźniki ekorozwoju. Wydawnictwo Ekonomia i Środowisko, Białystok, p 64
3. Turner RK, Pearce D, Bateman I (1994) Environmental economics. an elementary introduction. Harvester Wheatsheaf, New York-London-Toronto-Sydney-Tokyo-Singapore

4. Berkowska E, Sobolewski M (1995) Realizacja polityki ekologicznej w kontekście postanowień Szczytu Ziemi w Rio. Biuro Studiów i Ekspertyz, Kancelaria Sejmu, Informacja nr 291:1
5. www.odpowiedzialnybiznes.pl/hasla-encyklopedii/agenda-21/. Accessed 10 July 2016
6. European Commission (1990) Green paper on the urban environment. Brussels-Luxembourg, Ref. CD-NA-12902-EN-C
7. Eurostat (1992) The statistical concept of the town in Europe. Luxembourg, CA-70-91-758-EN-C
8. Heczko-Hyłowa E (2010) Miasta potrzebne Europie, Europa potrzebna miastom. http://ec.europa.eu/polska/news/opinie/101210_miasta_pl.htm#8. Accessed 24 April 2016
9. Christou MD, Struckl M, Biermann T (2006) Land use planning guidelines in the context of article 12 of the Seveso II Directive 96/82/EC as amended by directive 105/2003/EC. Joint Research Centre, European Communities 10
10. The Toledo Declaration (2010) http://ec.europa.eu/regional_policy/archive/newsroom/pdf/201006_toledo_declaration_en.pdf
11. Heszen-Niejodek I (1996) Jakość życia w badaniach psychologicznych. Śląskie Studia Historyczno-Teologiczne 29, Katowice
12. Borys T (2001) Jakość życia jako kategoria badawcza i cel nadrzędny. In: Jak żyć, wybrane problemy jakości. Wachowiak A (ed). Humanior, Poznań, pp 17–41
13. Rabenda-Bajkowska L (1979) Jakość życia w koncepcjach teoretycznych i w badaniach. Stud Socjol 1979(3):135–149
14. Wnuk M et al (2013) Review of quality of life conceptions in social sciences. Hygeia Public Health, 48(1), Uniwersytet Medyczny im. Karola Marcinkowskiego w Poznaniu, p 11
15. Economist Intelligence Unit. http://www.eiu.com/home.aspx. Accessed 24 April 2016
16. UN; Euromonitor. http://www.un.org/, http://www.euromonitor.com/. Accessed 11 July 2016
17. World Values Survey. http://www.worldvaluessurvey.org/wvs.jsp. Accessed 24 June 2016
18. US Census Bureau. http://www.census.gov/. Accessed 11 July 2016
19. UNDP Human Development Report (2015) http://hdr.undp.org/en/2015-report. Accessed 07 May 2016
20. CIA World Factbook. https://www.cia.gov/library/publications/the-world-factbook/ Accessed 24 June 2016
21. GUS (2016)
22. Ustawa z dnia 8 marca 1990 roku o samorządzie gminnym (Dz. (Journal of Laws of 1990 No. 16, item 95 as amended) apply to all matters not governed by this Agreement
23. Ustawa z dnia 5 czerwca 1998 roku o samorządzie powiatowym (Dz. U. z 1998 r. Nr 91, poz. 578); Ustawa z dnia 5 czerwca 1998 roku o samorządzie województwa (Dz. (Journal of Laws of 1998 No. 91, item 576 as amended) apply to all matters not governed by this Agreement
24. Dutkiewicz G (2010) Dzieje samorządu terytorialnego w Polsce po II wojnie światowej. Akademia Marynarki Wojennej, Colloquium Wydziału Nauk Humanistycznych i Społecznych, Rocznik II/2010, pp 193–206
25. Niewiadomski Z, Siemiński S, Sosnowski P, Tetera M (2001) Samorząd terytorialny ustrój i gospodarka. Oficyna Wydawnicza BRANTA, Bydgoszcz—Warszawa: 35:60
26. Leoński Z (2008) Ustrój i zadania samorządu terytorialnego. In: Samorząd w Polsce. Istota, formy, zadania. Wydawnictwo Wyższej Szkoły Bankowej, Poznań, p 118
27. Art. 7, Dz.U. 2013 Poz. 594, Obwieszczenie Marszałka Sejmu Rzeczypospolitej Polskiej z dnia 11 marca 2013 r. w sprawie ogłoszenia jednolitego tekstu ustawy o samorządzie gminnym, Art. 4, Dz.U. 2013 poz. 595, Ustawa z dnia 5 czerwca 1998 r. o samorządzie powiatowym
28. Brdulak A (2014) Dobre praktyki w kontekście sposobu funkcjonowania firm z sektora małych i średnich przedsiębiorstw (MŚP) oraz jednostek administracji publicznej (JAP). Wrocławski Biuletyn Gospodarczy, Zarządzanie i Marketing, Polskie Towarzystwo Ekonomiczne, Wrocław, p 16
29. Brdulak A (2016) Rola samorządów w zrównoważonym rozwoju miast. In: Zrównoważone Miasta. Życie w zdrowej atmosferze. United Nations Global Compact

30. Brdulak H (2016) Zrównoważone miasta. Mapa drogowa do 2030 r. In: Zrównoważone Miasta. Życie w zdrowej atmosferze. United Nations Global Compact
31. Król M (2016) Silny samorząd to silne państwo. Gazeta Wyborcza 14.05.2016, p 23
32. Klimczuk A (2010) Rozwój zrównoważony a kapitał społeczny i metody jego budowania. In: Wyzwania Globalnego Rozwoju, published within the framework of the project Kujawsko-Pomorska Akademia Edukacji Globalnej, p 56
33. Wojciechowski E (ed) (2014) Samorząd Terytorialny wPolsce. Raport. Wydawnictwo Instytut Diagnoz i Analiz Społecznych, Łódź: 11:71
34. Szołtysek J, Brdulak H, Kauf S (2016) Miasta dla pieszych. Idea czy rzeczywistość. Texter
35. Giordano K (2005) Planowanie zrównoważonego rozwoju gminy w praktyce. Wydawnictwo KUL, Lublin

Quality of Life and Gender Equality: Some Conclusions from a Public Opinion Poll in Poland

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Abstract The objective of this chapter is to point out that gender equality positively influences the quality of life. The analysis is based on literature review as well as the results of the public opinion poll conducted in April–May 2015 in Poland. The Gender Equality Index designed for all EU Member States in 2010 and 2012 confirms the persistence of significant inequalities between women and men. With an index at the level of 43.0 in 2010 and 43.7 in 2012, Poland is among the countries which are a long distance from accomplishment of gender equality. Does it influence the quality of life of Polish women and men?

Keywords Gender equality · Poland · Quality of life

1 Introduction

The quality of human life is influenced by various factors: the people's individual decisions and choices, as well as the law, the state of institutions and effectiveness of the state policy targeted at creation of the conditions facilitating the best possible use of social resources potential. One of the significant elements of good quality of life is legal prohibition of discrimination followed by execution of this law and real care to ensure that all people are felt treated equally in both public and private space.

Gender Equality is one of the pillars of the European Union functioning. The principle of equal treatment is included in the Community treaties, directives, regulations and recommendations. It is also included in the mainstream of Community policy (gender mainstreaming). The European Institute of Gender Equality (EIGE), established in 2006, has worked out the aggregate Gender

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Equality Index in order to monitor the pursuit of gender equality in the Member States. The Gender Equality Index 2010 and 2012 confirms the persistence of significant inequalities between women and men in many countries. Poland is among the countries which are a long distance from accomplishment of gender equality.

The objective of this chapter is to point out that gender equality influences the quality of life. The analysis is based on literature review and results of a public opinion poll conducted in April–May 2015 in Poland.

2 Quality of Life—Definition and Literature Review

Quality of life is a subject of studies in numerous scientific disciplines, therefore there are many definitions of this concept. Some researchers, e.g. Dalkey and Rourke [10], claim that quality of life consists of a subjective feeling of satisfaction and the sense of happiness. Other authors argue that quality of life comprises the level of needs' satisfaction within areas such as marriage, family life, health, friends, household activities, paid work, life in a given country, place of residence, leisure, housing conditions, education, and standard of life [7]. The definition applied for the purpose of empirical studies in sociology and medicine states that the quality of life means the assessment of one's own situation of life, carried out in particular time and taking into account the accepted hierarchy of values or the difference between a person's real situation and the situation dreamt or expected by them [11]. In the approach of specialists representing social sciences and medicine the quality of life reflects the way and degree of satisfaction of various human needs, including also the way of perceiving the achieved standard of life [2, 35].

It may be said that while in sociology the quality of life refers to the way in which the social needs (safety, fulfillment, social acknowledgement) are satisfied, while in w psychology—it refers to the individual perception of the sense of life, happiness and well-being, then in economy the quality of life is measured as the result of the contentment and satisfaction the individual achieves as a consequence of the consumption of market goods and services, leisure, public goods and other characteristics (physical and social) of the environment in which the individual is located [18]. Therefore, in social science, needs (material and non-material) and ways of their satisfaction, as well as the subjective measure of a degree of the needs' satisfaction constitute an inherent element of defining the quality of life [22].

The studies on the quality of life extensively use the World Health Organization Quality of Life questionnaire compiled by experts from 15 centres in different countries carrying out the studies on the issue of quality of life [8]. The questionnaire was published in 1994 taking into the account the definition of quality of life developed by the International Health Organization (WHO) which was presented in 1993:

> Health-Related Quality of Life (HRQOL) refers to the individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad-ranging concept affected in a complex way by the individual's physical health, psychological state, level of independence, social relationships, and their relationships to salient features of their environment [37].

On the basis of this definition, Saxena and Orley [32] specified factors which constitute the individual's quality of life, indicating that they comprise: physical health, psychical state, degree of independence, relations with other people, as well as the environment where a particular person lives. Thus, the surveys on the quality of life consider physical, psychological, social and occupational context of individuals' life. Many definitions of this concept indicate its multidimensional and multidisciplinary character, they also indicate lack of consensus and the appliance of various questionnaires to surveys on the quality of life [31].

Over the last decade the conception of well-being has been gaining significance in the studies on the quality of life. According to Hämäläinen [20] the capability approach of Sen [33] and Nussbaum [30] is not sufficient yet:

> it capability approach] must be augmented with an analysis of the human decision-making problems, higher social and psychological needs, and changing nature of living environments in affluent societies [20, p. 24].

The theory of capability approach is also applied in developing countries where social inequalities and deprivation of needs are universal, thus the conclusion that more chances and possibilities of choice are conducive to better quality of life is justified. In highly developed countries we deal with excess of freedom and the "problem of choice". This problem, as Hämäläinen [20, p. 21] concluded, is omitted in the theory of capability approach. Maslowian needs [29] as well as Antonovsky's sense of coherence ('comprehensibility', 'manageability' and 'meaningfulness') [4, 5] are key determinants of subjective well-being according to Hämäläinen [20, p. 24]. He also wrote that:

> The behavior and choices of individuals are influenced by the environmental constraints and supports within which the everyday life takes place: natural environment, prevailing technologies, organizational arrangements, demographics, cultural values, norms and activities, law and regulations, public policies, economic situations, labour market practices and the media. These important aspects of living environments may either empower individuals and facilitate their needs' satisfaction, or constrain them and the satisfaction of their needs [20, p. 25].

The studies carried out in Norway in 2007 indicate that gender equality creates well-being of women as well as men [21, p. 167], i.e., it translates into the quality of life in the entire society. Gender-equal practices are important especially for the women's quality of life, which will be further addressed after presentation of the situation in Poland in respect to gender equality.

3 Gender equality *de jure* and *de facto* in Poland

3.1 Equality *de jure*

The legal guarantees of equal treatment as regards gender have not existed in Poland for a very long time. One of the first international documents ratified by the Polish government in 1980, was the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), adopted in 1979 by the UN General Assembly. The Convention obliges the states parties to take all appropriate measures, including legislation and controlling in order to prevent discrimination and guarantee in practice that women can enjoy all their human rights and fundamental freedoms on a par with men. In particular, the Convention provisions oblige governments to introduce the equality principle into national constitutions (in Poland such provision was included into the Constitution in 1997 [15, p. 14]), and to implement regulations prohibiting discrimination in employment (as regards access to employment and occupations, access to training and promotions, or in the area of remuneration) and adopting respectively stringent sanctions for breaking the respective law [26, 41]. The Convention also obliges to revoke all regulations discriminating women and eliminate superstitions, habits and practices of discriminating character, particularly in respect to stereotypical presentation of female and male roles in school books; it also imposes an obligation to combat any forms of trafficking in women. It is worth underlining that for the first time the Convention indicated that execution of the temporary, interim special measures (called positive actions) targeted at compensation of the damage caused by the hitherto (worse) situation of women and equalisation of their chances, acceleration of implementing the actual equality, as well as introduction of particular provisions protecting maternity.

Prohibition of gender-related discrimination is one of the pillars of the Community law and social policy of the European Union. Already, the Treaty of Rome of 1958 included Article 119 adopting the principle of equal pay for women and men for equal work. The Maastricht Treaty of 1993 only indirectly refers to equality through the statement that European Union is based on democracy and respect of human rights and fundamental freedoms. The Treaty of Amsterdam of 1997 adopts not only the principle of equal pay for equal work, but also for work of the same value. In addition, the Article 141 of the Treaty of Amsterdam points out combating gender discrimination in the labour market as one of the priorities of the European Union. It also comprises extension of a narrow provision included in the Article 119 of the Treaty of Rome, which was limited to equal pay [36, p. 20]. A significant element of the Article 141 of the Treaty of Amsterdamistier 4, which introduces the possibility for the equalising actions compensating the situation of the members of gender represented to a lesser extent or facing particular hindrances in professional career, which is to serve the purpose of accelerating the process of implementation of the full equality in the labour market.

More detailed provisions and guidelines regarding the direction of actions may be found in the European Union secondary law: regulations, directives, recommendations and decisions [26].

The process of the Poland's accession to the European Union introduced antidiscrimination law into the Labour Code, which correspond with the Community requirements for prohibition on discrimination in employment. The Polish Labour Code included the definition of direct and indirect discrimination, definition of remuneration and the same work or work of equal value, as well as the definition of sexual harassment treated as discrimination against women. An employer has the liability for the evidence in cases of discrimination related complaints. There are sanctions for violating the principle of equal treatment and employees who make complaint against the employed on the basis of discrimination are protected. One of the significant obligations of the employer is informing employees about the principle of equal treatment of women and men in the workplace, e.g. by the provision in the internal work regulations and its publication in the Intranet or/and organization of the appropriate training for the staff. There is also article which stipulates that the employer may request from a candidate seeking employment only submission of personal data including: name and surname, parents' names, date of birth, place of residence, education, and history of the previous employment. The list does not include questions such as marital status, the number of children, or procreative plans—this is the information that the employer cannot demand at any state of recruitment.

Therefore, the Polish legal system consists of provisions prohibiting discrimination and facilitating respecting equal treatment of women and men in each domain of social life. Anti-discrimination law is contained in both the Labour Code and the Constitution of 1997 which includes provisions on equality of both sexes in respect to law, equal treatment by public authorities and prohibition of discrimination (Article 33), including discrimination in the labour market (Journal of Laws 1997, No. 78, item 483). Furthermore, the Act on implementation of some European Union regulations regarding equal treatment of 3 December 2010 has been in force since January 2011 (Journal of Laws No. 254, item 1700), called equality act. Its provisions define in detail the concept of equal treatment and its scope. It also indicates institutions responsible for implementation of provisions of the Act and monitoring of developments in this area. These institutions are the Commissioner for Human Rights and the Government Plenipotentiary for Equal Treatment.

3.2 Equality *de facto*

Numerous studies and analyses on the situation of women and men in the labour market and in the Polish society indicate that the principle of gender equality is applied selectively by both: private employers [16, 17] as well as state institutions [24].

The most often observed in practice cases of breaking the equal treatment principle in the labour market are: refusal to employ a women because of her pregnancy, dissolving employment contract because of a woman's reaching retirement age earlier than retirement age for men, lower remuneration of women than men even when they perform the same work or work of equal value, decreasing working hours (e.g. to half-time) of women bringing up small children with the simultaneous entitlement to particular rights, allowances or bonuses only of the full-time workers, asking women during job interviews questions regarding their marital status, procreative plans or the number and age of their children [19, pp. 45–64].

The scope of occupations traditionally associated with men exceeds by many times the number of those traditionally associated with women, therefore finding employment is more difficult for women, particularly if they fall into unemployment. If a woman loses her job or leaves the labour market because of childcare, her re-entry into the labour market is more difficult because of small children. According to Mandal [28, p. 15] being a member of female gender is a factor significantly limiting chances for leaving unemployment, while problems of women in the labour market have their source in traditional perception of family roles and negative stereotypes regarding women's economic activity.

The surveys carried out in enterprises [13] indicate that even if the job adverts do not indicate directly a gender of sought for candidates, then the male sex is preferred indirectly. In job offers masculine forms are dominant. The names of occupations usually have the masculine form with the exception of those traditionally associated with women (secretary, bookkeeper). Almost all job adverts indicate availability, which is associated with men, thus including such requirements in advert indirectly indicates male sex. Questions concerning the sphere of personal and private life are asked during job interviews. They are questions about the number of children, plans regarding having a child, and who will look after children in case of employment. All these questions are either addressed exclusively to women or to women significantly more often than to men. Such conclusion may be drawn from the surveys carried out in 2006 and 2007 in enterprises [13, 14], as well as from the survey conducted in government administration in 2012 [17].

There is occupational gender-related segregation in the labour market, i.e. division into female and male occupations and branches, and positions respective to a particular sex. One of the significant reasons for gender-related occupational segregation was the fact that for centuries performing some occupations was legally prohibited to women (there was no such restriction in case of men). Therefore, the belief that women and men are predestined to perform different work was consolidated in the social awareness. Gradually, the lists of occupations forbidden to women were revoked in particular countries. In Poland even until 1996 in force was regulation which forbade women to take up over ninety occupations, among which were, *inter alia*, a bus or truck driver, soldier, diver or miner (Journal of Laws 1979, No. 4, item 18; Journal of Laws 1984, No. 44, item 235). The regulation was revised in 1996 towards liberalisation of the limited access to occupations, albeit the list of jobs forbidden to women remained (Journal of Laws 1996, No. 114, item 545). The next revision of the regulation changed the title into "the list of jobs

particularly strenuous or harmful for health of women" (Journal of Laws of 10 August 2002). The regulation concludes that they are jobs connected with great physical effort or work underground. Liquidation of the list of occupations forbidden to women initiated their taking up jobs as bus drives, in police or security.

Polish national statistical data show lower rates of economic activity and employment, and higher rates of unemployment among women [1], their lower remuneration at the same or similar positions [25, 27], low representation of women on managerial positions, among entrepreneurs, in the parliament and government [26].

Such activities as positive actions—promoting women in the areas of employment where gender-related disproportions are most obvious—are met with opposition of the ruling elites. Supporting actions targeted at correcting inequalities, i.e. quotas and parities, reflects willingness to implement actual equality. Nevertheless, the positive actions hitherto have been a solution recommended by the European Union, and not obligatory, which causes different approaches of the governments in particular Member States to the issue of ensuring actual equality [6, p. 127]. Some countries such as Belgium, France, Italy have recently implemented (following Norway which introduced quotas in 2003) the legislature concerning quotas in business and stipulating sanctions for enterprises not complying with this law. Other countries—the Netherlands, Spain, Germany—have legislature in respect to quotas based on soft principles, i.e. without sanctions, while Denmark, Finland, Greece, Austria and Slovenia introduced a general provision to the equality law regarding pursuing the objective of balanced boards and supervisory boards in state enterprises [38, p. 13]. In Poland, the government did not take any formal steps in order to introduce quotas into business, only the Supervisory Board of the Stock Market adopted in 2010 the resolution which recommended ensuring balanced share of women and men inboards and supervisory boards (Resolution No. 17/1249/2010 of the Supervisory Board of the Warsaw Stock Exchange), which was in 2011 replaced by obligation of stock market companies to annual publication on their websites of the information about the number of women and men on the board and supervisory board for the last 2 years (Resolution No. 20/1287/2011 of the Supervisory Board of the Warsaw Stock Exchange).

The exemplification of the actual situation in respect to gender equality is Poland's low position in Gender Equality Index and Gender Gap Index rankings.

3.3 Gender Indexes for Poland

Gender Equality Index measures gender gaps within such domains as work, money, knowledge, time, power, and health across Member States of the EU. It is formed by combining the gender indicators of each domain into a synthesized measure [12, pp. 7–12]. It was launched in June 2013 and is updated every 2 years. Gender Gap Index was introduced in 2006 by the World Economic Forum [39] to point out gender disparities around the world. Its final value lies between zero and one, while

the Gender Equality Index between 1 and 100, where the lowest value in both stands for inequality and the highest for equality.

Despite different conceptual and analytical approaches the two indexes provide similar results and both are very useful and powerful measures of gender equality. However the scores of the Gender Gap Index are narrower than the Gender Equality Index [12, p. 113]. It does mean that the latter provides more information as to how the EU Member States vary in terms of achieving gender equality (see the comparison presented in Table 1). Gender Gap Index predominantly deals with the situation of women, by measuring the extent to which they have attained parity with men [12, p. 107].

Poland with Gender Equality Index at the level of 43.0 in 2010 and 43.7 in 2012 is placed below the average for the EU-28 (52.4 in 2010 and 52.9 in 2012). The top position in the ranking are held by the countries such as Sweden, Finland and Denmark where the Gender Equality Index achieves the level of 70–74 [12, p. 75]. In all European Union countries the relatively worst situation is observed in domains Time and Power, while a relatively best one in domains Health and Money.

Table 1 Gender Equality Index and the Gender Gap Index [12]

Characteristics	Gender Equality Index	Gender Gap Index
Institution	European Institute for Gender Equality	World Economic Forum
Purpose	Development of a tool that allows for the monitoring of EU policy effectiveness	Raising awareness of how gender gaps create challenges and opportunities among business professionals, decision-and policymakers as well as academics
Publication year	2015	2014
Years of data coverage	2012 with the exception of EWCS and SES data which refer to 2010	2009–2014
Country coverage	28 EU Member States	115 originally 142 by 2014
Theoretical approach	Equality between women and men	Women's parity with men
Domains	Six core domains: Work Money Knowledge Time Power Health Two satellite domains so far: Violence Intersecting inequalities	Four domains: Political empowerment Economic participation and opportunity Educational attainment Health and survival
Indicators	26	14

In the Gender Gap Index 2015 ranking, Poland holds the 51st position per 145 countries included in the analysis and obtains the index of 0.715, i.e. Poland closed 70% of the gender gap (the last country in the ranking—Yemen—has index of 0.484). The relatively worst situation is observed in the areas: political empowerment (subindex at the level of 0.213) and economic participation/opportunities (subindex at the level of 0.667), while the relatively best one is observed in educational attainment (fully closed the gap) and health (almost fully closed the gap) [39]. The highest position in the Gender Gap Index ranking occupy such the countries as Iceland, Norway, Finland, Sweden, Ireland (each of them closed more than 80% of the gender gap). In the field of political empowerment, only Iceland and Finland have closed more than 60% of the gender gap.

4 How Does Gender Equality Influence Quality of Life?

Among the objective determinants of quality of life there is usually Gross Domestic Product (GDP). It has been highly criticised as being an imperfect measure [34], but there are no widely accepted alternatives to capture the economic performance of a state or a group of countries overall. Some researchers stated that the Gender Equality Index positively correlates with GDP per capita [12 pp. 99–100]. It does mean that the countries with higher gender equality characterise higher economic development.

The surveys on quality of life takes into the account both: objective determinants, as well as subjective feelings of people. Objective determinants—beside the above-mentioned GDP—comprise the state of law and institutions which guard observance of law, the condition of infrastructure and access to crèches, kindergartens, schools, health care, as well as the condition of natural environment. Beside these determinants, there are also important the citizens' feelings and their perception of their own life, the degree of needs' satisfaction and their place in the society. In other words—subjective factors are important in assessing the quality of life [40]. In particular, the important issue is whether people, regardless of their sex, age and other socio-demographic characteristics have the sense of equal treatment and equal access to various type of benefits and institution.

In the years 2013–2016, a pioneer project concerning the impact of gender equality on the quality of life in both countries was carried out in Poland and Norway (www.geq.socjologia.uj.edu.pl). In 2015, a poll survey was conducted in Poland within the framework of the project (the survey has the sample of 1501 men and women. The response rate was 64%), which was targeted at obtaining opinions regarding gender equality and roles played by women and men in family, as well as the data on distribution of household and childcare responsibilities, participation of the respondents in economic activity, public and social life [9]. The data were necessary for the achievement of the survey goal which was finding how gender equality influences the quality of life. Quality of life was analysed with the use of the questionnaire Gender Equality Study Quality of Life Scale developed for the

project. The questionnaire was based on the WHOQOL-BREF questionnaire which was developed by the World Health Organization for the survey on quality of life in its various aspects: somatic, psychological, social, financial, infrastructural and general feeling of life satisfaction.

The poll survey results showed that gender equality is considered as the important value for the prevailing majority of women and men in Poland. Women more often than men declared the answers 'definitely important' (41% vs. 28%) while men the answer 'rather important' (49% vs. 42%). Also, the majority of the respondents agreed with the statement that gender equality is an indicator of the fair society (and again, women more often say that it is 'definitely important': 30% vs. 21%).

The obtained data indicate that gender equality was usually understood as equal chances for finding a job and professional career, as well as equal pay, equal treatment by law, partnership and equal division of responsibilities in marriage [9]. In opinion of both women and men, in practice there are observed cases of unequal treatment mainly in respect to division of responsibilities and in the workplace. Women over twice as often as men indicated experiences with discrimination in the workplace—18% women and 7% men or during job search—26% women and 10% men [9]. Whereas, paid work ensures the sense of life stability more often in case of women than men.

The survey results indicate also that in the families with partnership relations violence against children as well as women was observed less often. At the same time, the experience of violence during childhood facilitates violence in adult life and one's own relationship, which, in consequence, negatively influences the quality of life. It concerns women to a greater extent than men:

> Experiencing some forms of violence in childhood did not influence men's quality of life, while in case of women any form of violence decreased their quality of their life [9, p. 29].

Therefore, the results of surveys in Poland confirm the conclusions drawn from the surveys carried out in Norway [21]. As regards violence against women, higher "sensitivity" concerning this phenomenon may be observed in the European Union countries with higher Gender Equality Index and there are institutional mechanisms for tracing the cases of violence and allowing their easy reporting to the police:

> The higher the percentage of the population finding that domestic violence is acceptable in all or in certain circumstances; the lower the level of gender equality in a Member State [12, p. 134]

There is also relations between such phenomena as trust in the police and in the court sand violence against women. As Zmerli and Newton [42, p. 70] stated:

> trust in the police and in the courts is closely correlated with general social trust, probably because the law enforcement system is the social institution that is mainly responsible for maintaining the trustworthy behaviour of the population.

In turn, social trust is the highest in the Northern Europe countries (Finland, Norway, Sweden), which also characterize the highest Gender Equality Index [3].

5 Conclusions

Gender equality is a significant element of a good quality of life for both women and men. The studies conducted so far (even if not in great numbers) to establish the impact of gender equality on quality of life demonstrate that in the countries (mainly in Scandinavia) where gender equality is respected in, both, its *de jure* and *de facto* dimensions people have higher assessments of the quality of their life.

A pioneer project concerning the impact of gender equality on quality of life was carried out in Poland by the Jagiellonian University in cooperation with the University of Oslo in the years 2013–2016. The results of the surveys carried out within the framework of this project confirm that women evidently more often than men indicate their worse treatment in the workplace and in respect to division of household responsibilities, including the ones connected with childcare. So far, a workplace free from discrimination still remains an idea to be achieved, but the implementation of this idea is being done very slowly. The slow pace is caused by the fact that central and local government policies in respect to implementation and execution of the equal treatment principle are ineffective. None of major Polish cities have no the city human rights policy such as e.g. Reykjavik (http://reykjavik.is/en/city-of-reykjaviks-human-rights-policy). When answering the question who should be involved in the fight for gender equality, over a half of the Polish society answer that each person individually, while the state task should be only introduction of the law which guarantees gender equality and promotion of gender equality by media. Only one fifth of the respondents indicated the employers as those who should be engaged in actions promoting gender equality. Social awareness regarding the meaning of equal treatment, in particular awareness of sexual harassment at work and domestic violence against women is still very low in Poland. Because of this women rarely report cases of sexual harassment and domestic violence in their own relationships, much less often than women in the Scandinavian countries.

Women slightly more often than men poorly assess quality of their life, they also more often than men declare that they are stressed out. It is mainly caused by their worse treatment in the workplace and lack of actions which would include fathers in childcare. In Poland, a father is entitled to only two week's leave after the birth of a child, while, e.g. in Norway—10 weeks [23]. While the model of family with a double breadwinner (both spouses work) is dominant, then partnership in family is still not popular—women maintain paid work and perform most households and family chores. It is visible that Polish women are more gender sensitization than men.

Respecting the law regarding gender equality by private and public employers, easy access to institutional forms of child care at the place of residence and architectonic facilities in the urban space for mothers with prams or nursing mothers, as well as actions targeted at wider involvement off adhering parental care, and preventing domestic violence against children and women by public institutions (the government and local authorities) constitute elementary requirements for

improvement in quality of life of the society. Following the establishment of the fact of a positive relation between gender equality and the quality of life [21 p. 261], the surveys on the quality of life should include the scope or degree of implementation of the principle of equal treatment in respect to gender.

References

1. Aktywność ekonomiczna ludności Polski (2015) Główny Urząd Statystyczny, Warszawa
2. Albrecht GL, Fitzpatrick RA (1994) A social perspective on health related quality of life research. In: Albrecht GL, Fitzpatrick R (eds) Advances in medical sociology, quality of life in health care, vol 5, Jai Press. Greenwich CT.UK, London, pp 1–21
3. Alesina A, Ferrara E La (2002) Who trusts others?. J Public Econ 85:207–234
4. Antonovsky A (1993) The structure and properties of the sense of coherence scale. Soc Sci Med 36(6):725–733
5. Antonovsky A (1987) Unraveling the mystery of health: how people manage stress and stay well. Jossey Bass Social and Behavioral Science Series, San Francisco, CA, US
6. Boruta I (1996) Równość kobiet i mężczyzn w pracy w świetle prawa wspólnoty europejskiej. Implikacje dla Polski. Wydawnictwo Uniwersytetu Łódzkiego, Łódź
7. Campbell A et al (1976) The quality of American Life: perception, evaluation, and satisfaction. Rasel Sage Foundation, New York
8. Carr A et al (2003) Quality of life, vol 13. BMJ Books
9. Ciaputa E (eds) (2016) Równość płci i jakość życia. Raport z badań sondażowych. Uniwersytet Jagielloński, Kraków
10. Dalkey NC, DL Rourke (1972) The Delphi procedure and rating quality of life factors. University of California, LA
11. De Walden-Gałuszko K (1993) Wykorzystywanie badania jakości życia w psychiatrii. In: Pamiętnik VII Gdańskich Dni Leczenia Psychiatrycznego. Gdańsk
12. EIGE (2015) Gender equality index 2015—measuring gender equality in the European Union 2005–2012. European Institute for Gender Equality. Publications Office of the European Union, Luxembourg
13. Fuszara M (2007) Równe traktowanie w procesie rekrutacji. In: Lisowska E (eds) Monitorowanie równości kobiet i mężczyzn w miejscu pracy. EQUAL, UNDP, Gender Index, Warszawa
14. Fuszara M (2012) Równe traktowanie w procesie rekrutacji pracowników. In: Lisowska E (eds) Polityka różnorodności w administracji centralnej. Warsaw School of Economics, Warszawa
15. Fuszara M, Zielińska E (1994) Progi i bariery, czyli o potrzebie ustawy o równym statusie kobiet i mężczyzn. In: dawne i nowe role. Biuletyn Centrum Europejskiego Uniwersytetu Warszawskiego i Ośrodka Informacji i Dokumentacji Rady Europy.No 1. Warszawa, Kobiety
16. Gender Index (2007) Monitorowanie równości kobiet i mężczyzn w miejscu pracy. In: Lisowska E (eds): EQUAL, UNDP, Warszawa
17. Gender Index (2008) Firma równych szans 2007 (II edycja konkursu). Raport z badań. In: Lisowska E (eds) EQUAL. Polska Konfederacja Pracodawców Prywatnych Lewiatan, Warszawa
18. Gillingham R, Reece WS (1980) Analytical problems in the measurement of the quality of life. Soc Indic Res 7(1):92:91–101
19. Gonera K (2009) Analiza przepisów antydyskryminacyjnych i orzecznictwa sądów polskich w zakresie równego traktowania w zatrudnieniu. In: Równe traktowanie w zatrudnieniu. Przepisy a rzeczywistość. Raport z monitoringu ogłoszeń o pracę. Polskie Towarzystwo Prawa Antydyskryminacyjnego, Warszawa

20. Hämäläinen TI (2014) In search of coherence: sketching a theory of sustainable well-being. In: Hämäläinen TI, Michaelson J (eds) Well-being and Beyond. Broadening the Public and Policy Discourse. Edward Elgar. Cheltenham, UK
21. Holter ØG et al (2009) Gender equality and quality of life. A Norwegian Perspective. The Nordic Gender Institute. University of Oslo, Oslo
22. Jankowska E (2011) Pojęcie i narzędzia pomiaru jakości życia. Toruńskie Studia Międzynarodowe 1(4):33–39
23. Korsvik TR, Warat M (2016) Framing leave for fathers in norway and Poland: Just a Matter of Gender Equality? Nord J Feminist Gend Res 24(2):110–125
24. Lisowska E (eds) (2012) Polityka różnorodności w administracji centralnej. Warsaw School of Economics, Warszawa
25. Lisowska E (2015) Remunerations and gender: The Case of the Polish Government Administration. Univ J Manage 3(3):131–141
26. Lisowska E (2010) Równouprawnienie kobiet i mężczyzn w społeczeństwie. Warsaw School of Economics, Warszawa
27. Lisowska E (2012) Wynagrodzenia a płeć. In: Lisowska E (eds) Polityka różnorodności w administracji centralnej. Warsaw School of Economics, Warszawa
28. Mandal E (2004) Stereotypowe postrzeganie ról kobiet i mężczyzn jako wyznacznik karier zawodowych i funkcjonowania na rynku pracy. In: Płeć a możliwości ekonomiczne w Polsce: czy kobiety straciły na transformacji? World Bank, Warszawa
29. Maslow AH (1943) A Theory of Human Motivation. Psychological Review, 50, 370–396
30. Nussbaum MC (2000) Women and human development: The Capabilities Approach. Cambridge University Press
31. Papuć E (2011) Jakość życia—definicje i sposoby jej ujmowania. Curr Probl Psychiatry 12 (2):141–145
32. Saxena S, J Orley (1997) Quality of life assessment. The World Health Organization perspective. Eur Psychiatry 12(supp. 3):263–266
33. Sen A (1993) Capability and well-being. In: Nussbuam M, Sen A (eds) The quality of life. Clarendon Press, Oxford
34. Stiglitz JE et al (2009) Report by the Commission on the measurement of economic performance and social progress. Paris(http://www.stiglitz-sen- fitoussi.fr/documents/rapport_anglais.pdf)
35. Tobiasz-Adamczyk B (1996) Jakość życia w naukach społecznych i medycynie. Sztuka Leczenia 2:33–40
36. Wandzel M (2003) Równe traktowanie mężczyzn i kobiet. Wydawnictwo Universitas, Kraków
37. WHO (1993) Report of WHOQOL Focus Group Work. World Health Organization, Geneva
38. Women in economic decision-making in the EU: progress report. A Europe 2020 initiative. European Commission, Luxembourg
39. World Economic Forum (2014) The global gender gap index 2014. world economic forum, Geneva(http://reports.weforum.org/global-gender-gap- report-2014/part-1/)
40. Woźniak B, Tobiasz-Adamczyk B (2014) Quality of life and well-being. Jagiellonian University, Krakow
41. Zielińska E (1998) Kilka uwag o konwencji w sprawie eliminacji wszelkich form dyskryminacji kobiet oraz Deklaracji o eliminacji przemocy wobec kobiet. Wydawnictwo Ośrodka Informacji Środowisk Kobiecych, Warszawa
42. Zmerli S, Newton K (2013) Winners, losers and three types of trust. In: Zmerli S, M Hooghe (eds) Why context matters, pp 67–94, UK: ECPR Press. Clochester, Political trust

The Analysis of Quality of Life—The Case of Warsaw

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Abstract There are many ways to measure quality of life, but analysts do not agree on what criteria should be used so that the result was the maximum objective. These analyzes are conducted by a number of research centers, scientific agencies, magazines, credit rating agencies, etc. Comparison of quality of life in polish cities (Polityka 2014) shows that the position in rankings is not directly related to its size or generalized prosperity measured by GDP per capita. The reference to the *Theory of needs* L. Doyal and I. Gough suggests that the best city life quality provides the activity to meet the needs in the area of material security combined with a high level of autonomy. A special case is Warsaw, where the autonomy of the actors of urban life is the result of structural complexity of metropolitan growth. In the article the authors will analyze the value describing the quality of life in metropolitan center considering the example of Warsaw.

Keywords Quality of life · Culture · Local development · Ways of measures of life satisfaction

1 Introduction

There are many ways to measure quality of life, but analysts do not agree on what criteria should be used to make the result the most objective. These analyses are conducted by a number of research centers, scientific agencies, magazines, credit rating agencies, etc. Many wrote about the quality of life, among others: Castells 1994 [2], Gorzelak 2007 [5], Sassen 2002 [14], Jacobs 1995 [9], Karwińska 2007 [11],

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PricewaterhouseCoopers reports 2007 and 2015, and Polityka 2014. The comparison of the quality of life in Polish cities [21] shows that the position in a sheet is not directly related to a city's size or to generalized prosperity measured by GDP per capita.

The reference to the theory of human needs by L. Doyal and I. Gough suggests, that the best quality of life is offered by cities meeting high financial security needs, combined with a high level of autonomy. A special case is Warsaw, where the autonomy of the actors of urban life is the result of a structural complexity of metropolitan growth. In this article we analyse values describing the quality of life in metropolitan areas, taking into account the example of Warsaw.

The aim of this article is first to show different perspectives of the concept of quality of life, and to indicate the most adequate one in the context of the functioning of modern metropolises of the 21st century. The specific objective is to analyse the quality of life of Warsaw inhabitants, according to the adopted methodology of understanding the quality of life (however, it would be hard to recommend any of these methods as the only, fully adequate one).

2 Quality of Life in the Literature

The quality of life in cities throughout history was contemplated by philosophers, sociologists, psychologists, economists, architects, urban developers, as well as local governments, businesses and many other social groups. Each of these social communities was characterized by a subjective look at the issue of quality of life, similarly as at the factors and conditions affecting the quality of life. One of the key perceptions of the issues of quality of life refers to the level of wages and job security of the inhabitants [6]. Job certainty in this respect is understood as an opportunity to get a job not worse than the one had and lost. Therefore, it relates not only to competences owned, but also to the "capacity" of the local job market. The main measures of quality of life—with such pragmatic, material terms of quality of life—are: the supply of jobs, the degree of sectoral diversification of businesses, the level of wages, the number of companies providing services or belonging to modern industries; absorbency of markets and patency of communication connections which provide the ability to distribute manufactured goods and capital; access to knowledge which drives companies' competitiveness, as well as the extent, nature and intensity of external connections of a city.

During the 1970s A. Luszniewicz [12, p. 36] defined the quality of life as: "… the degree of satisfaction of material and cultural needs of a society by a stream of goods and paid services and the collective consumption fund in a given unit of time and space". He singled out seven basic types of needs, including food, housing, health, education, recreation, social security and material development [7]. On the other hand, according to Z. Żekoński [8], the standard of living means all the conditions in which a society, a socio—occupational group, household, or

individual lives, expressed primarily in the amenities for the process to meet individual and collective needs, that is in conditions where a consumerist behaviour occurs, in ecological conditions, conditions of work, conditions of free time and ways to use it, in some aspects of the organization of social life (e.g. personal safety).

In the 1970s scientists realized that the quality of life is more than the financial situation of a city or a country. Not only factors such as having housing, access to basic services, parks and recreation space, but also the perception of people turned out to be affecting the assessment of quality of life. The results of research conducted at that time showed that quality of life is a characteristic that differs from each city, region or country. Since 1970 local governments at various levels in North America and Europe have implemented a series of studies to measure quality of life and identify its determinants. In Canada, at a national level, a special network called the Canadian Policy Research Network's (CPRN) Quality of Life Indicators determined the directions to improve the quality of life. At the municipal level, in turn, an institution called the Federation of Canadian Municipalities Quality of Life Project dealt with collecting data on the quality of life in cities, taking into account issues such as health, housing, environment, infrastructure and income. These studies were carried out in order to "allow a balanced discussion on the public priorities in terms of social, economic and environmental dimensions of quality of life". There appeared the two main issues on quality of life: What should be measured? How to measure it best? [9].

C. Bywalec and S. Wydymus [1] assumed that the standard of living is the degree of meeting the needs of a population, resulting from the consumption of man-made material goods and services and the use of environmental and social values [10]. According to the expert committee of the United Nations from 1954, the standard of living includes all the actual conditions of human life and a level of material and cultural satisfaction of their needs through the stream of goods and paid services, as well as the ones from social funds [10].

Quality of life is defined as well-being (a subjective category), welfare (an objective category), life satisfaction, or—in a broad sense—health. The meaning and sense of quality of life are treated as a result of one's own thoughts, attitudes to life, and the impact of social life (environment). The quality of life, apart from ownership status (wealth, house, high standard of living), is increasingly determined by intangibles, such as happiness, freedom, health, education, family, social contacts, and professional work. Quality of life can be seen in the context of three approaches [11]: (i) normative—as a set of objective conditions of human life, attributes of life territory, environment, health, attributes of material and socio-cultural world; (ii) processual—as cognitive-emotional evaluation of each objective dimension of life (favourable, unfavourable) and subjective evaluation of these conditions by a person (positive, negative); four types of quality of life are distinguished: reasonable satisfaction, dissatisfaction dilemma, paradox of satisfaction, justifiable discontent; (iii) interactive—where it is assumed that there are certain objective areas of life which are essential for almost all people, and areas important only for individuals, and that there is a connection (interaction) of these

objective conditions of the individual aspects that are specific only to some individuals; the relationship is subject to a subjective assessment by individuals, and its importance stems from an individual approach. Reflections on quality of life can also be based on a multi-sectoral concept of the welfare state, according to which the quality of life of individuals and social groups is determined by their location in a modified "welfare triangle", designated by [12]: a competitive market, based on an ability to pay and a freedom of choice; the public sector (state and its agencies), where the criterion of access to goods is constituted by the rights guaranteed by law, equality and security; and the community (organized in households and, both, formal and informal civil society organizations), which is dominated by co-optation (assignment), elicitation and personal participation, personal responsibility, reciprocity, appreciation, respect, solidarity, and even altruism.

It is also worth mentioning that in studies on quality of life two models are sometimes indicated [13]: hedonistic, which distinguishes between the emotional balance of experience and cognitive dimension of a mental well-being, including the evaluative assessment of their own past, present and future lives; and eudaimonistic, according to which the highest value and goal of the demeanour is personal or social happiness; whereas happiness itself, according to the "onion theory of happiness", is understood as a theoretical construct made of three layers: the will to live, a positive attitude towards life as a whole and the partial satisfactions e.g. the satisfaction of the conditions of life and social relations [13].

From the point of view of indicators describing the quality of a society's life, its development potential, the direction of change and threats and challenges, one can distinguish two complementary methods of analysis. One is based on objective macroeconomic indicators, for example GDP, unemployment rate, the number of doctors per 100 thousand inhabitants, infant mortality, education or voter turnout [15]. The second way refers to the opinions and behaviour of citizens. In this description, the quality of life can be determined from a set of criteria adopted by the investigator referring to emotions and behaviours of people. According to these criteria, the quality of life depends on a subjective assessment of the degree of satisfaction of certain expectations regarding such things as: marriage and family life, health, neighbourhood [26, p. 125] satisfaction with work and life in the place of residence. Complementarity of these methods arises from the fact that none of them is fully accurate, reliable and sufficient. The fact that people become more affluent while GDP grows does not necessarily mean that they are therefore more satisfied or inclined to civic behaviours [13].

In economics textbooks quality of life is sometimes identified with social well-being. This happens when an author is looking for an aggregate measure of the quality of life [14]. Constructing such a tool of measurement is virtually—and, one may venture to say, also theoretically—impossible or nearly impossible. Therefore, a simplifying assumption is adopted, which reduces the quality of life to one dimension, namely economic welfare. This limited concept is not a quality of life but only one of its aspects, welfare. Net Economic Welfare (NEW) is a modified concept of Gross National Product (GNP), which takes into account non-market

goods and losses by adding certain items, such as household chores, leisure, etc., subtracting certain disregarded usual cost (or "demerit goods"), such as pollution, noise, littering, which occur during the formation of GNP, to exclude certain indirect services such as police and fire protection. NEW, of course, like GNP is unable to measure the human costs such as mental and physical stress, security, economic activity, monotony, stress and risk, the level of civil liberties [14].

Though finally it was decided on a different set of indicators, as expanded later in this text, when analysing the measures of quality of life, scientists and experts often refer to:

- The material situation—GDP per person in US dollars, while maintaining the purchasing power parity. Source: Economist Intelligence Unit
- Health—the average life expectancy in years. Source: US Census Bureau
- Political stability and security—assessment of political stability and security. Source: Economist Intelligence Unit
- Family life—divorce rate (per 1000 inhabitants), expressed on a scale from 1 (lowest divorce rates) to 5 (highest). Sources: United Nations; Euromonitor
- Community life—this variable is set to 1 if the country has a high rate of church attendance or membership in trade unions; otherwise zero. Sources: ILO; World Values Survey
- Climate and geography—latitude, to distinguish between hot and cold climates. Source: CIA World Factbook
- Security of employment—the unemployment rate, as a percentage. Sources: Economist Intelligence Unit; MOP
- Political freedom—the average indicators of political freedoms and rights. Scale of 1 (completely free) to 7 (without freedom). Source: Freedom House
- Gender equality—the proportion of average earnings of men and women, the latest figures available [22].

The quality of life according to R. Kolm is: the degree of satisfaction of spiritual and material needs of a man, the degree of satisfaction of the requirements determining the level of material and spiritual existence of individuals and a society as a whole, the degree of fulfilment of the contractual expectations of normality in activities and situations of everyday life of individuals and society.

Raising the quality of life is a goal that can be found in a number of development strategies of Polish cities. But how to operationalize this goal and how to measure the quality of life? There are many global comparisons of quality of life, including an important study by Mercer company [20]. The rating made by the world's largest corporation involved in the management of human resources is significant; after all, the acquisition of foreign direct investment is a major element of development policy, especially in developing and catching-up countries. Quality of life is one of the factors that affect the evaluation of investment or location attractiveness, because, as the authors of the ranking point out, it directly affects the cost of recruitment and retention of foreign workers (expats).

3 Ranking the Cities

Mercer's ranking is not surprising in its marginal assessments, and the list of leaders with Vienna in the first place for many years, followed by Zurich, Auckland and Munich, does not raise questions. Similarly it is not a surprise that the ranking closes with Iraqi capital, Baghdad, in the 230th place. The middle of the list is, however, surprising. Post-communist countries first come into view with Leipzig in the 60th place, ahead of Prague (69), Budapest (77), Vilnius and Warsaw (joint 79) and Wroclaw (99); the rate is cut by Detroit occupying the 70th position.

Such a high rating of the American city-bankrupt is a cause of amazement, not only in Warsaw or Wroclaw but also in Łódź, which vigorously fights against the label of a "Polish Detroit", proving that it is a city of tough post-industrial transformation but nowhere near collapse or bankruptcy. In any case, in Polish perception, Detroit is a synonym of unimaginable disaster, so the relatively high position of this city must raise doubts. The authors of the Mercer ranking create its index basing on 39 indicators in 10 categories, the quality of local policies through access to housing, public services, cultural and educational quality of the environment. However, they point out that one parameter of extremely great importance is safety, which is why the position of Paris deteriorated after the terrorist attacks.

Not only Mercer appreciates the quality of life in Detroit more than e.g. in Warsaw; a similar assessment is formulated by the Economist Intelligence Unit in its Global Liveability Ranking. This study, however, was criticized several years ago by The New York Times, which summed up the results of the analysis briefly: ELU recognizes the quality of life as equal to speaking English (only two cities in the top ten did not come from English-speaking countries). In turn, the distant and close positions of the cities of Central Europe suggest that their assessment is more determined by the semi-peripheral status of the countries in which they are located, than the actual quality of life.

What, however, would the real quality of life mean? Can it be measured objectively? Seeking answers one should change the perspective and use a European study, "Quality of Life in European Cities". It compares 75 entrants, among them the main Polish cities: Warsaw, Kraków, Białystok and Gdańsk. The Euro barometer survey focuses on the assessment of cities by their residents, which exposes cities in a different perspective than the earlier studies. Even such a basic issue as the statement "I am satisfied with the life in…" shows that in the opinion of inhabitants, Zurich is ranked the highest, but the leader of Mercer's ranking, Vienna, performs worse than Gdańsk and Białystok. Berlin, praised from the outside, ranked by Mercer on 13th position, here lands far away in the second half of the study.

The answers to specific questions about the quality of streets, safety, the quality of neighbourhood community, the environment, locate Bialystok surprisingly high, the metropolis of so-called "Poland B", the capital of the province of Podlasie, one of the poorest in Poland. In the opinion of its inhabitants Bialystok appears, however, as an almost Scandinavian city, while the considerate position of Warsaw

and Kraków is not surprising. This level of self-assessment is confirmed by the results of Poland's Social Diagnosis survey. In terms of "satisfied" and "very satisfied" with their city in 2015 Gdynia was in the first position (87.2% positive ratings), Gdańsk (79.2%), Toruń (73.1%), Kraków (70.5%) and Białystok (68.3%). So what is the situation? Whom to trust more—residents or external experts?

4 Quality of Life in the Context of Warsaw

The Polityka weekly has decided to combine both perspectives and prepare a comparison of the quality of life in the Polish cities with county status (66 units), adapting to its research the methodology of Better Life Index, used by OECD to assess the quality of life in the member states. This method involves the use of both objectified statistical indicators and social ones, referring to the subjective assessment by the inhabitants [3].

The OECD study distinguishes ten categories to illustrate various aspects of quality of life. These are: housing, income, jobs, community, education, environment, civil society, health, life satisfaction and safety. The Polityka experts added another one, relating to the quality of local government.

For each category, from two to four different criteria were chosen. These included, for example, the rates of unemployment and economic activity for "work", and—for "education"—per capita spending on education, the average Polish-language and mathematics results by junior secondary school students, and the percentage of children aged 3–4 years attending kindergartens. For each criterion, the city with the best result received 100 points, and the one with the worst was assigned 0. For other cities intermediate values were calculated. For most criteria (e.g. the number of doctors, turnout in the elections, average salary) the highest result was considered the best. However, in the case of suicide, unemployment or weight of waste, of course, the lowest result was the best.

Then the arithmetic mean of the criteria within each category was calculated. The average of the results for all eleven categories creates the ultimate Quality of Life Index. Theoretically, the maximum result is 100 points, and the minimum 0 points.

The list of all criteria (with their sources):

- Housing conditions: usable floor space per person [23]; satisfaction with housing conditions [3].
- Revenue: the average salary [23]; revenues of the city budget per capita [24].
- Work: unemployment rate [23]; economic activity rate [25].
- Community: the ratio of suicides to the population (district police station); trust in other people [3].
- Education: spending on education per [23]; the percentage of children aged 3–4 years covered by preschool education [23]; the average score of the secondary school exam in parts: Polish language and mathematics [27].

- Environment: percentage of population with access to sewage treatment plants [23]; mass of mixed waste per capita per year [23].
- Civil society: the level of activity for the benefit of local community [3]; turnout in the local elections of 2010 [28].
- Health: the number of physicians per capita [23]; satisfaction with health [3].
- Life satisfaction: satisfaction with life [3]; level of happiness [3].
- Security: the number of crimes per thousand [23]; satisfaction with the state of security in the place of residence [3].
- The quality of self-government: expenditure on culture per capita [23]; spending to service public debt as a percentage of total city budget expenditure [23]; level of funding from the European Union in the 2007–13 perspective per capita [23]; length of cycle paths in relation to the area of the city [23].

The criteria constructed in that way helped to create a comparison, with Warsaw in the first place, followed by the other top-ten entrants: Sopot, Wroclaw, Rzeszow, Ostrołęka, Gdańsk, Leszno, Kraków, Poznań and Tychy. The survey, announced just before the local elections in 2014, caused great excitement and questions, such as whether it makes sense to compare life in Warsaw with life in much smaller Ostrołęka or Leszno? Is it possible to enjoy a similar quality of life in Warsaw, Rzeszow and Tychy?

A straightforward answer is not impossible, just as it is impossible to create a single, universal measure of quality of life, as shown after analyzing several rankings. The question can, however, be objectivized, combining quality of life with the basic task of local government (city, municipality), which is to provide for the needs of residents. The better the educational, cultural, housing or health offer, the better the position in ranks. The correlation seems to be simple but, as demonstrated by the Polityka survey, the correlation is not clear—the introduction of subjective ratings can change the expected outcome. A similar length of bicycle paths and a similar ease of finding a job do not necessarily translate into a similar life satisfaction in a particular respect.

That finding is not surprising, cities are not repeated mechanical structures, they often have completely different stories, and different sources of social and individual identity. It is, however, worth trying to find some patterns that could lead to tips helping in the creation of local, urban public policies actually aimed at the realization of the strategic objective of improving the quality of life.

The quoted Polityka ranking of quality of life crowned a several-month project “Portrety miast polskich” (“Portraits of Polish cities”), whose aim was to present the state of Polish metropolises in the quarter-century of political transformation. It is not anniversary symbolism but the conviction that a certain model of modernization comes to an end. That model consisted in catching up with civilization, by means of increased investment in infrastructure, widely supported by funds from the European Union. The peak of the process came with preparations for the European Championship Football “Euro 2012”, organized jointly by Poland and Ukraine. To ensure proper operation of that huge event the construction of highways accelerated

(although not all plans could be implemented), and the cities hosting the game gained new stations, airports and stadiums.

The preparatory process and the course of the Championships itself (with the exception of the results of the Polish team) were generally graded well, which, however, was accompanied by a growing criticism of an "eventing" and infrastructural model of urban modernization. The main source of this criticism had its roots in a new phenomenon in Polish public space, the so-called new urban movements. It was the initiative of new urban movements that led to a referendum in Kraków in 2014, in which residents rejected the idea of applying for hosting the 2022 Winter Olympics.

According to many researchers, the new urban movements are not so much protest movements in particular cases (along the lines of e.g. the environmental movement), but they are associated with the emergence of a new form of empowerment associated with the rise of the middle class and their respective lifestyles, as well as with the development of the identity referring to urban space. Some even call this process the formation of the "new burghers", a class whose position stems not only from the socio-economic status but also from their urban lifestyle.

Regardless of terminology, profound transformations of the social structure in the Polish cities are a fact. Yet, in 1989 all the cities in Poland were industrial in nature, even in Warsaw factories approached the limits of downtown, and the working class was the largest compact professional category. After two decades the employment structure has changed radically; in cities, especially those with the metropolitan status, the working class was displaced by the creative class. In Warsaw, in jobs belonging to the creative class, the workforce is close to 60% of all people in employment, and in many locations universities have become the largest employers.

The dynamics of this change is well shown by the development of the business services sector, an important element of the post-industrial transformation, especially visible in Kraków, Poland's second largest city. An area of economic activity that was residual a decade ago, in 2016 gave 55 thousand jobs to people, and the annual growth rate reached 20%. In Warsaw, at the beginning of the century, graduate diplomas of artistic studies were given to 700 people a year, and after a decade the number increased to 1300. This rapid change is also accompanied by changes in expectations towards urban space, infrastructure and local authorities.

The change of attitude of residents to their cities was shown by the contest for the title of the European Capital of Culture. 11 Polish cities applied for this prestigious title, and in some cities (Wrocław, Gdańsk, Poznań, Warsaw) the application process ran parallel to the preparations for the UEFA European Football Championship "Euro 2012". To the surprise of many observers, in most centres this process freed an extraordinary power of social commitment. Could it be residents contemplating the cultural dimension of their cities gained grounds, and at the same time a chance to talk about themselves? The application effort, regardless of its quality, became a witness of a new identity of Polish cities, strengthening their character.

What is the most important is that this process engaged the residents themselves, not just experts hired earlier in the campaign and their promotional work on the brand. Only one centre could win, and the title of the European Capital of Culture was awarded to Wroclaw. But a permanent imprint was left on other cities, too. In Bydgoszcz a symbolic culmination of the EEC effort came with a Congress of Culture and the local Culture Pact signed by the authorities and resident representatives. It stimulated search for new forms of enabling residents to co-govern the city. Similarly in Lublin, the mayor co-opted city activists into the co-decision process. employing their representatives in the City Hall. Warsaw, unsuccessfully struggling with writing a Programme for the Development of Culture under the expert model, in the end entrusted the task to the public. The result is a modern document that reflects the changing aspirations and needs of the residents.

The rising interest in culture and the city, not only in the material but also the symbolic dimension, can be considered a symptom of the process described by Ronald Inglehart [7] in which a growing wealth of society results in an increasing importance of so-called post-material values, at the expense of material values. Indeed, the next round of World Values Survey [8] suggests a systematic movement of Poland on the map of values, away from "Survival Values" into the area of "Self Expression Values", with stable attachment to "Traditional Values".

In tackling this question, we have to begin with the concept of needs. The Polish public debate is dominated by the way of thinking about the needs derived from the thoughts of C. Abraham Maslow. According to this thought, human needs form a hierarchy that is reflected in the so-called Maslow's pyramid. It has physiological needs at its basis, then the need for security, then the need for love and belonging, and further the need for recognition and ultimately self-realization.

Hierarchy means that meeting more basic needs opens the way to meet the needs of the upper levels of the pyramid. It might seem that such thinking about needs is consistent with the study of values by Inglehart. It leads to simple recommendations for public policies: if you want citizen satisfaction, first invest in physical infrastructure and jobs. Then comes a time for "soft" investments, when people are satisfied. The support for people in poverty and economic marginalization was for many years, and still is, built on similar grounds.

First, people are bombarded with food to ensure a minimum of calories that guarantee survival. This simple scheme was challenged by Esther Duflo and Abhijit Banerjee, economists studying the effectiveness of aid. Scholars cite a conversation with Oucha Mbarbek, a Moroccan villager who didn't have enough to meet all nutritional needs. They asked him what he would do if he had more money. He answered that he would buy more food. And if he had more money? He would buy tastier food. The researchers received the replies with compassion for the Mbarbek family, seeing that his house was equipped with a television and other technological gadgets. Why buy all these things, if he could not afford to provide adequate food? "He laughed and said 'Oh, but television is more important than food" [19].

Similar observations in Britain led to the hypothesis that it might not be possible to determine objectively what the catalogue of human needs is, and thus to propose a list of solutions and priorities. Perhaps there are many undisclosed and unsatisfied

needs, which in turn must lead to suffering and a reduced quality of life. As a result of this hypothesis, a project of "Meeting unmet Needs" referring to the theory of human needs by Ian Gough and Len Doyal was created. Gough and Doyal, unlike Maslow, do not create a hierarchy, they just indicate that there are two fundamental needs: the reproduction of the physical person, which means survival and health, and autonomy, which means empowerment and ability to take action. Using these fundamental needs, a matrix can be created that will help understand why people negotiate between the amount of calories they eat and the bill for the cell phone. Because calories are to survive and the cell phone is autonomy, both are fundamentally important, and the trick is to optimize.

Gough and Doyal argue for the universality of their theory, pointing out, however, that the realization of its objectives, namely expression and meeting needs always takes place in a specific social reality and cultural context. If a basic need is the need for autonomy, one must understand the contemporary social context of the possibility of autonomy, which leads to the question of empowerment (e.g. [4]).

The answer is given by Alain Touraine, who notes that a modern human entered a pro-social era, i.e. institutional and collective forms of coordination of individuals were eroded.

Political parties, trade unions, associations, public institutions, churches still exist but are no longer an expression of a collective subjectivity of a functioning society, but rather a form of a boutique supermarket of "services for the population", used by an individual selecting the most appropriate offer. In other words, this individual is now the subject and his or her autonomy allows to satisfy other needs [16].

This empowerment of the individual is associated with the phenomenon of a networked individualism, described by Barry Wellman. Agency and performance of an individual in managing one's autonomy stems from the access to Social Operating System, which is a physical and logical infrastructure, access to information and communication. Social Operating System takes over coordination functions, which were previously performed by institutions of a modern society. This raises specific challenges for the institutions themselves, as well as the for management of such organisms as cities [17].

Firstly, due to the transformation of the social structure reflected, among others, in a new occupational structure, the structure of the aspirations and vision of the good life of residents are changing. Growing social differentiation also leads to increasing differentiation regarding the offer to meet the needs of residents.

Secondly, networked individualization leads to a strengthening of the autonomy of individuals, which, thanks to Social Operational System, gain an opportunity for empowerment in a hybrid space, not limited within the boundaries of the city (district, region, country), often bypassing the institutions involved in the management of the territorial dimension.

Thirdly, because of the growing importance of self-supply needs by autonomous citizens, institutions and public authorities do not receive enough information about the quality of their actions, often treating their own needs as an expression of self-efficacy. This cognitive dissonance can lead to crises, as evidenced by a series

of dozens of referenda convened by the urban population in the period preceding the local elections in 2014 and the elections themselves. Their results showed, often contrary to earlier analyses and polls, that there has been a sharp increase in dissatisfaction with the actions of previously-praised municipal authorities. This process was clearly summed up by Krzysztof Żuk, the president of Lublin (in elections in 2014 he won in the first round) at a June 4 2016 seminar: the era of technocratic management is gone, we need a new model which assumes a greater empowerment of citizens.

It is an obvious observation that, given the previously mentioned challenges and processes, the methods of identifying and satisfying residents' needs previously available for public authorities are now losing their effectiveness. This leads both to the alienation of power, and the development of the category of "unmet needs", which in turn leads to a decline in quality of life. Warsaw provides an interesting illustration: the largest and richest Polish city, the capital of the country. As mentioned, Warsaw adopted a Programme for the Development of Culture developed by social partners. The next stage of work on the program was to write operational programs, including Programme for the development of creative potential and artists support.

Diagnostic works involving the examination of the ecosystem of Warsaw culture —networks of actors, institutions and resources—revealed that the ecosystem had already reached metropolitan complexity. This means that there is no one dominant actor who could impose control over key resources or knowledge needed to work in the field of culture. Biuro Kultury (the Culture Office) responsible for the city's cultural policy has only approx. 25% of public funding for culture in Warsaw, while the remaining part is held by district authorities, institutions overseen by local government and national cultural institutions.

The public flow of resources is strengthened by private funds. Warsaw has the most developed sector of the creative industries and a wealthy audience of cultural events. As a result, creators have autonomy in implementing their projects, which is incomparable with other Polish cities. It stems not only from pluralism of control of access to material resources but also from the complexity of Warsaw metaculture, i.e. pluralism of sources of knowledge and critical communication circuits devoted to culture.

The level of autonomy, which is given to creators by Warsaw cultural space is a magnet to Warsaw culture-making energies. A steady flow of talents results in an increasing competition for resources, which do not expand at a similar rate. This competition, to some extent, promotes innovation culture and organization. More and more initiatives are taken outside the existing institutional circuit, in new hybrid spaces of creative activity combining private resources of creators, entrepreneurs, the public, elements of public and private infrastructure, exchange with the participation of market and non-market mechanisms, with the participation of crowd funding platforms.

The rapid increase in the complexity of the system means that existing forms of action of actors present in urban space—institutions, NGOs, authorities—are no longer enough. Cultural space clearly shows that Warsaw has become a metropolis,

but it is still organized in the institutional dimension as a modern city. Dysfunctions of this model are mitigated by the high level of autonomy enjoyed by participants in Warsaw metropolitan life. It stems both from the above-described objective reasons, as well as the structural ones, derived from metropolitan complexity.

This high level of autonomy has a big impact on the quality of life in Warsaw and on the highest place of the capital city in the national ranking. This autonomy, and consequently, the quality of life in the capital, is the source of its attractiveness, which leads to the creative competition for resources. But since it is not possible to reproduce the material resources fast enough, the competition must lead to an exhaustion of the system's development potential. What is needed is change in the management model of the city, so as to increase the efficiency of sharing and production of resources necessary to meet the needs of citizens, without depleting the autonomy.

It is no longer only about the field of culture, but about all the dimensions of city life. Culture has proved to be a good laboratory, but also the cultural field observations point out the conditions hindering the implementation of complex, cross-sectoral public policies in Poland, involving different actors and their resources. The primary barrier is the endemic low level of generalized social trust, which translates into a low potential for cooperation. The actors of public life prefer "solitary bowling": cultural institutions do not trust NGOs and entrepreneurs, with full reciprocity. We all lead a solitary game with the use of public resources, power. Everyone else running the game is a competitor, and the option to co-operate in order to increase the pool for distribution occurs very rarely.

As we mentioned, structural conditions and metropolitan complexity in Warsaw cause that the game also becomes more complex. In other centres, "bowling alone" will consolidate clientelistic way of governance, in which the dominant position in the control of important resources is the basic mechanism of government. Not only that, for the reasons described above, the effectiveness of institutions in meeting the needs of citizens decreases, and there has been no improvement in conditions for implementation of autonomy do not improve; autonomy which would lead to an increase in the efficiency of self-supply needs on the basis of their co-production in hybrid models of inter—and cross-sectoral collaboration.

Cooperation leading to cogeneration requires the actors of public life to be in a relationship of interdependence. The research of sociologist Ronald Burt shows that deficits of collaboration between different social groups emerge as a result of structural gaps—specific groups/social networks have no points of contact and no connections with each other. Although they exist in the same physical space, they inhabit separate social spaces.

5 Summary

How to deal with this deficit? Brokers prove themselves best in such situation; persons filling the structural gap by way of building a bridge to mediate a meeting of two different social worlds, for example of indigenes and settlers. Burt draws

attention to a multi-stage nature of the possible meeting moderated by the broker. The first stage, the simplest one, consists in mutual noticing and recognition. In the next stage, it becomes possible to exchange good practices. It is not yet an interaction; it becomes possible only when during the dialogue, analogies are discovered between the practices of different groups, a similar axiological, epistemological, praxiological bases. The discovery of common metalanguage opens the opportunity for synthesis, for actual interaction, which may result in the creation of joint projects.

A broker may well facilitate the process of dialogue and explore the symmetrical relationship of interdependence, which will result in the ability to create what is common. To work effectively, however, the broker needs support and a minimal dialogue supporting infrastructure. This infrastructure is space, a place stimulating meeting and dialogue in a symmetrical relationship of interdependence rather than domination. Places in public space have their weight, density; it is different to run the meeting at a church rectory, different in a school room, and still different in a private art gallery. If a place is to serve dialogue, it must be, as a broker, reliable and open to all participants in the process. It is not easy to create such places, but they are essential.

Another element is metacultural support—for an effective process of dialogue, solutions legitimizing the process are needed, giving it importance and expressing public recognition (e.g. awards, positive reviews). Metacultural support often plays a greater role than direct material support, as shown by the study on the effectiveness of systems supporting innovation.

Perhaps one can take many definitions of a happy city. Let us assume that a happy city is a city with high quality of life resulting from the best meeting of the needs of its residents. In the context of contemporary society and individualized subjectivity, the policy concerning the quality of life must create and strengthen structural conditions for the autonomy of the actors of urban life. In this way, not only one of the basic needs is satisfied but also these actors, by gaining subjectivity, also gain the ability to produce and co-produce goods and services intended to meet other needs in the various models of distribution (market, non-market socialized, public, etc.).

Pluralism in access to public and private resources to implement life plans in the field of culture, in the social, political or economic space increases the sense of autonomy.

As the autonomy increases, so increases subjectivity, which requires an adequate response from public authorities and other institutions which must go from governance and management to co-governing based on the relationship of interdependence of its actors. There is no simple recipe for making such a transition in the conditions of a particular city—here, one needs continuous exploration and experimentation. At stake is the formation of a positive feedback, a development loop that involves subjectivity resulting from the growing autonomy of the participants of city life, not only in self-supply of needs in the model of "autarky citizenship" but in the simultaneous production of goods and services intended to supply the needs while enlarging the pool of development resources (capital).

References

1. Bywalec C, Wydymus S (1992) Poziom życia ludności Polski w porównaniu z krajami Europejskiej Wspólnoty Gospodarczej. "Ekonomista" No. 5–6
2. Castells M (1994) Technopoles of the world: the making of 21st Century industrial complexes. Routledge, London-New York
3. Czapiński J, Panek T (eds.) (2009) Diagnoza społeczna 2009. warunki i jakość życia polaków. Raport, Instytut Psychologii Uniwersytetu Warszawskiego, Rada Monitoringu Społecznego przy Wyższej Szkole Psychologii i Zarządzania w. Warszawie, p 151
4. Doyal L, Gough I (1991) A theory of human needs. Macmillan, Basingstoke
5. Gorzelak G (2007) Metropolia a region—kto kogo potrzebuje? In: rozwój przez wspólnotę i konkurencyjność. Instytut Badań nad Gospodarką Rynkową, Gdańsk
6. Grewiński M (2009) Wielosektorowa polityka społeczna. O przeobrażeniach państwa opiekuńczego, Wyższa Szkoła Pedagogiczna TWP w Warszawie, pp 83–88
7. Inglehart R (1991), Culture shift in advanced industrial society. Princeton University Press
8. Inglehart R, Norris P, (2003) Rising tide: gender equality and cultural change around the world. Cambridge University Press
9. Jacobs J (1995) Cities and the wealth of nations. Principles of economic life Random House. New York
10. Kamerschen DR, McKenzie RB, Nardinelli C (1991) Ekonomia, Fundacja Gospodarcza NSZZ "Solidarność". Gdańsk, p 114
11. Karwińska A (2007) Poziom mezospołeczny, In: Karwińska A (eds.), Odkrywanie socjologii. Podręcznik dla ekonomistów, PWN. Warszawa
12. Luszniewicz A (1982) Statystyka społeczna: podstawowe problemy i metody. PWE, Warsaw
13. Rostowska T (2009) Małżeństwo, rodzina, praca a jakość życia. Kraków, Oficyna Wydawnicza Impuls, p 27
14. Sassen S (ed) (2002) Global Networks. Linked Cities, Routledge, New York
15. Strzelecki Z (2008) Gospodarka regionalna i lokalna. Warsaw
16. Touraine (1997) Pourrons-nous vivre ensemble? Egaux et différents, Fayard
17. Wellman B, Berkowitz SD (1988) Social structures: a network approach, JAI Press
18. Żekoński Z (1974) Z problemów metodologicznych sformułowania społeczno-bytowych celów rozwoju, Gospodarka Planowa No 6, p 18
19. http://www.economist.com/blogs/freeexchange/2011/04/banerjee_and_duflo_1
20. http://www.mercer.com/newsroom/western-european-cities-top-quality-of-living-ranking-mercer.html
21. http://portretymiast.blog.polityka.pl/2014/11/14/ranking-jakosci-zycia-komentarz-metodologiczny/
22. http://hdr.undp.org/sites/default/files/2015_human_development_report.pdf
23. https://bdl.stat.gov.pl/BDL/dane/podgrup/temat
24. http://www.wspolnota.org.pl/fileadmin/user_upload/Andrzej/Ranking_-_Zamoznosc_samorzadow_2015_r.pdf
25. http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml
26. http://www-isp.miks.uj.edu.pl/pliki/e-monografie/monografia-4-t2.pdf
27. http://bip.oke.waw.pl/publikacje/podglad.php?id_publikacji=1
28. http://pkw.gov.pl/

Aiming to a Future University—The Case of the SGH Campus Redevelopment

Marek Bryx

Abstract Cities have competed with each other since we could remember. Now, the main objective of the city competition is quality of habitants life. The base of all different methods of competitiveness is knowledge. Cities cannot change their location or history, but they change themselves. For a city as a whole, education is the basis for the development and improvement of the existence of its inhabitants. The life of the present and future citizens depends on their level of education. Quality of education determines understanding and acceptance of quality of inhabitants life. However, there is still an open question—how a new university should be built? Alternatively, this question also asks about the best ways to educate young people. Both sides—students and their future employers put a pressure on universities to modernize their methods of education. New methods need new technology, buildings and open-minded teachers.

Keywords Historical campus redevelopment · Redevelopment procedure · Public participation

1 Introduction

I would like to consider a development dilemma of contemporary universities on a case of Warsaw School of Economics (the SGH), the oldest university of economics and business school in the Central and Eastern Europe. In this case I show circumstances of expected change in the education process and possibilities of campus redevelopment. It also requires to present a brief history of the existing historical campus of the SGH. The results of surveying students on their satisfaction and opinion about functional advantages and disadvantages of their university environment are also included. Then I present a few important dilemmas which are more relevant in the case of a public university. And finally I will present public

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discussion by which we wanted to provoke academics, students, local community and the municipality to speak in the common debate on the SGH's future.

The SGH is going to be the university open to the citizens and ready to meet expectations of all of these groups of people. However, their interests must be clearly expressed by them. Therefore, such public discussions and debates are very important for creating a future university. Especially, when the local spatial plan is rather against the redevelopment of a historical place and the conservator of heritage is rather skeptical about the final results.

In such determinants the university must show a special responsibility and attention for the past (heritage) and the future of their own and the local community.

2 Quality of Habitants' Life and the Education Process

Cities have always been a combination of human capital and other resources. I understand "human capital" rather widely, as an intellectual potential and ability to use it in a constant process of a sustainable city development. Similarly, resources mean mainly technical stocks and economical funds arose from the predominance of location and growth potential. The latter is also a result of an intellectual potential of habitants, skills of its use which is strictly connected with the need for dominance or to obtain a better position among competing cities.

Cities have competed since we could remember. History gives us many examples of wars between cities that could have given them a better position in their world. Fortunately, war was not the only form of competition between these municipalities. Struggling for international glory and status, cities also invested in education, culture and art, and the results of their activities can now be seen and admired in places that have created unique objects. Some of them were fortunate and were not destroyed by wars.[1] The base of all different methods of competitiveness is knowledge; this is an effect of both—education and experience from one part, and efforts of inhabitants to develop themselves, called the education process, but these two support each other. The oldest university boasts over 1,000 years of tradition, however education had been at a price much earlier and determined the positions of individual people, castes, cities or states.

When we look at the contemporary city, we can say that the essence of the city, as a combination of what they possess—human and other potentials, resources (including techniques), skills, desires, efforts and ability to use them in the most effective way, have not changed over the years, and I do not think they will.

So what has changed in cities as a specific social and spatial organization over the centuries? Mainly—the size, and the growing numbers of inhabitants, which is an obvious result of urbanization. But also operating methods, competition techniques, ways of communication etc., all of which are results of today's civilization

[1]Paris, Rome, cities of Tuscany, but not only.

and its knowledge, new techniques and technologies. It is obvious that these new technologies will age and eventually be systematically replaced by newer ones in the future.

To compete effectively today, cities must have an important distinctiveness that impresses other cities and their inhabitants. The basis for today's position of cities are their achievements of the past, and the actions taken now. Hence, among other activities, international competition promotes different activities which are important for modern city and development of the local community as e.g. competition for the cleanest environment—European Green Capital Award or competition for the best museum—European Museum of the Year Award or other similar.

Each of the aforementioned competitions and similar activities seek better educated citizens in the area of the competition concerning—the history, the environment, human relations, economic development and so on. The greater the number of educated residents, the greater potential for development and the better opportunity. Education—once the privilege of a narrow elite, later for a wider but richer part of society, today is spreading before our eyes.

The globalization process, a movement of capital, and also people, have partly changed the purpose of the activity of municipal authorities. Today, cities must be attractive not only for foreigners, to attract them from around the world, but—first of all—for their own residents. If not, habitants can easily change their place of residence, and thus economic activity, paying taxes etc. The purpose of the competitive struggle between cities has become a quality of life, important for residents and those who visit the city. Cities cannot change their location or history, but they can improve the impact from the past to the present and the future. They can develop their intellectual potential, change their development strategy, improve their environment in a sustainable way, and as a result of taken actions change their position in the world.

For a city as a whole, education is the basis for the development and improvement of the existence of its inhabitants. The life of the present and the future citizens depends on their education level. Quality of education determines the understanding and the acceptance of quality of inhabitants life. It is also as important as health, ability to work and rest. These four goals, closely related to each other, together constitute the quality of life in the city. Quality of life, therefore, has become the main objective of competing for taxes of citizens and their voices in local elections. It is shown on Fig. 1.

At the first glance the pyramid looks reasonable and convincing. On the other hand, there is a significant difference between goals in small and big cities. As I. Rudzka says, in Poland "only 15% of urban population living in cities smaller than 100,000 residents are satisfied with the quality of life offered to them by the city. For comparison, in the largest urban centres in Poland the percentage of satisfied inhabitants ranges from 72 to 77%" [7]. The most important thing for in habitants of small cities is to be employed. Up to now there are still cities in Poland where unemployment is higher than 25%. In such situations, it is not possible to discuss an improvement of the quality of life. The lack of jobs produce a lot of negative phenomena in cities—pathologies, a general feeling of hopelessness and (the most

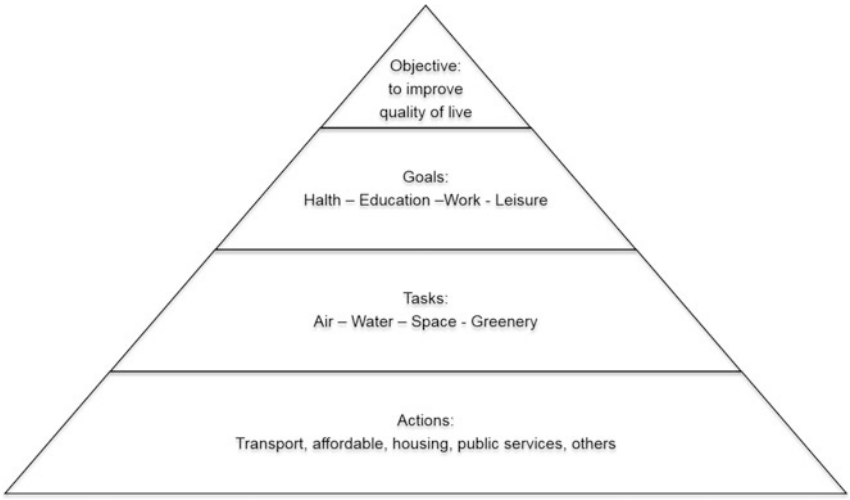

Fig. 1 Pyramid of habitants' purposes. *Source* [2]

important) a trap of a closed circle. However, cities with an university create better chance of development for their graduates and for themselves.

Generally we can say that the only constant and long-term activities called constant learning or long life learning can change a level of peoples' education and their mentality. And only as a result of such a change, we can think of a new environment, green cities or smart cities. We do not create these modern cities for elites but for all residents. So we should not feel pressured to change them or their environment, but we should educate them showing new possibilities, opportunities and chances. Nobody would like to be educated by force; but, everybody can be interested in it and ready to work hard if we show them good examples of possible changes and find appropriate methods of education. Since this is a life-long process that starts in kindergarden, the universities have their role to play in the process.

3 The University Education and Its Influence on Quality of Inhabitants' Lives

On the above background, the related objectives, methods, activities, internal struggle for resources, etc. raise the question about the role of the modern university in the city (not only for inhabitants) development. Considering both, an improvement of the quality of education and improvement of the quality of residents' lives, we think about university education in the completely new conditions; such as—an impact of new tools and techniques, completely new non-university knowledge availably online, globalization of education etc. Though, we, academics, believe in

a crucial role of the university in the deep sense of the educational process, we would rather prefer to ask: is the role of contemporary university in creating a quality of life in cities really important?

We all know that the universities have been changing; however, to be highly educated is still a dream of many, many people. To possess a university degree is still one of the most important goals of many people. And when we look around, we can see that there are still traditional universities and they have got dominated role in the education process, although technical revolution is not a new phenomenon now. It rather proves that the idea of studying any subject in a university library on one's own, looking for and finding answers, solutions, formulating conclusions, is still very attractive, intellectual work. On the global scale, it will always be a determinant of societies' elite. Similarly, a lively discussion with a professor is a value in itself. Likewise, a workshop organized and conducted by an academic at the university is a bit different than one organized on the internet. Of course, new technology helps to organize didactic process via distance learning and discussing materials sitting in different places, but it is still not exactly the same as a traditional meeting in the university atmosphere. It is possible that distance learning techniques will be refined in the future and will create the same scientific atmosphere, but up to now, it has not been visible. Thus, traditional methods still have an advantage over new technics and will continue to do so for the foreseeable future.

On the other hand, not everybody is ready to search for the truth through an independent study. Most of students are interested in knowledge that can be quickly possessed and effectively implemented in a way that will create some profits. This is also a very important and pragmatic goal of education that cannot be ignored by the universities. In Poland, all leading universities are public and mainly paid for by tax transfer. Thus, they cannot disregard the expectation of society expressed indirectly by demand for university services or by the Ministry of High Education.

Not only students, but also an industry, put pressure on universities to modernize their methods of education. An industry is a recipient of university graduates and has its own requirements and expectations. Of course, the industry needs perfectly educated graduates, what means-having full knowledge on the subject. But this is only a base. This is only a prerequisite for an acceptance by the employers. The sufficient condition is to have other competencies as well. The most important of these is the ability to work in a group. This in turn means that graduates must have skills of listening to other people, understanding their arguments, gently discussing them with others. They have to know how to present their arguments to convince others to their concepts, ideas or rights. The graduates must be able to live in the work environment and move smoothly inside and at the same time bring newer, better ideas to their employers' organizations. It was tried to implement these competencies to students' curriculum many years ago; so it is not a new idea. However, it was named differently at that time and there was not as much pressure on the university from the employers as it is now.

To develop all these features expected from university graduates, we very often cooperate with a company from the industry, our clients or receivers of our graduates. We invite them to participate in the educational process, especially in

creating skills required from students. This cooperation is usually effective and positively assessed by the students because they feel closer to the employers and their expectations. The representatives of the companies are also glad of such cooperation with the university. They provide the students with their expectations as to the competence of future employees, but they can also investigate students' knowledge and skills. Interestingly, they choose those who know the most. And knowledge, not only competencies or skills, is still the main selection criterion.

Thus, we can say that a contemporary university should create a personality of its students by development of their competencies, skills and manners on the base of knowledge.[2] To achieve this, an university has to use all available techniques and methods of training in cooperation with the industry representatives.

It is worth noting that cities move towards business activity, much more than it was in the past. They know that they live from taxes paid by inhabitants and companies mainly. So they try to be competitive and attractive for people who want to do business in the city area and for those who would like to visit cities giving possibilities for all businesses located there to improve. So, in their structures, cities need graduates with business background. It means they have to be well prepared by an university for their roles in city structure. Final conclusion is that universities, especially schools of business, must positively answer to such challenge.

4 The Case of Warsaw School of Economics

4.1 Circumstances of Change

A development dilemma of a contemporary university and its relation with local society and authority is considered on a case of Warsaw School of Economics (the SGH). Strictly speaking, since the beginning it was a school of business preparing students to different roles in the industry. However, since the interwar period it has started to be the university of economics, which employs more than 180 professors now. As every university, the SGH develops and creates new relations not only with its students, but also with its academic, non-academic staff as well as industry partners (business) and cities.

There are a few important issues faced by the SGH nowadays. They have appeared in accordance to the global trends but also by an accident. Between 1978 and 1984 the socialist government founded a new building at the university campus. After less than 30 years it appeared that the building cannot be exploited longer. Finally, in 2016 it was pulled down. Now the SGH must answer the

[2]By the way: some people say—modern knowledge…, well… Let me give an example that the knowledge does not change as quickly as technics. I am ready to prove that the rules of mortgage system are exactly the same like there were introduced in the XIX century. However, the technics is completely different and allows for selling or buying or converting these financial instruments on time and even organize a financial world crisis.

question—how to replace it? However, a simple exchange is impossible because of restrictions in the local development plan. Moreover from the conservator's point of view, who is glad of the situation, the famous library building is now incomparably more visible than earlier.

In the second decade of XXI century the SGH has started to be under the pressure of planning its strategic redevelopment. The university collided with all the problems of strategic planning perfectly described by Friend and Hickling [3]. However, the highest challenge to the university and the biggest uncertainty is: how to convince the local authority (both—responsible for spatial planning and for protected heritage) that we need a new building and although the spatial plan and the municipal conservation policies are against the SGH, the university must construct something new to carry out educational mission. Looking for an answer to the challenge the SGH has decided to accept the protection of its heritage, but not to accept the existing local plan which does not allow any development in the university's area. Contrary, we want to explain to the local authority that new university façade can create a new icon for the capital city. And, what is the most important, it meets expectation of our students and professors, creates a new relations with local society. This is the SGH real desire, and not some kind of marketing game.

4.2 A Brief Description of the SGH and Its Historical Campus

For a better understanding of an actual argument for the SGH redevelopment, we should (briefly) revisit the history of the university.

It was set up as a private institution for men in 1906 and started its activity in a rented building. It has been growing constantly, becoming a college during the First World War. When Poland came back onto European maps, the new Rector, Professor B. Miklaszewski started to think about a construction of the SGH own campus. He had invited few architects to prepare some sketches and chose a proposal had designed by Jan Witkiewicz-Koszczyc. It was a big assumption in a classic palace style, with two buildings looking like guardhouses outlining a public space in opposite to the main entrance and an axis of symmetry (east-west) as well, and many interesting, rich details, especially mosaics. Two years later the architect prepared a new very similar drawing (Fig. 2).

Unfortunately there was not enough money at the small, private college to realize such a big project. The architect was asked to prepare the next project that could be realized in stages. Thus, in 1925, the SGH started to construct its first building called "A". After 12 months, the new academic year was open in a new building (Photos 1).

The next step was to build the SGH library. It was the second public library in Europe, designed as a library, after the first had built in Zurich. With its almost

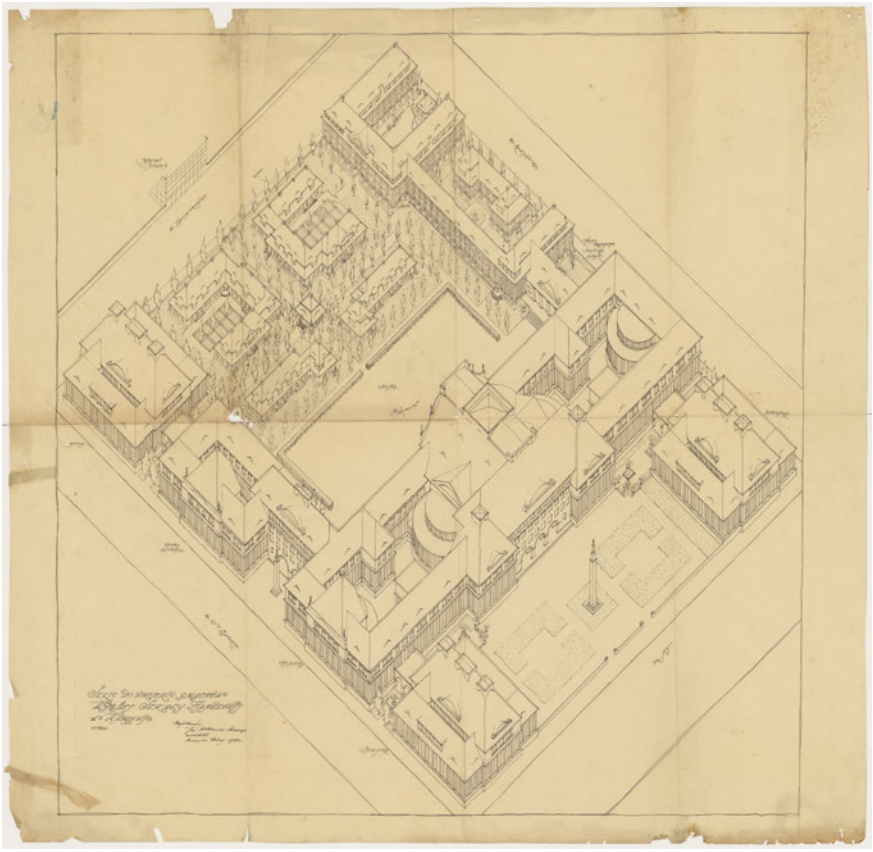

Fig. 2 One of the first sketches of the SGH, 1923, Jan Koszczyc-Witkiewicz. *Source* [6]

1,000 m^3, the reading room is still admired by all visitors, especially architects. In the meantime, the Polish government confirmed the SGH entitlement to be the full university, equal to the Warsaw University and a few others.

Before the Second World War, a small building with flats for professors was constructed as well. The rest of the plan was realized after the Second World War. Fortunately the library building was saved[3] but building A was burnt by the Nazi Germany's local authority, which was occupying Warsaw that time. Therefore, the academic year in October 1945 started in the library building. The students came back to the building A in 1947 (Photo 2).

[3]This is a long story. Officially the University worked as high school accepted by Germans. However another curricula was realized for the students. It allowed to display all German's books, especially historical, in the first raw of the reading room. Thus German authorities delayed to the last moment the decision to burn the building and books. Finally, when they came to fulfill the order the director drunk them and the next day they fled from the Soviet Union army.

Photo 1 Building A. *Source* [8]

Photo 2 The reading room in the library. *Source* [9]

Photo 3 The main building. *Source* [10]

In 1949, the university was nationalized and the socialist government decided to continue the plan of constructing the SGH campus. The main building was constructed shorten by 60 meters in 1955 than it had been planned (the architect's protests against the decision were ignored). Two buildings with flats for academic teachers on the opposite side were completed as well (Photo 3).

In 1984, a new building for academic teachers was constructed but it was closed in 2010 and was demolished in 2016. So, finally, we have arrived at the place called the campus or the historical campus: 2 buildings with rooms for teaching, the library building and 3 buildings with flats which are no longer our properties. We have 3 student dormitories, a students' club, and a new building created in 2006, but they are outside of the historical campus. In 2008, the campus was inscribed to the register of the Warsaw monuments.

I must add that the historical campus was very modern for its times. The architect received a silver medal for the architecture of building A at the world exhibition in Paris in 1937. The campus was not only interesting from a technical or architectural point of view, but also as public spaces which created a common area for professors, assistants and students. These spaces were inside the buildings and also in the garden located in the heart of the campus.

The very functional buildings of the historical campus are perfect examples of the architectural thought of the first part of XX century. They are so excellent that every idea to rebuild the campus is a great challenge for contemporary architects (Photo 4).

Photo 4 Auditorium A in the building A. *Source* [11]

4.3 Goals Should Be Achieved by Rebuilding of the SGH Campus

There are 6 important goals that should be achieved by the redevelopment of the SGH campus, which are important from the societal point of view and from the future position of the university on the academic map of Europe.

- First of all we want to meet with all expectations of our students. They know what they need and their expectations, anticipation of the future shape of the university do not diverge from the general world trends.
- Second group that must be satisfied with the new campus are the SGH workers, especially academic staff members. This is fully understandable and we want to satisfy them as much as is possible.
- From the future SGH budget perspective the university must be more active to raise new sources of funding. The government donation is too small for all task the SGH wants to meet.
- Heritage conservator. According to the present situation the office representatives will be happy if nothing is done in the area. However, they officially say that they understand the SGH development needs, but unofficially we know that the present situation without new actions from the SGH's part is ideal for them.
- Spatial planners and officials responsible for spatial planning in Warsaw are rather unhappy that they would be required to change the local plan, which has been completed recently,
- Local society and the city could be interested in changing this 4 hectares area, which is used only to change one kind of public transport to another, into a new, modern and effectively use public space.

Finally, the 100 years old vision of the architect can be reactivated and implemented. As we can see the first three goals are crucial for the SGH present and future. And they are clearly against the fourth and fifth goal. The sixth goal is rather neutral. It can be realized or not but if we would really achieve these goals the sixth will be very attractive because it is an argument against a possible conservative action of official representatives. The SGH does not predict any special barriers built by the officials. In contrary, they rather support the university as one of the most important academic institution in the city.

4.4 Dilemmas of the Campus Redevelopment

If we look at the above mentioned six goals we can see that it is rather impossible to find a common space of them as a product of sets. The challenge is that they all must be met. It could be only discussed whether every expectation can be fully realized, i.e. can 100% of every group expectation be achieved. And the answer

rather is “no”. On the other hand—the crucial question is—how far can we give into every above goal?

The group of professors and lecturers must be finally satisfied. For almost 6 years, academics have had their offices located in a place located 1.5 km from the campus, and the idea that campus is the place where students can meet their professors is restricted by the distance. We would like to bring the teachers back to the campus and create again a suitable atmosphere of collaboration between students and teachers. This is also a matter of esteem for their hard work and for their age, too.

We should remember that the SGH want to play its role as the leading university of economics and the leading business school in Poland also in the future. Thus, satisfied academics and pretty good conditions are the base of present and future results of their job. However, there is some kind of uncertainty of future methods of teaching. New technologies storm into every aspect of our everyday lives. They change all of us, mainly young people, especially students, but up to now, a life contact with a teacher is constantly highly rated by students.

As it was said, the first goal—the expectations of the SGH students are very important and we will do our best to accomplish them.

To find a daring, interesting and acceptable vision of the campus redevelopment we conducted a student inquiry asking about their future vision of the campus and their expectation. From my initiative, Ferdynand Gorski prepared and conducted it [1]. We asked them 4 questions (Photo 5):

Photo 5 Parachute roof at the main building. *Source* [9]

- what do you really like at the SGH?
- what really annoys you about the facilities?
- what do you miss the most?
- what kind of investment should be made?

There was an empty space in the questionnaire that could be filled with personal answers. However, some possible answers which were suggested by students from Students Club of Investment and Real Estate, had been added to the questionnaire. Although it was an exam period (June 2011) we received over 1,300 responses, 3–4 times more than expected. All of them were very interesting and included important suggestions to improve the academic life at the SGH through the programme of redevelopment. I can add that it was the first and only questionnaire on the SGH campus among our students and workers.

Among a lot of interesting and alluring answers concerning details of our present and future buildings, weaknesses of our property management, neglected areas (especially the basement), the survey gathered some important suggestions for expansion of the campus. Students clearly expressed what they need:

- more seats in the internal public space (comfortable)
- spaces for small groups for talks/jobs/discussions
- sports facilities
- multimedia in every teaching room
- places to meet teachers in the campus
- paintings and artistic posters instead of advertising
- high quality public spaces
- attractive, fitted out space between the buildings instead of these existing car parking
- the campus, rather than a loose collection of buildings
- a comfortable passage between the library and the main building
- a direct underground passage to the subway station

and they generally suggested to locate as many different function connecting the campus as it is possible, including branch of a bank, a restaurant, a post office, hairdresser etc. There were also suggestions (more or less specific) on how to realize the idea:

- it's time to get down to work and not just discuss
- create an endowment fund as Yale and Harvard have got
- to develop contact with graduates—they are usually in top companies and have got cash
- try to create a joint venture or other cooperative with the private sector
- reliability and consistency in implementation of a development plan

My colleagues and I had been thinking about the redevelopment of the SGH campus knowing these expectation quite well. However, a direct confirmation made by the students that we look at these issues in the same way, was a kind of nice discovery.

And the third main goal, important for the SGH future, is to create a new flow of cash for the university. In the past few years, using EU sources, we prepared new curricula for foreign students. There are full curricula, a few specializations consisting a few subjects of studies and single subjects. Each solution is acceptable and can be chosen by foreign students according to the time they are ready to spend in Warsaw. Unfortunately we do not have a dormitory of suitable standard of living for them. As Warsaw residents, all we know that our capital city is safe; but for foreign students (and their parents) who come here for the first time, a safe flat which provides satisfying living standards is a determining factor of studying at the SGH. A student who decided to study at the SGH must live in suitable, modern conditions. It simply means that new student dormitory must be provided as a part of the redevelopment strategy for the SGH Campus. As our actual, built in the fifties of the past century, are not attractive and do not meet the standards.

Therefore, when we agree that these three issues really crucial for the SGH future, the question has to be asked—how to reconcile them with these 3 barriers which are created by the bureaucratic rules? We do not want to fight against them but we want to encourage officials to help and guide us in order to create a new campus according to existing rules. And we think that a compromise between the SGH expectations and existing rules is obviously possible. To search for the compromise we decided to use a public discussion as a method of dissemination of the SGH ideas.

4.5 Public Discussion

As of the 2012–2016 term of office, the SGH has not allocated special funds in the budget for jobs related to the development of the campus; Therefore we decided to invite students from two partner universities to try to solve our problems with the campus redevelopment in their final jobs for their graduation. To encourage them we prepared three competitions. In each of them, students tried to answer to all the above dilemmas and could prepare their own vision of the future campus. They were not obliged to respect an actual local development plan, but their visions were to be in a harmony with the historical objects. We have got several very interesting and inspiring projects. For example, a tunnel (instead of the present street), which could potentially create a public space, is rather expensive and not for "our pocket". However, the tunnel and the features could be attractive for the city.

The outcomes of their work were discussed publicly and finally published by us [4, 5]. We can say that we have final results of these competitions and the questionnaire, so we have not wasted our time; but, time and technology are changing so quickly that we decided to make a workshop with our students again (including students from abroad) to check if their expectation has changed.

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On 8th June 2016, the special workshop with our students, young architects (former participants of the second and third competitions), academic teachers, librarians and administrative staff of the SGH, was organised. The workshop was conducted by two students, and supported by two others, who all participated in our specialization called "Eco-innovation in cities" and studied a parallel subject called "Design thinking" at Berlin University of Technology. We put before them a problem—what should be inside the new buildings. What kind of spaces are needed now and we will be need in the next years, Does we give a perfect answer for these present and future expectations? Will the space in these new buildings still be required when the buildings are completed? It must take a few years to build them —all the while, the world, technology and teaching methods in the conditions of uncertainty can be changed. But not a technology is a challenge but a conviction that these new spaces will be useful and require in the future as well.

It was a very inspirational workshop. It started with a few short introductions on the task, subject and method. Then we all visited the campus and it appeared that there are a few unknown places, historical experiences, and unseen details. From the perspective of the participants, who felt responsible for redevelopment of the SGH area, the campus presented itself more intriguing than they had expected in their dreams. Then we came back to the room and worked in groups.

Finally, Six groups of participant pointed out that this historical place is beautiful, prestigious and was better designed than finally realized. And it must be adjusted to the present and future needs of students and staff. Everybody agreed with the following opinions:

There are 3 objects of the utmost importance, absolutely indisputable:

- Modern standard dormitory for students
- Modern standard of the building for academics, their institutes, divisions, units
- Internal garden as an integrative (not a car-park) area

A quite long discussion was about the shape of new buildings. However, there was an unexpected consensus of opinions of the participants concerning the functionality of the new buildings. They generally agree that nowadays students need different free spaces, not too big, to meet each other to discuss or work in small groups. They want to meet their professor in the free space to have informal meetings. They also need a space to work in silence on their laptops or smartphones, or simply for leisure and rest. The concept of a place with access to a few ping-pong tables was accepted by acclamation. They also want to discuss with representatives of business, especially partners of the SGH, their business ideas and plans and to cooperate with them in development of their ideas, start-ups or even companies.

So, the workshop confirmed and extended everything we had thought and known from the earlier survey and our experiences. The students extremely need a space for better contacts with each other, academics and representatives of

businesses. They also require arts and cultural events in the SGH spaces. During the workshop the nearest inhabitants, our neighbors, proposed a public square located at the front of the main building.

It was a kind of a discovery that in the past 5 years, when the technology has drastically changed, the students' (and others') needs have not changed. Still the first thing that is required is accessible, free, easy-going space divided into many small cabins or simply opened with special furniture allowing for work, rest, leisure that can be easily and flexibly reorganised.

Personally, I think that all the demands expressed in the survey responses made in 2011 and confirmed at the workshop on 2016, should be realized because the need of creating them is obvious and redeveloping the campus means to make it more friendly for students and academics. It is said these two 2 new buildings, which will occupy 2 of 4 empty corners of the campus, will solve 2 of our problems —the dormitory and the office for the staff. Combining all our task together we must remember that the SGH campus has a very clear axis of symmetry; thus, we have to keep the idea for the future.

Taking into account that these two new buildings should be constructed with respect to the axis, and not to be located at the front of the campus because they can obscure our historical buildings. They could be rather located in the second part. The façade of the SGH campus is located strictly in the front of the underground station in the capital city center. And this is perfect location. Many developers would like to buy the front of the campus together with us. However, the public university has its own mission, which connects different parts of academic society (teachers, researchers, students, admins) with the local community and opens the university for people. These two corners of the front should therefore be built by objects which spaces connect the SGH with the city. And it was more or less visible on these two new drawings (Photos 6 and 7). They suggest that we can build something interesting which will become our new icon as the reading-room in the library building or the parachute roof in the main building are.

What is more, every architect has seen and pointed out many imperfections of the unfinished historical campus of the SGH. Thus all these faults can be deleted by the redevelopment process.

Finally, going to the compromise between first 3 goals—i.e. meets the needs of the university and with the next 3, i.e. meets expectations of bureaucracy—the SGH asked young architects, former students participated in our competitions, to sketch

Photo 6 New vision (the first team). *Source* [12]

Photo 7 New vision (the second team). *Source* [13]

their vision of these buildings that should be created at the present campus. Both these vision are interesting and possible to implement if the local authority decides to change the local spatial plan. And, frankly speaking, it was a hidden purpose of their job—to show to the public, the officials and the local authority—what is realty possible if they decide to change the local spatial plan. And they agree to protect heritage despite expansion of the SGH, in this specific way which will highlight the historical values while allowing breathing new life in the old campus. We would like to achieve it not only to portray a modern shape of the building(s), but also because of the function realized inside. We want to continue the first thought of Jan Witkiewicz-Koszczyc, our architect, on order to create a public space in front of the main entrance and connect the existing buildings with these new ones, and establish an integral and functional university complex. What is more, this undertaking in front of the campus, new icons or a new face of the city must be accepted by the Warsaw conservator of heritage. So, how extravagant these buildings can be will be decided by her/him. However, we agreed that the campus was very modern for its time due to the newest technology and daring vision. Thus, it is clear we must do the same—implement a daring architectural vision and use the newest technology and materials. Two new drawings were prepared by the young architects to show that it is possible to create a new face of the capital city and Mokotow district by rebuilding and redeveloping the place. And this is really unique. The SGH is able to design and construct their new buildings located at the campus space as modern,

beautiful and useful today as these done in the first half of the past century and were the excellent constructions in their time. And they are still very useful and could be a new icon of the city.

5 Conclusion

The world is going to a new post-industrial economy. It has to be managed by green and responsible economy in which our planet's resources will be used cautiously, and we learn to live frugally and wisely. To achieve this, it is not enough to have knowledge and skills; it still needs to be sensitive and be able to use one's abilities not only for himself/herself, but for others and for future generations. To be, a bit of an altruist, you must meet other people, cooperate with them, play with them, work with them and understand them. In the other words, to understand what really means "green city" one requires to be inside such environment or to participate in building it. We want to create and give our students, academics and local society this unique opportunity to make an effort to create it and grow inside. The SGH wants to be a green city open for all.

In the above presented case of the SGH it also means that the new façade of the campus will create a new space where students can meet academic staff, but both of them can also meet there locals, entrepreneurs, representatives of industry and services (especially digital), creators of culture and arts and everybody who would like to go there. All of them on the same rights. This intellectual mishmash should create something new and important. Not only for students but for all who will involve in the creative atmosphere which will be done by all participants. Then, not only predatory company and tycoon of business can be visible there, but also innovative enterprises can start as results of exchanging knowledge, ability, willingness, openness, and sensitivities of people who do not even perceive themselves as creators.

We know that graduates and students of the SGH have enormous potential. I think that we should build for them an innovative center to give a chance to connect people and the ideas swirling in their heads. This open, without commitment, friendly collaboration, is a part of contemporary urban ecosystem. However, the university can be mainly a facilitator of actions taken by students and their partners inside newly constructed areas. The most important thing is to create a new, modern, smart space without disturbing those who are willing to work, support or participate. Of course, traditional lectures and classes will be done in the old, yet still functional buildings.

The SGH student is not an engineer and probably cannot invent a patent on nanotechnology, biotechnology or medicine, but perfectly understands the tools required by the business. I think that this innovative space sensitizes her/him on social issues especially on the issues of the fight against poverty, security, education from scratch, personality development, alleviation of cultural differences, etc. A student or a graduate from an elite university, with an open mind and willingness,

is able to bring a lot to the development of the local community. However, he/she needs the conditions for doing so. And the university and the city should help them with creating and finding those conditions.

References

1. Bryx M (ed) (2011) Rethinking University Space: Warsaw School of Economics Redevelopment. INTA/KNoP Roundtable. Warsaw, pp 187–200
2. Bryx M, Lipiec J, Rudzka I (2014) Green urban regeneration projects. CeDeWu e-book: p. 33
3. Friend J, Hickling A (2005) Planning under pressure. Routledge, pp 1–18
4. Gzell Sl (2014) Historyczny kampus SGH w Warszawie w studenckich konkursach urbanistycznych. [historical Campus of the SGH in Warsaw in student urban study competition]. Urbanistyka, Special number of 2014
5. Krolikowski J, Wlazlo-Malinowska K (eds) (2016) Młodość nadzieją miasta [Youthfulness—Hope of a City]. SGH, Warsaw
7. Museum of Architecture in Wroclaw MAW, IIIb_136–6
6. Rudzka I (2016) Deprived areas as a barrier to urban development in small and medium cities in Mazovian Region. ECEE 7th Conference
8. The SGH archive, author M. Gorski
9. The SGH archive, author M. Gorski
10. The SGH archive, author: J. Sokolowski
11. The SGH archive, author: B. Trzcinska
12. https://web.facebook.com/Kwadratura109656105786846/photos/?tab=album&album_id=1043354285750352&_rdr
13. https://web.facebook.com/photo.php?fbid=1513618251997007&set=pb.100000465394555.-2207520000.1472838753.&type=3&theater

Part III
Integrated Infrastructures and Processes Across Energy, ICT and Transport

Integrated Infrastructures and Processes Across Energy, ICT and Transport

Dariusz Samól

Abstract Smart Cities need modern infrastructures for achieving economic prosperity. Their main goal is to adapt to a fast-changing world and power urban transformation, innovation, and best-in-class performance. Digital Transformation is a key enabler of the networked economy. According to this approach, smart city communities use devices and sensors for integrating transport, increasing mobility and optimizing their energy consumption. Their business processes are intensely driven by data, and all stakeholders experience frequent digitalized interactions. We believe that thanks to these capabilities the quality of city governance and city workforce management will be significantly improved. Integrated infrastructures and their processes create a strong foundation for the next concepts of city development: public safety and security, healthy populations and environmental sustainability. All these ideas lead to the city being a great place to live and work.

Keywords Digital transformation · Networked economy · Integrated transport and mobility · Data driven cities · Public safety and security

1 Introduction

Why is the next technological revolution digital? This question is posed many times, also by computer specialists and experts. Information Technology has been widely known for more than fifty years, and computers were always 'digital' (not counting the early analogue calculating machines). So, what is the real difference? Looking at the history of Information Technology development one can see gradual change from centralized to personal computing. It is hard to believe but in 1989, when the initial computer university network ARPANET was finally shut down in order to give way to what is today known as the Internet, only 150,000 hosts were connected worldwide. The majority of serious applications were then run on big

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mainframe machines, with personal computing mostly confined to the gaming industry. The Internet was not yet treated too seriously, not being much relevant for serious enterprise applications. Although UNIX machines appeared to be much more flexible comparing to old main frames, they were still connected by leased lines based on packet exchange protocols, such as X.25. From user experience perspective they offered alpha-numeric terminals, where function key and transaction codes needed to be remembered by operator. Using graphic interface with a newly invented mouse was not a common practice. Only highly specialized working stations could offer this kind of sophisticated capabilities. Meantime, a completely different trend could be seen on the consumer market. Personal Computing devices, developed by the gaming industry (Sinclair Z80, Spectrum, Atari, Amica) and later amplified by Apple, Microsoft, and IBM with its Taiwanese clones, changed user behaviors and expectations. Why is that important to mention now? There is one basic answer: consumer and personal data processing changed the shape of the whole Information Technology industry. Although the year 2001 brought the Internet bubble, when many young companies collapsed, the year 2003 became an advent of social networks: initially Myspace and later Facebook (in 2004). Since that moment almost 1 billion users are rewiring business and personal boundaries almost on a daily basis. One can discuss threats and risk connected with that (also psychological and sociological), however the truth is that due to this fact many new disruptive business models appeared, accelerating change and speeding up innovations. This phenomenon is aligned with a growing power of the middle class worldwide, which leads to higher consumption of resources and sustainability issues. Consumption of energy and natural resources, such as like water, fish, forests or precious minerals, has increased perceptibly from the previous decades. One of these consumption factors is created by the technology itself: almost 50 billion devices will be attached to the network in 2020 and the number of users will double up by then [1]. These figures need to be supported by relevant infrastructure, materials and availability of energy. The amount of data circulated in the network doubles every eighteen months. Moreover, a new cohort now enters the stage. This is Generation Z, or people who will not understand why consumer technology must be different from the industrial one. So the answer lies not so much in strictly technical definitions as in the new quality and usability provided by the unified technology. This process of transformation does not start today. For the past ten years, we have seen a continuous explosion of these technology trends:

- Hypreconnectivity
- Supercomputing
- Cloud computing
- Sensors, Robotics, 3D Printing and other things which work on the Internet
- Cyber Security.

These trends have only strengthened today, and they are increasingly important for the cities which want to develop, modernize, achieve economic sustainability and provide a good place to live for their citizens. These trends cannot be simply

ignored because each of them makes strong impact on nearly every citizen's life. Let us take the first one, hyperconnectivity. This factor now drives the flow of nearly everything that is important for our wellbeing: goods, services, knowledge, skills, jobs and finally—our wealth. Hyperconnectivity is supported by the next two trends, supercomputing and cloud computing. Progress in building electronic circuits of very large scale of integration, coordinated with the development of new ways of dealing with data, has led us to a point where we can use a game-changing methodology: in-memory computing. This term means that the data are no longer trapped in physical discs. Bytes and bytes of information do not need to be written, stored and read again. The collected data are just electronically existing in these circuits, exposing persistent readiness to be processed (of course this statement does not apply to data archivization processes and long term storage).

Cloud computing also benefits from development of in-memory electronic appliances and from better telecommunication infrastructure. Rapid development of mobile networks caused fast growth of demand for this kind of computing service. Thanks to its capabilities, small mobile devices can efficiently use remote data centers. They become stronger and more capable. This approach created foundation for world-wide collaboration platforms where B2B and B2C transactions can be executed almost from everywhere, on every compatible device. In the next step, another type of technical world connects to this area. The physical part of our future life: newly designed sensors and robots, equipped with artificial intelligence have changed the game. All these physical devices have potential to create new reality which is called: Internet of Things. In this situation one can consider not only processing of information, but should think also about physical impact of computing processes which are going to happen in real time. For this purpose new concept has been created. It merges two technical worlds into one common solution: cyber-physical system. This physical effect is amplified by three dimensional printing with the final result of suppression of the impact of space (suppression means that we do not need to transport the product but can print it at the end of the journey). Finally, these technologies need new ways of protecting and defending themselves because bad actors have expansive new capabilities to attack, undermine and disrupt digital businesses. Cybersecurity comes as the topic number one because now the trust becomes our ultimate currency.

Modern city will benefit from these trends when installing and using many specific systems—like intelligent transportation solutions, multi-energy stations, smart houses, electric cars etc. But before going to these sophisticated solutions it is worth to consider five main pillars on which they are built. They are: digital platforms, new units of computing power, user experience and physical, connected devices and the last but not least–cybersecurity.

Let us discuss these pillars by answering following questions:

- What is the meaning of digital platform?
- How will supercomputing help to drive city with real time data?
- What is the real change for the user if the user wants to stay in the center?

- What is the real impact of Internet of Things in the real and virtual world?
- What are the goals of cybersecurity and how to access cyber services safely?

Finally, we want city and its citizens to stay happy. Playing only with technology does not create the answer about how to achieve happiness. Despite the fact that happiness or well-being are not the catogories which can be considered at this level, the last chapter takes a challenge to detect basic dependencies between new capabilities and citizens' wellbeing.

2 Focus on Digital Platform

World Wide Web, being a huge, globally distributed collection of information and data is accessed the Internet (the communication net connecting other nets) with the help of HTTP—Hypertext Transfer Protocol. This way, Internet became the most important medium of our days. However this way of exchange information created a big break through, it also caused many contemporary risks and threats. Digital Platforms seem to establish the next, important step for achieving safer and more user friendly networks. Unlike unsecured, free models of communication, Digital Platforms offer structural approach which creates many new opportunities for every modern city. They are often included to solution category known as 'Cloud' because of their remote presence, enabling 'no matter where from' mobile access. The first important fact is that the Digital Platforms are usually represented by well-designed and purposely organized infrastructure (Data Centers). This approach provides required level of scalability and information security. It is also critical for providing digital services what starts from provisioning space for simple data stores and moves up to sophisticated big data analytics. Platforms in their basic forms can be offered as an Infrastructure as a Service (IaaS).

"Infrastructure as a Service (IaaS) provides the infrastructural components in terms of processing, storage and networking. It uses virtualizations techniques to provide multitenancy, scalability and isolation; different virtual machines can be allocated to a single physical host. Examples of such a service are: Amazon S3, EC2; Mosso and OpenNebula" [2].

More demanding users (in our case: citizens) may obtain next level of maturity, relevant for specific user activities—like: collaborating with the other users, connecting their intelligent devices, creating personalized, graphical interfaces or analyzing data by using complex algorithms. For these users or developers, this kind of platform will provide convenient accounts enabling consumption of programming resources, managing application lifecycles, managing application data sets and their configurations. It is essential to know that this kind of user accounts are fully isolated and based on strong authentication mechanisms. This digital offer is called Platform as a Service (PaaS).

"Platform as a Service (PaaS) provides the service of running applications without the hassle of maintaining the hardware and software infrastructure of the Iaas. Googe App Engine and Microsoft Azure are examples of PaaS" [2].

Finally one can also imagine a platform which substitutes any solution which is traditionally used on premise. This approach can replicate to certain extend any functionality of traditionally well-known enterprise systems being composed of commerce, purchasing and human capital management solutions. Licensing and delivery model of this type is known as Software as a Service (SaaS).

"Software as a Service (SaaS) is a model of software deployment that enables end-users to run their software and applications on demand" [2].

It should be noticed that the capability of replication of traditional on premise systems needs to be analyzed each time, case by case. One can admit that certain limitations exists—for example: capability of flexible customization will not be as extremely high in a cloud as on premise. In contrast, administration and maintenance procedures are dramatically simplified for the cloud. Responsibility for development of the cloud solution exists on the provider's side and the new version of the software has better chance to arrive always on time.

Solutions deployed from the platform have also one additional feature which is not frequently discussed during their comparison with the traditional systems: their network orientation. This effect is more difficult to achieve by on premise approach. Here below, some representative examples are listed:

- Human Capital Management solutions, when deployed from the cloud, can better manage any network of internal or freelance employees, their skills or their contingency employments, comparing to capabilities of 'System of Records' provided by traditional Human Resources software.
- Procurement solutions deployed from the cloud have capabilities to link better suppliers and customers in multi-tier supply network, providing virtual space for their cooperation, comparing to traditional 'behind the wall' buying systems.
- Supply Chain Management solutions are based by their nature on networking and mobility. This is the reason why the platform approach is expected to provide more capabilities for better support of multi-tier and real time supply networks. This is also true when looking at every level of supply chain abstraction—from long term planning to short term scheduling and operational execution. Although nowadays it seems that traditional SCM solutions demonstrate higher maturity cumulated from many years of development, the cloud concept develops fast and becomes competitive. Significant example supporting this statement can be Supply Chain Control Tower which is pure cloud application by its nature.
- Finally—model SaaS has changed our traditional understanding of Customer Relationship Management. It seems that the cloud approach is better for managing omnichannels together with sales assets distributed over the wide networks and territories.

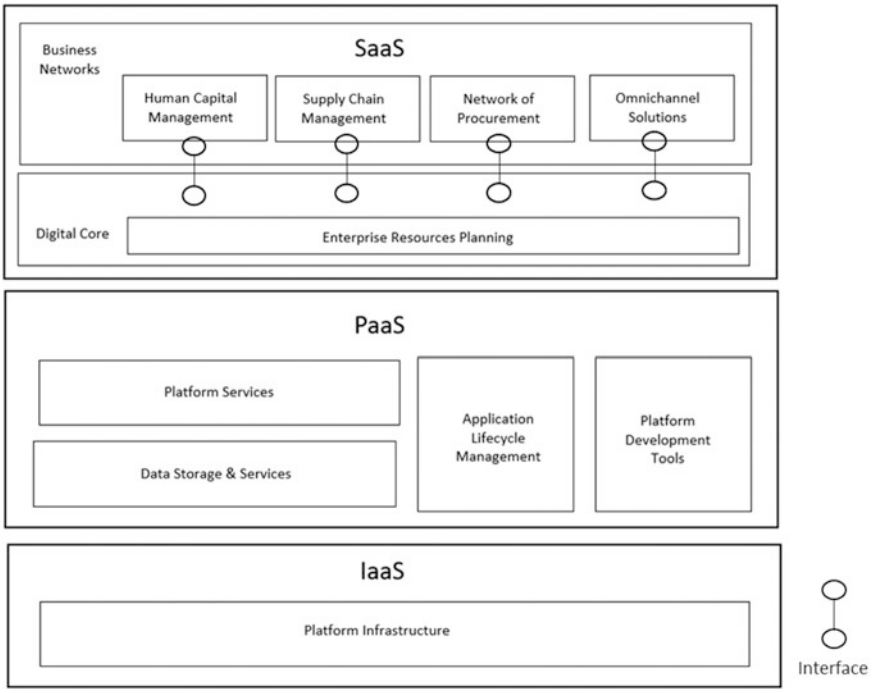

Fig. 1 Example of three layers of modern platform with its services

Thanks to all those features, all three models of providing technology are useful for citizens (IaaS, PaaS and SaaS). They can assure higher degree of safety of all solution constituents when engaging deeply with diverse communities at the same time. Platforms foster more openness and inclusiveness of the society what makes opportunity to address important factors of city improvement.

Figure 1 shows the example of the digital platform designed according to discussed principles. Now, one can see differences of this approach comparing to traditional solutions installed on premise. All components, like human Capital Management, Supply Chain Management, Procurement and Omnichannel Commerce can be deployed to interact with the network, integrating and unifying communication between different business partners. In result many new business networks with their specific business rules, standards and content can be created. From technical point of view, these business components are installed on the new concept of Enterprise System which plays the role of the so called Digital Core. This new solution type provides common, standardized Master Data logic for all of the business components, simultaneously acting as in-memory unit, processing data in real time. This way, the traditional Enterprise Resources Planning capabilities can be combined with the new network oriented approach. Let us not forget that Master Data are essential for each type of presented business solution.

They describe stable parts of business models like customers, products, technical locations, transportation routes, suppliers, price lists and many others.

In order to explain the role of Enterprise System better, let us consider following example. Let us imagine that predictive analytics system detected a real threat of malfunction of the certain traffic lights at a given street of the city district. In the next step relevant notification has been issued by the Asset Management system and Human Capital Management responded to that with planning workforce having skills matching to the specified task. During the same time, Supply Chain Management system checked inventory of the relevant technical parts and if they were missing, it entered new procurement order straight to the Procurement Network. When the service reached the status of being fulfilled, new facts were recorded, including work activities, material usage and labor costs. On the basis of that, electronic documents had been electronically undersigned and exchanged. Finally, invoices were submitted and corresponding payments collected. One can admit that this part of the process could not be done only in the network operating systems. In order to perform these tasks, centralized finance system is necessary and here the functional role of the Digital Core is quite visible.

This simple example shows that all business components installed on the platform can cooperate during planning and execution phase of the city maintenance service. Moreover, all business parties involved can share the same applications together as SaaS in a public cloud. There is also another possibility: selected or leading company can rent a private cloud for its internal solutions and make them partially available for its collaborators.

Another significant example of platform technology at work can be healthcare. Secure platforms, enabling proactive collaboration among patients and healthcare team can lead to improvement of their care plans. Participation of the other users (like family members) will build motivation and help them to establish clear health targets. Performance-based incentives will track their progress and measure the effectiveness of given rewards. Smart data (derived from big data analytics) and knowledge management will help the whole community to build sufficient health awareness.

Platforms can also be used for increasing public safety and security. By staying in touch together, people can protect themselves through greater community preparedness. They can increase any kind of public threat anticipation. City resilience will be improved by better monitoring and surveillance, early warnings and faster problem resolution. One example is the situational awareness based on interpretation of massive amounts of public safety data. This way the cities can better identify their risks, threats, and consequences of potential incidents, including criminal acts, security breaches, cyber-attacks or terrorism. By this approach, recognizing and analyzing anomalies will be done in real-time, so quick and protective measures will be applied. Merging theses data with geo-base services and making them available in mobile solutions will facilitate post-disaster, critical for saving lives and reducing property losses.

But not only during the evident crisis time can platforms be helpful. During daily life in the city, digital platforms will contribute to increasing comfort of using

different public services or purchasing commercial products. Services like membership management, digital content management or city related loyalty programs will create new opportunities for local economic growth. One should not forget that city communities will get more opportunity to exploit benefits of shared economy. By sharing assets in effective way (for example ridesharing), avoiding unnecessary waste and pollution, communities can shape their cities better and efficiently practice environmental sustainability.

One of critical factors enabling effective usage of the platforms in a cloud is its availability. This is the reason why modern cities invest in the first order into their telematics including infrastructure of fast data transmission, like fiber-optic rings providing ultra-high speed over open city networks (Example: Chicago, USA). The other approach is to provide wireless access to everyone together with open data which has significant value for the public—e.g. economic, historical geographical or meteorological (Example: Hong Kong, as Special Administrative Region of China).

3 Supercomputing Data Driven City

One of significant technological change during last years is the new way of treating computer data which are collected from the real world. For a long time, traditional methods of processing data were not moving far away from the logic of early computers. Despite big progress in electronics (Moore's law is still valid [3]) any logical data models were not changing relatively fast. Data in the traditional systems are still allocated in the linear address space, playing the role of the virtual magnetic tape like forty years ago. The main symptom of this phenomenon was still visible: it is a classical split between Online Transaction Processing (OLTP) and Online Analytical Processing (OLAP) type of data. This double nature of data is convenient for smoothing overload of databases, however it is also a cause of persistent delays between data actualizations and lack of data integrity in real time. Moreover: classical application architecture assume creating aggregates—many intermediate places where data are stored on different levels of granulation. Frequent data copying, replicating, storing in intermediate data buffers, slicing and freezing for reporting results with lack of real time information in the traditional IT system. This situation has been recently changed by the new technology: in-memory data processing.

Example: let us imagine situation where for traffic monitoring purposes one needs to count incoming and outgoing vehicles, passing by one hundred points of control in the city. In traditional approach, each registered vehicle updates relevant counter in the computer system. Two hundred counters (inbound and outbound) are stored periodically in time buckets (let us assume that a time bucket is one hour). These buckets are next aggregated into daily, weekly or monthly values and stored in Data Warehouse for relevant reporting. Thanks to in-memory approach, the way of data treatment may be completely different. Let us imagine that each vehicle

creates a small record with a timestamp in the computer memory without storing it in the database (of course these records are later periodically archived in order to avoid memory overflows—but considering capacities of modern in-memory appliances, it does not need to happen in short time horizon). Now, the analytical application can act according to the principle: 'code to data'. It means that data processing code can be sent to the same memory where original data exists and required calculations can be done exactly at this place. If the question of the user is: 'what is the balance of incoming and outgoing vehicles for the time period of latest 4 hours?', the relevant report with the answer will be generated in flight. There is no need to keep aggregates or predefined reports. All data are real, coming from one source which is updated in real time. There is also no need to split data according to OLTP and OLAP categories. The principle 'one version of truth in the computer system' can be easily applied here.

Example of this type of thinking, based on SAP in-memory product HANA, is presented in [4]: "People doing database work normally bring all the data they are working with up to the application layer for analysis. When the database can't handle that, they are trained to work around the problems. With HANA, you rethink your approach to data modeling. The more work that gets done in the database, and the less data that makes its way to the application, the more power you have in the system and the bigger the performance gains over traditional disk-bound database applications. We call that "HANAfying" your application." And later: "Finally. look at ways of moving application logic into database. Whenever possible, move calculations that would have been once part of the design of the application into database calculation view. You'll find that they will run faster inside the database, and that by providing these results in views you can reuse them in other context."

Now it is possible to imagine a city being driven by this type of real data approach. No pyramid of reports is necessary but real time data which creates transparency and responsiveness. In this situation, good city governance can be supported by well-defined performance, efficiency, and accountability. Due to the fact that information derived from raw data is generated in flight, any insight to the situation can be strictly role-based and contextually defined. All reports start to be fully meaningful for their stakeholders. Each of the stakeholders can keep appropriate transparency of the performance while aligning corresponding operations with strategy. Specially designed dashboards for instant, interactive data visualizations will be used. This can be also a place where key performance indicators (KPIs) gleaned from best-run cities and local governments worldwide can be easily benchmarked and compared.

Any modern city, using real time data access can better formulate its development strategy and translate it into execution as a foundation of creating environmental and economic sustainability. In this circumstances midterm planning and budgeting can be done faster and be more accurate. Capabilities of measuring and optimizing scarce resources will support all these tasks. Because of to lack of aggregates and data distortions, predictive analytics will be operating on always updated information. It will be not only giving reliable results but also enabling fast reaction on incoming events, sometimes—unfortunately also threats.

4 Internet of Things

In the early concept of World Wide Web, the network was created in purpose of exchanging documents which can be read by humans and referenced by hypertext. In contrast, nowadays more and more data are exchanged by connected, physical devices. The amount of transferred bytes of information seems to be greater than all volumes created by human beings. IT analysts forecast that by 2020 there will be 50 Billion connected devices of this kind with 1.9 trillion dollars of their economic value [1]. Until we have reached this point of time no one can tell how realistic this predictions are, but even now this phenomenon proves that the global network transforms from human-to-human connections to the human-to-machine and machine-to-machine interactions. If this approach is developed properly, it should not be perceived only as risk or threat for human role in future digitized world. The most of all, it may be considered as the major opportunity for further development of useful side of Internet. By analogy to the early network development, one can observe that adding any new physical device to the data processing concept, in majority of cases created new, attractive dimension of Internet growth. This happened right after launch of Apple's iPhone and was repeated to certain extend after introduction of iPad. The devices of this kind boosted fast growth of mobility. Let us notice that each such an item is autonomous, what means that it has internal intelligence (operational system) and owns its proprietary set of data. Such an architecture pattern can be replicated to other physical objects, like measurement devices, vehicles, buildings and other smart connected product. They can use their own electronic systems, sensors and software, however their intelligent features can be masked from the perspective of the whole global network. This is great advantage because they can be treated as 'intelligent black boxes' and thanks to this, the network will gain significant flexibility and expansion power. Its structure will be easily modifiable with no need for reconfiguring or effort consuming customizing. In result, large amount of Big Data will be continuously, automatically collected and—what is equally important—the network will contain dispersed intelligence with certain amount of processing redundancy. This is an opportunity for cities to improve management of their all critical infrastructures by adding to them more intelligence. Two options are possible at this point:

- Data can be transmitted to the selected hubs and processes centrally (in data centers)
- Edge computing principles can be applied, where applications are pushed away from the centralized points to the logical extremes of the network.

In the first approach, similar to this one tested currently in manufacturing industry, cities can follow their idea of digitalization of physical world. In this approach smart, connected devices will be supplying real time information to the cyber-physical systems, in other worlds: logical areas where situational images of the reality will be re-created and further analyzed. Simulation models and algorithms will be applied to them. This environment is ideal for connecting to other solutions mentioned above—like: in-memory data processing or platform based

applications. It is very probable that looking at the city through its virtual models, updated in real time by connected devices, will become effective management practice in the nearest future.

Currently real life examples of this approach can be presented in the area of waste management, where municipal waste collection is based on smart bin tracking and truck telematics in real time. Additionally self-service mobile application are added to that solution for billing, requesting of bulky waste collection and relevant reporting. Using sensor data create efficient planning context, enabling workforce planning, asset management for bins, trucks and recycling stations (Example: Duisburg, Germany detailed sescription of this case can be found at [5]).

Also energy management will benefit from mass data collection from sensor devices. The first and very intuitive idea is to monitor energy consumption and shape better user behavior for avoiding energy waist. More automatism can be added to that by observing ambient conditions and steering devices automatically for better energy consumption. Good example at this point can be street lighting system which optimizes energy consumption at the level of its individual lights, according to traffic conditions, number of pedestrians on the street, weather or ambient light depending on a day time (Examples: Los Angeles, USA; Oslo, Norway). Connecting these kind of systems to the intelligent buildings looks to be the next step of this solution development. Street lights, as they are natively connected to their central unit, can also play the role of excellent Wi-Fi access points. This approach will provide easy connectivity for home automation or smart metering.

Importance of the Internet of Things for energy management goes far beyond the city boundaries. It makes impact on the whole energy value chain: generation, transmission, distribution and storage. It modifies the definition of traditional Power Grid and converts it into Future Smart Grid where many small power plants can cooperate together, by using digital communication for real time energy balancing. Such a Future Power Grid needs to cope with many distributed energy resources, including photovoltaic systems and wind turbines that is why new concepts are currently being developed and tested. As an example of this trend Smart City Rheintal Project (Austria) can be mentioned. The goal of this project is to leverage local existing resources, including hydropower in order to make the whole region energy independent (the plan assumes to reach this goal by 2050).

Very similar role of Internet of Things can be observed in the area of water management. Capabilities for predictive maintenance are widely used in the water smart grid concept. Water leakage attributable to aging pipes can be significantly minimized. Cities can better control the flow of water using sensors in their water pipes which are also connected to their pump control systems. Depending on water consumption measured in real time, the amount of water in the whole distribution system can be precisely regulated. This way, the amount of leakage is reduced and formation of new leaks is minimized. Unexpected events like pipe bursts can be predicted, avoided or—if detected—also responded in shorter time, minimizing water loss.

The second approach to Internet of Things, as mentioned before, leads to the more autonomous network of distributed, connected and intelligent devices. Here we may experience an evolution: from simple limited device-to-device connectivity to initially defined Subnet of Things. This areas will be managed by specific industries or city communities. In future, by adding new applications and solutions which can seamlessly share data, a full scope of distributed intelligence network will be created.

The scale of possible applications of such a Subnet of Things for a city seems to be endless. This is only the question of how innovative city leaders can be in proposing new solutions and new business models. Currently we can see big opportunities for creating smart services based on:

- Preparing contextual information by using Big Data techniques, for example: real time traffic conditions
- Using this information for controlling other processes or human behavior, for example: linking vehicle control systems with contextual information for helping the driver to drive the car better
- Getting feedback from the controlled processes or human behavior, in this example: driver's behavior will help to create his profile and in combination with real time location will streamline his personal contextual information, prepared especially for him.

Currently small part of these capabilities have been applied to the real life. One example is improving car parking in the city center. It has been measured that about 30–40% of traffic in the city center is generated by drivers who are looking for parking place. By implementing smart parking solution which informs drivers about parking space availability, cities can reduce this traffic congestion and improve automatic billing (Example: Barcelona, Spain). Similar pattern can be used form helping passengers in using public transport. In the simplest case contextual information presenting current traffic at passenger's waiting location makes a difference. A person who is waiting at the bus stop, can be receiving real time information about expected bus arrival time on his or her smartphone. More sophisticated version of this solution can lead to planning capabilities where one can arrange his or her travel, across the city by using information about multimodal means of public transport. The most sophisticated approach of this kind can lead to a new business model for personal transportation. This approach combines public transit, car travel, cycling and even walking into one stream which can be executed by the user on request. Developed model of this kind of public transport system is presented at [6]. Large automotive companies also can join this game by offering alternative routes, taxis, shared cars or bicycles. In order to provide relevant environment for this type of activities, the city needs to provide unified pricing and ticketing service, also should harmonize different means of transport and put them into one collaborative and operational mode.

The other trend based on Internet of Things is 'Servitization'. This concept has been around since 1980s, however now it gained full capability to develop fast.

"The basic idea of servitization is that the manufacturers move from a model based on selling assets toward a model in which they offer a service that utilizes those assets" [1].

In the context of city it will create opportunity for introducing new city services based on city infrastructure. One example can be the model of sharing vehicles. Nowadays it is common and very popular to share bicycles however in the nearest future sharing personal cars will be also possible. A car equipped with special terminal enabling driver check-in, check-out, geo-locator and movement tracking system is already technically possible and tested. In order to implement this service, the new business model is required because this is idea is totally based on innovative thinking. It will be even more critical when the new generation of this car will be autonomously driven.

5 Cybersecurity

Even small progress and development, leading to the new approach, new technology and new solution, creates new categories of security risks. This topic is huge and surely it cannot be closed in one small chapter. Discussion about security frequently starts when solution cloud deployment model comes to action. Many users intuitively worry about their sensitive data dispatched somewhere in the air. But there is also good news: great portion of security is also delivered together with the cloud itself. Assuming that the cloud provider is IT professional, it seems to be good approach to outsource the fight with viruses, malware, exploits and other serious threats to the provider's skilled teams. The fact that the software in the data center is properly maintained, timely updated and continuously evaluated against potential security threats, is one of the major benefits which are available since very beginning. Here, in this chapter one can consider remaining problem which is still on the user side: how to access safely all of these protected resources in cloud environment? In order to find the answer, let us start with the basics, considering goals of every security system.

At the beginning it is possible list three main goals of the Internet security system:

- Confidentiality
- Integrity
- Availability.

Confidentiality means that all confidential information, like passwords, paying details, health, private letters and others, cannot be read by anybody who does not have relevant authorization for doing that. Integrity considers ability to protect data and information from unauthorized manipulation. In case of data distortion due to poor transmission conditions, the user should be capable to discover this kind of technical fault by himself. Availability means that no one who has not permission can stop the service or computer the user is working on.

These goals have created foundation for longer list of security derivatives:

- Authentication—confirming identity of a given person or user;
- Access Control or Accountability—allowing access only for the users with relevant authentication;
- Anonymity—keeping identity protected for other communication participants in the open network;
- Privacy—keeping personal data safe;
- Non-observability—protecting communication not to be observed by 3rd unauthorized parties in the open network;
- non-repudiation, legal enforceability—keeping stable relation between identity and data transmitted. For example: in case of bank payment process, there is always relationship between user identity, bank account and transaction document.
- Copy protection—assuring that the information can be copied only by the authorized user.

All these security goals and its derivatives show that simple approaches based on sending user login and password to the receiving parties are highly irrelevant for the cloud technology. Keeping these credentials at the user's account with the user data, would act like direct call for action for any hacker. Moreover, brute force type of attack, considering contemporary processing power which hackers can easily possess, would probably have high rate of success. This is the reason why authentication mechanisms were introduced. The main principle here is that identity management and authentication processes are delegated from the platform provider to a trusted identity provider. Special protocol is needed for this kind of communication due to exchange of sensitive information. Nowadays, XML based protocol called Security Assertion Markup Language (SAML) is widely used for this purpose. Figure 2 presents basic idea of this kind of authentication. Let us assume that for the first time, the authentication is being delegated from the platform to the Identity Provider (1) by setting trust relationship between two systems. Next, the user sets relevant account at the same Identity Provider and verifies his or her authenticity. In result, the user needs to sign on to this account or to install relevant certificate to his or her personal web browser. These specific mechanisms may be different for different implementations but this fact does not make any impact on the rest of the authentication process. When the same user wants to access the platform protected resource, the platform sends request for authentication through the web browser. In response, the Identity Provider sends via the same browser confirmation to the relevant application (2). Since that moment the protected resource can be accessed (3) without transferring any critical credentials.

The situation becomes even more complex when the user wants to use not only the web browser but any autonomous application which is run on his or her device. This situation became realistic since Twitter, Facebook, and others started to open their platforms to 3rd-party applications through Application Programming Interfaces (APIs). In this case the process can be split into two stages: classic

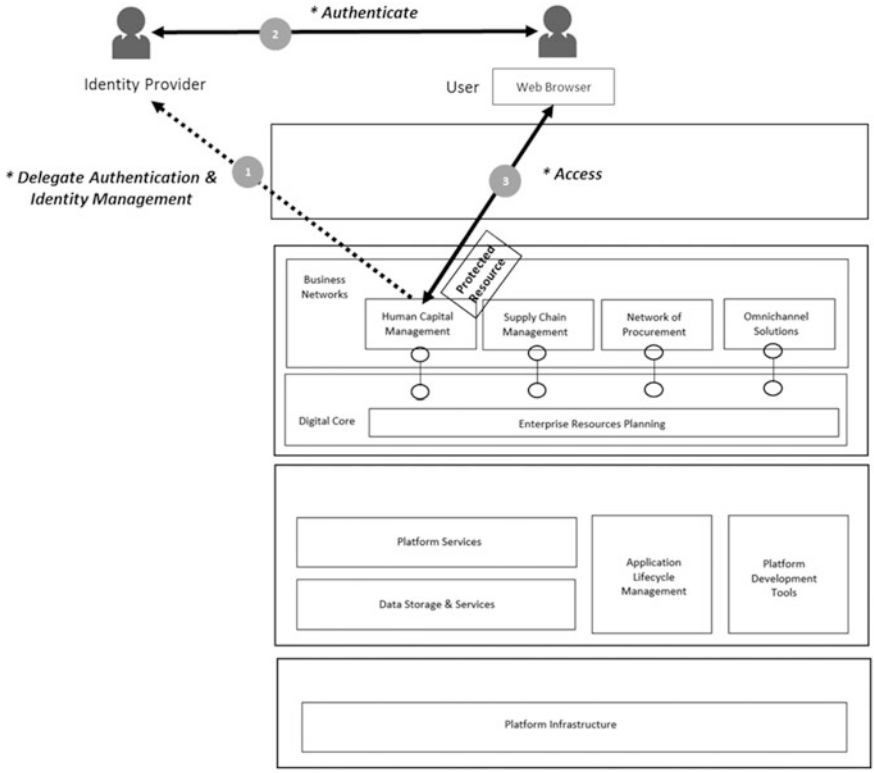

Fig. 2 Example of three layers of modern platform extended to the user interface with authentication

authentication (similar to the previously described case) and the second one: issuing the Access Token with limited accessibility scope and duration of validity. The last feature is important because the user's application should be able to access only strictly controlled portion of protected resource according to the user's actual role. As the example let us consider issuing leave request. It can be assumed that the requestor does not approve his own requests, so the token will not allow him to access this function. Considering authentication process, major difference at this case is that additional server for authorization is required. This can be explained by consideration the open standard for authorization called: OAuth. In the scenario presented on Fig. 3, the user initiates the process (1) and the request from the device is being sent to the OAuth Authorization Server (2). Next, authentication by interaction with the Identity Provider is carried out (3), (4).

After getting positive result, the user's device gets relevant Access Token (5). This fact creates the basis for accessing protected resource from the application through relevant Web API (6).

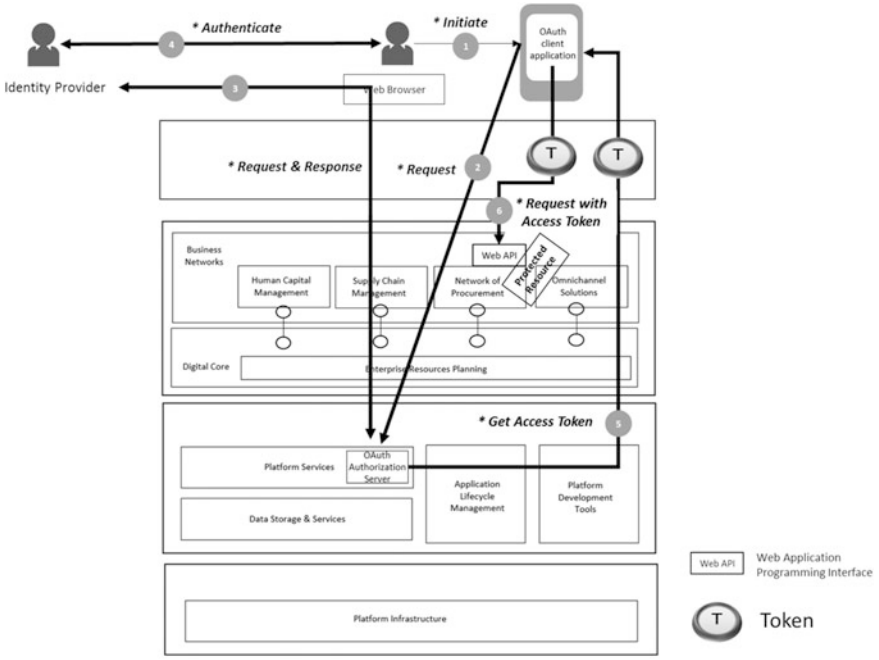

Fig. 3 Example of three layers of modern platform extended to the user interface with authentication and Web API protection

6 The impact and outcome

Finally, having all presented capabilities in mind, one can discuss their impact or more precisely: how to make the cities—in the first step: smart and in the second:—happy. It is worth to note that as the first factor (being smart) depends much on technology, the second one (being happy) describes how the citizens can feel. The definition of smart city is still under construction [7] and its concept is based on the idea of integrating capabilities of technology with the city services. It is still in the phase of development by setting up practical implementations. When thinking about applications, the possibilities seem to be endless. In traditional approach they are proposed by software vendors. In more mature approach (Smart Cities 2.0) the solutions and necessary IT applications are proposed and even designed by citizens themselves.

According to [7] Smart City 2.0 "can therefore be described as follows: it is a community aimed at individual and urban (self-) preservation comprising all groups of human stakeholders. Their behavior (including production and consumption) is completely geared to the urban goal system jointly developed by all of them on the basis of the city's meta-goals (sustainability and generalizability). They are committed to their diverse community goals, champion their sovereignty as consumers,

residents, and humans, as well as the protection of their city's natural environment and wildlife. To achieve this, they employ technical facilities to a great extent, but do not allow technology to expand uncontrollably, dominate urban life or acquire decision-making authority."

There are major characteristics that make a city "smart" can be summarized as follows [8]:

Immersive city services through the use of real-time data sensing;
Knowledge engineering that enables the aggregation and parsing of all of the data;
Gaining access to data in a seamless manner that contains information from various interlinked domains.

Every city with this kind of aspirations is developing its own way. For example city Amsterdam launched public–private partnership in order to transform Amsterdam Metropolitan into a smart city. One activity was called Apps for Amsterdam, which "challenged app developers to take publicly available data and build apps to improve the lives of residents and visitors" [9]. Good example of its result could be application highlighting a risk of house burgle, depending on environmental conditions. This kind of approach can be treated as template for other cities. As was written before, there is huge amount of data in the network and using them is a good challenge for innovative thinking. Other directions of developing applications and solutions in Amsterdam are:

Data driven traffic control connected to car parking coordination system;

- Programs supporting sharing economy;
- Electricity points for electric vehicles;
- Smart grid for energy management (Nieuw-West).

In contrast Barcelona has a vision of being self-sufficient, producing zero emission [7]. That is why the city developed bicycle sharing system, installed thousands of urban sensors for Near Field Communication protocol and launched many other projects—like telemanaged water irrigation.

So these examples are repeatable and easy to reproduce. Here one can formulate more generic city solution model based on three pillars (please, compare [10]):

Urban Resilience, group applications which care about public safety, security and citizens health. It can also contain solutions addressing sustainability problems and supporting sport activities.

Digital Transformation, enables new digital best practices in city governance (including city workforce management), improves user digital experience (cares about user interfaces, user devices), helps to embed data to daily base decisions (data-driven cities).

Economic Prosperity, what means all applications for sharing economy, integrated transport and mobility. This pillar also groups asset infrastructure pro-active management and maintenance including waste, recycling, energy and utilities.

Technology will not make these cities happy only because it is provided on place and used according to instruction. Cities need to have their vision which is based on

human values, expressed in common and agreed citizens' goals. Technology, despite its great potential for automatization and artificial intelligence, needs to support citizens and not force them to do things which they do not want, do not like or are not aware of. The positive vision of a city is based on creating a great place to live. Most of these topics come from the discussion about organization of the city space. At this point the question can be posed, can a happy city be different from the cities we know today? How much can its concept be moved away from the twentieth century monsters with scattered suburbs and inhabitants struggling with traffic jams every morning and evening? Does it mean that the happiness starts from our understanding of this word and from our perception of a city in this context?

In contrast, if only technology stays as a driving factor, without our taking care of happiness, it may lead us to a point where the cities we know today will simply disappear during the next twenty years. "Economy of space" will take the upper hand. With the cost of distance declining, some cities may no longer be the important business or political centers they are today. Of course, this is a very futuristic vision, but an initial trend of urban space being left by smart employees who can work remotely has already been observed, initially in the United States. There are also examples of new cities built but not happily planned, and not developing as fast as they were expected to.

It is a very intuitive understanding that happy city means the place when people stay together and interact. Physical, natural interaction is more important than electronic communication. This is not a contradiction: at this point technology will help citizens to sense better their rate of participation. But this participation will not be triggered by technology. The city unique spirit is crucial here. If these conditions are fulfilled, better interaction with city institutions will be possible. IT tools and solution will help. Information visibility and access will be improved by opening new, efficient communication channels.

The notion of happy also city means a prosperous place with better governance. By using technology, there is a great chance to improve the information quality of decision making. This goal can be achieved by monitoring key performance initiatives and related impacts of associated projects. It can also benefit from integration of planning processes with the complete performance management cycles and generating reliable collaborative planning information. In the next step, better linking strategies and objectives with operational plans and execution projects will improve compliance and risk management. This can be a preparation phase for implementing full city sustainability and development program. A good example here is a smart city program in Stockholm where structured dialog with citizens and business had been set up. Another one is Rio de Janeiro, the city which invested in a big Center of Operations, providing the required level of city services management.

Prosperous cities demonstrate economic sustainability. They need to find new revenues by applying new technologies. Introducing smart and better services for citizens and tourists, and encouraging them to use public transport instead of private cars, is another good example. Such an offer should be attractive and convenient. Initiatives of this kind need to be coordinated with a removal of big city pain points —such as s high rate of traffic accidents due to the number of cars or a sense of

insecurity in public places. This topic is especially important now that terrorist attacks became a real threat for Europe.

Finally, the happy city should know how to make savings without diminishing its citizen's wellbeing. This can be done by increasing city assets utilization with a simultaneous reduction of environment, health and safety management costs. At this point, network based technologies open great opportunities.

On the basis of the examples given, one can see that while technology is important, it is neutral in the context of happiness. It is an enabler of well-designed city development plans. The snag is that cities generally not always consider global pictures when it comes to specific improvements or removal of specific pain points. In contrast, an uncontrolled, spontaneous use of modern data processing technologies creates many new dependencies and vulnerabilities. Technology based disruptive business models develop fast, which means that the technology supplier frequently has to translate the city's needs into smart and safe solutions. As these solutions became more and more user centric, it is important to learn how to include all city stakeholders into the process of effective design and prototyping.

References

1. Slama D, Puhlmann F, Morrish J, Bhatnagar RM (2015) Enterprise IoT. O'Reilly Media 1:5
2. Dobre C, Xhafa F (2016) Pervasive computing, next generation of platforms for intelligent data collection. Elsevier Inc. 50
3. Moore's Law, Wikipedia https://en.wikipedia.org/wiki/Moore%27s_law
4. Jeffrey Word (2014) SAP HANA Essentials, 5th edn. Epistemy Press LLC: 403. http://www.saphanabook.com/
5. Wirtschaftsbetriebe Duisburg—AoR (2015) Keeping the city clean and clear with SAP waste and recycling. SAP Business Transformation Study, SAP SE
6. Gruel W, Piller F (2016) A new vision for personal transportation. MIT Sloan Manage Rev 57(2)
7. Chirine Etezadzadeh (2016) Smart city—future city?, smart city 2.0 as a livable city and future market. Springer, Medien, Wiesbaden
8. Mohammad S, Obaidat PN (2016) Smart cities & homes. Key Enabling Technologies, Elsevier Inc
9. Fitzgerald M (2016) Data driven management, a close look at Amsterdam's city initiative. MIT Sloan Manage Rev. http://sloanreview.mit.edu/case-study/data-driven-city-management/
10. SAP Solution Explorer https://solutionexplorer.sap.com

Lessons from a Large Scale Demonstrator of the Smart and Sustainable City

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Abstract Concentrating a large part of the planet's population and economic activity, cities consume around 70% of the energy in the world and generate around 80% of the greenhouse gas emissions, responsible for global warming and climate change. If the greenhouse emissions are to be reduced, our cities must be transformed into more sustainable, ecologically and socially responsible entities. This transformation requires huge investments in the construction of new urban infrastructure, and adaptation of the already existing infrastructure towards meeting sustainability requirements. Affected by funding shortages, cities have been turning their attention to the Smart City concept with its promise of optimal management and sustainability, to be achieved at the optimal costs. A significant barrier, though, is lack of experience in the field. Cities must first learn through large-scale experimentation and pilot projects covering various sides of the smart city concept, such as an urban information system, smart monitoring, data analytics, optimal management of infrastructures, and citizens' involvement in city governance. To help meeting these goals, a Smart City initiative was launched in 2011 by a consortium of public and private urban actors, seeking to provide a large-scale demonstrator to analyse, explore and visualize how the Smart City concept could be implemented. This chapter presents the demonstrator, which is run at the Campus of the University of Lille (northern France). The campus stands for a small town of 25,000 residents. After a discussion of the Smart City concept, the paper moves to describing its implementation at the University of Lille Campus and presenting the project's early results.

Keywords Smart City · Smart water · Smart grid · District heating · Internet of things · Smart sensors · Sustainable city · Demonstrator · Experimentation · Large scale

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1 Introduction

Cities around the world already represent 50% of the global population—and by 2050 the proportion is expected to grow to 75%. Due to this high concentration and aging infrastructures, cities produce around 80% of the greenhouse gas emissions, which are responsible for global warming and climate change. In order to protect our planet and ensure a good quality of life for citizens, cities must be transformed into more sustainable organisms that are eco- and socially responsible. This transformation requires huge investments to build new—and adapt existing—urban infrastructure, and thus meet sustainability requirements. Due to a shortage of funding, cities are particularly interested by the Smart City concept, which uses both digital and social innovations to achieve sustainability goals at optimal cost [1–4]. However, the implementation of this concept suffers from insufficient experience in this new area of large scale innovation.

Cities need to learn more about the concept through large scale experimentations and pilot projects covering the various sides of the smart city such as (i) construction of urban information system including both assets and operating information of urban systems, (ii) smart monitoring of urban infrastructures, (iii) analysis of large amounts of data, including both historical and real-time data, (iv) optimal and secure management of urban infrastructures and (v) involvement of the city stakeholders in the city governance.

The construction of smart cities' demonstrators and pilots is seen as a major element in the strategy of Smart Cities development around the world. In June 2011, seeking to provide a boost to smart urban technology, the European Commission launched an Innovation partnership for Smart Cities and Communities [5], with a particular focus on a small number of demonstration projects to be implemented in partnership with cities. In the United Kingdom, in 2012, the Technology Strategy Board launched a Future Cities Demonstrator Competition [6], which challenged UK cities to show how they would integrate city systems to create better places to live and work. The competition included a two-stage process. In the first stage, cities were invited to bid for funding to carry out the feasibility study for a demonstrator project. Among the 50 cities which submitted feasibility study proposals, thirty were awarded grants of £50,000. In the second stage, 26 cities submitted proposals for a large scale demonstrator, to which purpose up to £24 m was set aside under the project. The Glasgow City Management System [7] was selected in that competition.

In December 2015, the U.S. Department of Transportation launched a challenge [8] backed by a $40 million fund to support the city which would become the country's first to "fully integrate innovative technologies—self-driving cars, connected vehicles, and smart sensors—into their transportation network". The city of Columbus came out the winner. Yet another project, the Smart City Initiative of Amsterdam [9] includes smart pilots in eight sectors: smart mobility, smart living,

smart society, smart areas, smart economy, big and open data, infrastructure and living labs.

This chapter aims at sharing the results of the 5 years of large scale experimentation with the smart city concept (SunRise Smart City demonstrator), run at the Science Campus of the University of Lille, northern France, which stands for a small town of 25,000. After a presentation of the Campus, the chapter describes the implementation of the Smart City concept and summarizes the lessons learned from the different stages of this large experimentation project. The focus is on the methodology followed in the construction of the demonstrator, the smart monitoring of urban networks, and the economic returns of the Smart City concept.

2 City Challenges

With the increasing unban concentration of both the population and economic activity, cities meet large challenges, in particular:

- How to ensure basic urban services such as transportation, water supply, sanitation, energy supply and management of solid wastes?
- How to ensure the safety, security and resilience of urban infrastructures and services regarding natural, human and industrial risks and disasters?
- How to contribute to sustainable development by reducing natural resources consumption and greenhouse emission as well as the pollution of soils and water resources?
- How to engage citizens in sustainable development of their city and in its governance?

All of these challenges are related to the quality of life in the City, which is a determinant factor in building a Happy City. Happiness in the city requires a high environmental quality (green space, public space, fresh air, ease access to natural resources …), excellent urban services (mobility, education, health, culture, entertainment …) as well as involvement of citizens in the city governance.

The capacity of cities to address these challenges depends on the quality of urban infrastructures such as the transportation infrastructures, electrical grids, drinking water, sewage, gas and telecommunication networks. In developed countries, cities have large urban infrastructures, which were mainly built in the 20th century. The upgrade of these infrastructures to meet the sustainability and resilience requirements needs large financial investment. In less developed countries, cities need huge investments for the construction of new urban infrastructures to ensure the basic urban services for citizens.

The management of urban infrastructures is crucial for the city development. It should ensure an optimal use of the urban infrastructures and their interoperability. The infrastructure management requires a good knowledge of the infrastructures asset and operating performances. The use of the Geographic Information System

(GIS) constitutes an excellent tool for an efficient management of the infrastructures. A monitoring program is also required to understand the operating performances of the infrastructures. Numerical modeling could also enhance our understanding of the infrastructures state and operation, and consequently reinforce our capacity in the optimal city management.

3 Smart City Concept

The Smart City concept aims at using the digital technology as well as social innovation for a real-time monitoring of urban infrastructures and services [1–4]. Monitoring includes smart sensors and actuators connected via wired and wireless communication networks, which allow a real-time supervision and control of urban infrastructures. The sensors readings and users data are stored in large data sets together with information on the infrastructure asset and other useful data such climate information, traffic, users' profiles and consumptions. The data could also be enhanced by images, videos and audios resulting in the construction of urban Big Data.

The analysis of the real-time and historical data results in an enhanced understanding of the infrastructures and services performances. It allows also an optimal management of the infrastructures by reducing the energy and water consumptions as well as the pollution emission. In addition, the system can detect abnormal events, which could be related to infrastructures fault or unusual consumptions. Consequently, rapid intervention could be carried out to ensure the infrastructure security.

The Smart City concept offers also technical possibility to confine a local fault and consequently to prevent its extension to larger areas or to other urban networks. In the case of a general fault, the Smart City concept allows easy and safe self-healing.

Furthermore, the Smart City concept is based on the interaction with citizens. It provides citizens with pertinent information about the city services, infrastructures operation and safety issues. Citizens enhance also the urban information system by providing their observations and reactions as well as by spreading useful information via social networks. Thanks to the interaction with users, social networks could enhance the Smart City system, and consequently highly increase its capacity in the sustainable and resilient management of cities. In the case of urban disasters, citizens could be informed and mobilized in the organization of emergency actions.

The Smart City concept will provide authorities with pertinent data about the real performances of urban infrastructures as well as the citizen behavior during any urban crisis or disaster. Analysis of this data is crucial for a good understanding of the real behavior of the City (infrastructure, citizens, public services, emergency…) during any urban crisis or disaster and consequently to improve the city's capacity to address the challenge of resilience.

4 Presentation of SunRise Smart City Project

4.1 Objectives—Originality

The SunRise Smart City project was initiated in 2011 by a consortium of academic, industrial and local government partners to build a large scale demonstrator of the Smart City, with a particular focus on urban infrastructures. Through this project, the consortium aimed at developing an international expertise, bringing together experts of governmental agencies, industry and academia, for the assessment of the environmental, economic and operational impacts of the Smart City concept in improving the current state of practice and the city capacity building in the field of sustainability. The demonstrator was established at the Scientific Campus of the University of Lille, which stands for a town of about 25,000 inhabitants.

The originality of SunRise project lies on the following: (i) it concerns a large scale experimentation that of a small town, (ii) it covers the totality of urban infrastructures as well as buildings, (iii) it is supported by a large local government, industry and academic partnership, (iv) it is used as a living lab for both research, education and PhD programs and (v) it is conducted within an international environment.

This project was launched through a large partnership with both cities, urban services providers as well as start-ups. The project road map was established after 1 year of discussion and brainstorming with the city stakeholders. The implication of industrial partners greatly facilitated the implementation of this project. In addition, this implication allowed the integration of international practices as well as latest technology in this project.

4.2 Presentation of the Scientific Campus, Support of SunRise Demonstrator

SunRise Smart City demonstrator is established at the Scientific Campus of the University of Lille, which is located near the City of Lille in the North of France. The campus stands for a small town with about 25,000 inhabitants. It was constructed between 1964 and 1966. Latter on, some buildings were renovated and others were constructed. The campus includes 145 buildings with a total construction area of 325,000 m^2 (Fig. 1). Buildings are used for research, teaching, administration, students' residences and entertainment activities. The campus is deserved by 100 km of urban networks: drinking water, storm water, sanitation, electrical grid, public lighting, district heating and roads.

Fig. 1 Scientific campus of the University of Lille, support of SunRise demonstrator (145 buildings, 325,000 m^2)

4.2.1 Drinking Water Network

The smart water system aims at improving the asset management, the reduction of the water leakage and the enhancement of end-users information and awareness [10–15].

Site Description

Figure 2 shows the drinking water system of the Campus. It is composed of 15 km of grey cast iron pipes over 60 years old with a diameter varying from 20 to 300 mm. It also includes 49 hydrants, 250 isolation valves and a set of air valves. The water network is supplied by the local water company at several sections located in the North, West and South of the campus (identified by red color in Fig. 2).

Smart Monitoring

The water network system is monitored by 93 Automatic Metered Readers (AMR) and 5 pressure cells (identified by green color in Fig. 2). The Automatic Metered Readers (AMRs) provide at 1-h time lag the water supply as well as the buildings consumption. The pressure sensors provide at 15-min time lag the pressure in 5 sections of the campus. The data transfer is carried using a local radio network, which is connected via GPRS to the central sever.

Figure 3 shows an example of the variation of the water flow and pressure in a teaching sector during a week in April 2014. We observe a regular profile of the water consumption, with significant consumption during the working hours. The daily variation is related to the change in the teaching activity, which is maximum in Tuesday. The minimum night flow (0.7 m^3/h) is also observed during the

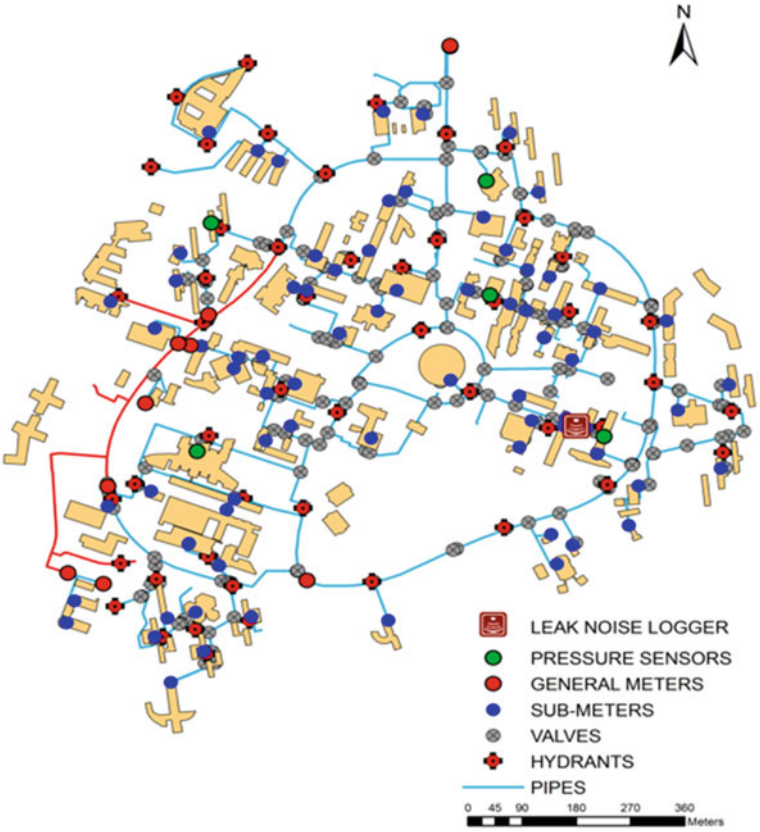

Fig. 2 SunRise drinking water system asset and monitoring

week-end, which indicates the presence of leakage in this sector. The pressure varies around 3.1 bar. It decreases with the increase in the water consumption.

Leak Detection

Two methods were used for the detection of water leakage: The Minimum Night Flow (MNF) and the Water Balance.

The Minimum Night Flow approach is based on the water flow between 2:00 and 4:00 am when the demand is minimum, the pressure is high and leakage is dominant. Figure 4 shows the result of the application of this approach on the campus in the period July 2015–March 2016. Two events related to leakage are clearly observed August 11 and September 17, 2015.

The volume water balance method is based on the balance between the volume of water supply of a sector and the volume of the totality of consumptions within this sector. AMRs provide data which allow to establish the water balance and to detect water leakage.

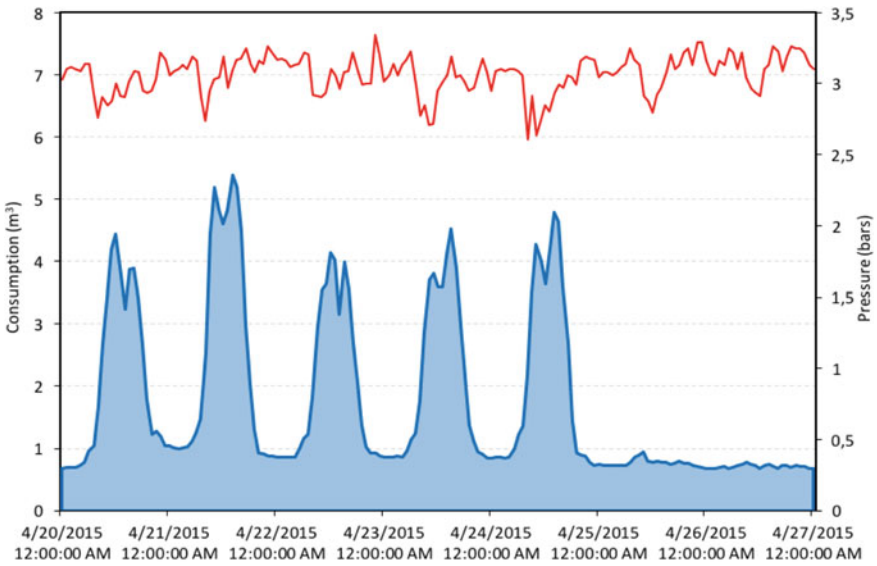

Fig. 3 Example of water flow and pressure registered in a teaching sector

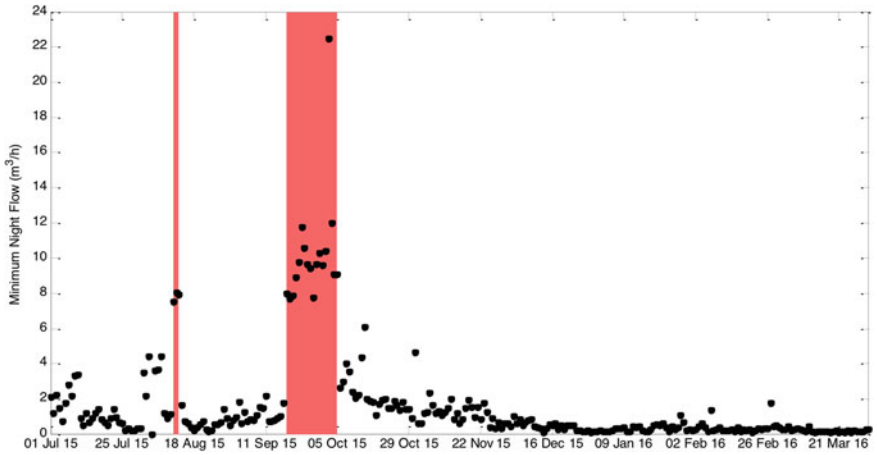

Fig. 4 Application of the minimum night flow to the water system in the campus (July 2015–March 2016)

Figure 5 shows the result of the water balance (difference between the water supply and the water consumption in the Campus) in April 2016. We observe a variation of the water losses with a minimum around 30 m^3/day. This figure shows clearly 2 peaks, followed by a rapid drop. These peaks are related to water leakage, which was immediately repaired.

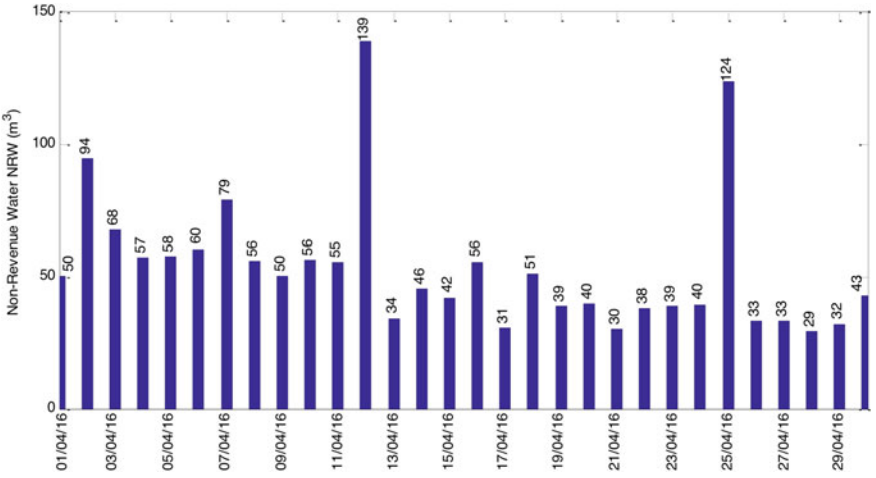

Fig. 5 Application of the water balance method for leakage detection

4.2.2 District Heating

The smart heating system aims at the improvement of the asset management of the heating system, the reduction of heating consumption and losses through an improved management of the energy production and demand and an optimal regulation of buildings heating [16–18].

Description of the District Heating System of the Campus

The district-heating system ensures the heating of the campus buildings as well as the supply of the hot water. It includes a gas-heating center, a 5-km principle network and 4-km secondary network (Fig. 6). The principal network transports heat to 37 substations, which transmit heat for the secondary network. The later ensures the buildings' heating. The substations are monitored by smart sensors, which transmit the heat consumption as well as all the control parameters (temperatures, velocity, pressure, valves' state …) to the heating control center. Some substations are equipped by a local regulation system.

Thanks to the substation monitoring, we can follow the heat consumption in each building and establish correlations with the external temperature, which is used for the control of the heating supply. This system was used to explore the energy saving which could be obtained by smart regulation. Figure 7 shows the results obtained for a teaching building. The red color indicates the measured consumption of this building, while the blue color shows the expected consumption if the building is equipped by a smart regulation, that takes into account the real use of the building as well as the comfort condition. We can observe that the Smart Regulation could lead to a large energy saving. Based on this result, the university will start next year a huge renovation program of the heating district system for its transformation into a Smart District heating that uses Smart Regulation as well as available renewable energy in the Campus.

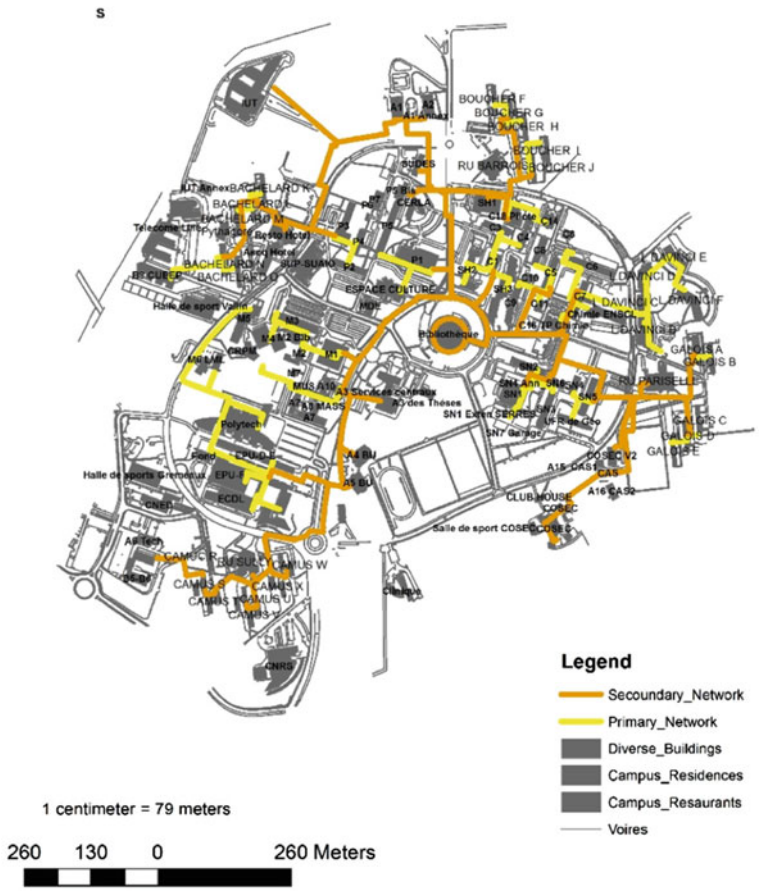

Fig. 6 The district heating system of the scientific campus of the University of Lille (*Source* SunRise smart city [17])

4.2.3 Electrical Grid

Figure 8 shows the electrical system of the Campus. The red color indicates the Medium-Voltage grid (20 kV) which was renovated in 2012. The blue color shows the Low-Voltage grid, which is about 50 years old. The electrical system includes 17 substations, which ensure local monitoring (current, voltage, frequency, data transmission …), local regulation as well as the energy transformation from the Medium-Voltage to the Low-Voltage power. The Campus is supplied by the French Electrical Company at the supply station located in the North of the Campus (building A2). From this supply station, the electrical power is distributed trough 2 loops (East and West), which converge towards the substation in building (M6) with an open-switch. If a local fault occurs in a building, the concerned substation is isolated using the substation switches, while the control switch located in building

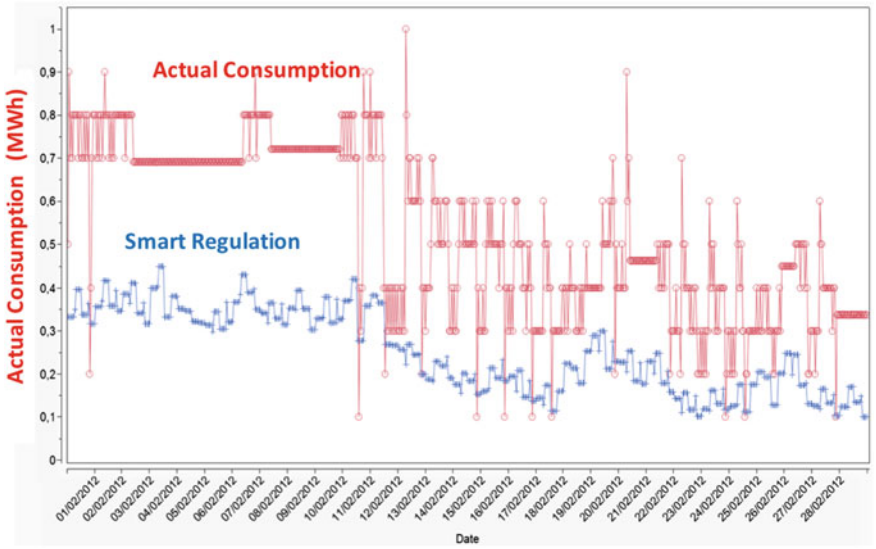

Fig. 7 Impact of the smart regulation on energy saving of a teaching building with low energy performances

M6 is switched-on to ensure the supply of buildings of the campus located between the isolated substation and the control substation in building M6.

Thanks to the substations monitoring, we have collected the consumption data for all the buildings and conducted preliminary analyses of this consumption. Figure 9 shows the consumption of a teaching sector in January 2015. Each curve presents a week consumption. We can observe that the consumption varies during the working days between 2.1 and 4 MWh, while in the week-end, it varies between 2 and 2.6 MWh.

The medium-voltage grid works well. It ensures the security of the grid and provides data about the performances of this grid. The low-voltage grid is old with low performances. Our work focusses on this network in order to analyze its performances and suggest its upgrading to more safe and efficient network.

5 Conclusions

This chapter presented the large-scale Smart City demonstrator run at the Science Campus of the University of Lille, France. A town of 25,000 inhabitants, the campus comprises some 150 buildings, served by 100 km of urban networks. The project is conducted by a large private-public consortium.

Its first step included the construction of a GIS-based urban information system, which today stores data on all components of the urban networks and their

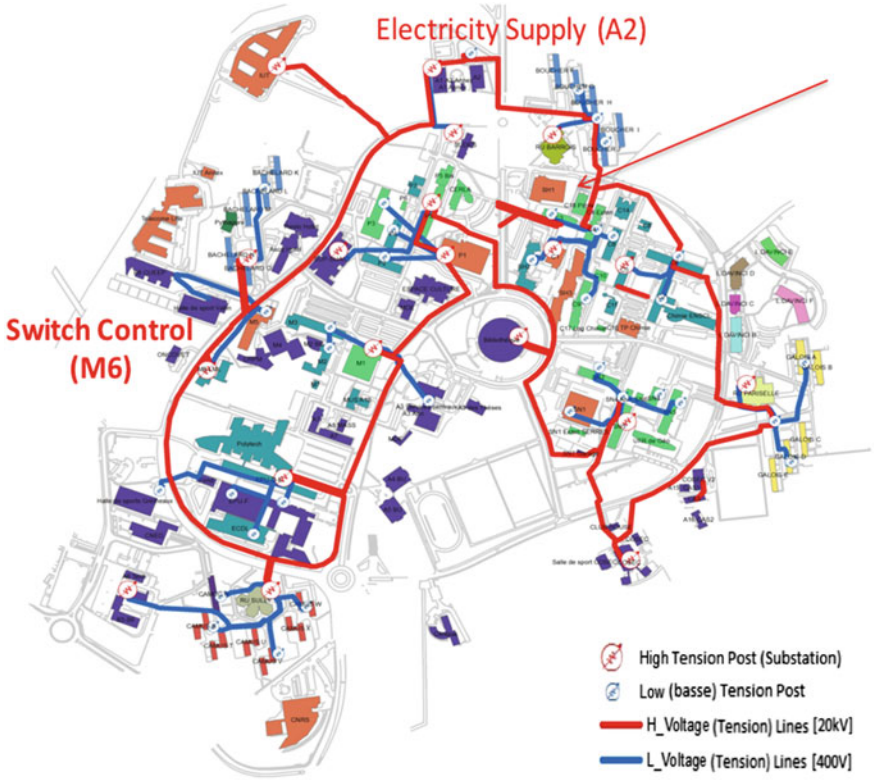

Fig. 8 The electrical grid of the scientific campus—University of Lille (*Source* SunRise smart city [17])

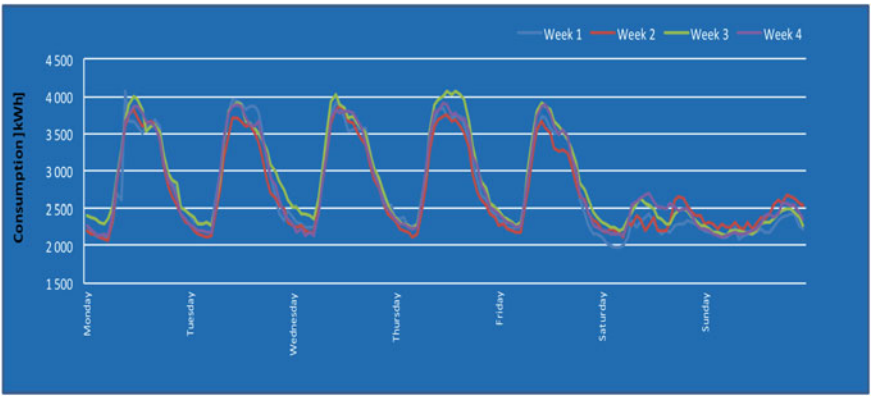

Fig. 9 Electricity consumption of a teaching sector—January 2015

attributes. In the second stage, smart monitoring was installed for major urban networks: drinking water, sanitation, storm water, district heating and electricity. Based on this monitoring, we analysed the performances of these networks and related services, and we developed tools for detection of abnormal events. The system is capable of efficiently and rapidly detecting water leakage; it is used by the technical staff for network supervision. An analysis of the district heating system demonstrated that substantial economies could be obtained by using smart heating technology, and an examination of the electrical grid showed good performances of the medium-voltage grid, but poor performances of the low-voltage grid.

The demonstrator helps companies to evaluate the performances of innovative solutions, and it is also used extensively in education and research.

Work is underway on providing a social network for easy and efficient interactions with campus users, including their engagement with the pursuit of a sustainable smart campus agenda.

References

1. Buchholz BM, Styczynski Z (2014). Smart grids—fundamentals and technologies in electricity networks, Springer, ISBN: 978-3-642-45119-5
2. El-Hawary ME (2014) The smart grid—state-of-the-art and future trends. Electr Power Compon Syst 42(3–4):239–250
3. Momoh, J. (2012). Smart grid: fundamentals of design and analysis, Wiley-IEEE Press, ISBN: 978-0-470-88939-8
4. Tuballa ML, Abundo ML (2016) A review of the development of Smart Grid technologies. Renew Sustain Energy Rev 59:710–725
5. EIP-SCC Smart cities and communities: the European innovation partnership on smart cities and communities. http://ec.europa.eu/eip/smartcities/
6. TSP (2014) Technology Strategy Board (TSB) future cities demonstrator. http://www.stepupsmartcities.eu/Portals/51/Documents/3%20point%202%20reports/Glasgow%20Technology%20Strategy%20Board.pdf
7. Glasgow (2012) Glasgow city management system, Final report, Glasgow City Council. https://connect.innovateuk.org/documents/3130726/3794125/Feasibility+Study+-+Glasgow+City+Council.pdf
8. U.S. Departement of Transportation (2016) Smart city challenge. https://www.transportation.gov/smartcity
9. Amsterdam (2016). Amsterdam smart city. https://amsterdamsmartcity.com
10. Boyle T, Giurco D, Mukheibir P, Liu A, Moy C, White S, Stewart R (2013) Intelligent metering for urban water: a review. Water 5(3):1052
11. Colombo AF, Lee P, Karney BW (2009) A selective literature review of transient-based leak detection methods. J Hydro-environn Res 2(4):212–227
12. ITU-T (2014) Smart water management in cities, Focus group on smart sustainable cities, Focus Group Technical Report

13. Morrison J (2010) Managing leakage by district metered access: a practical approach. Water 21:44–6
14. Mutikanga HE, Sharma SK, Vairavamoorthy K (2013) Methods and tools for managing losses in water distribution systems. J Water Resour Planning Manage 139(2):166–174
15. Thornton J, Sturm R, Kunkel G (2008) Water loss control: McGraw Hill Professional, 2nd Edition
16. Lund H, Möller B, Mathiesen B, Dyrelund A (2010) The role of district heating in future renewable energy systems. Energy 35(3):1381–1390
17. SunRise Smart City (2016) Large scale demonstrator of the smart city. http://sunrise-smartcity.com/fr/accueil/
18. Rezaie B, Rosen MA (2012) District heating and cooling: review of technology and potential enhancements. Appl Energy 93:2–10

Mobility Oriented Development (MOD): Public-Private Partnership in Urban Parking and Traffic Management with the Use of Autonomous Automobiles, Car-Sharing, Ridesharing Modes of Transport and Mobility as a Service (MaaS)

Piotr Marek Smolnicki

Abstract The focus of the following research are relations between mobility technologies and metropolitan (urban and suburban) spatial structures. In this paper the author discusses various urban modes of transport (e.g. automobile, mass transit) in the context of emerging technical (autonomous vehicles, self-driving cars and driverless shuttles) and organizational (carpooling, ridesharing, car-sharing, on-demand mobility) solutions for the mobility as a service (MaaS). The author presents assumptions (chances and threats) and solutions for a scenario for better transportation-related city management proposing Mobility Oriented Development (MOD).

Keywords Car-sharing · Mobility as a service (MaaS) · Mobility oriented development (MOD) · Parking · Real estate developer · Selfdriving cars · Traffic · Urban development

1 Introduction

I wish to forewarn the reader of potential significant side-effects of the emerging mobility as a service (MaaS) solutions basing on historical and contemporary evidence from the field of transportation. In general MaaS intends to give the possibility of traveling without the need of self-owning any mode of transport (neither bike nor car). The chapter will present how mismanaged MaaS may badly

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affect both environment (built and natural) and people. Thus, I present assumptions based on known facts and logical thinking.

My interest in mobility came from architecture and urban design studies, which I finished with my hometown redevelopment concept, designing awarded mixed-use compact district with bike- and walkability approach [55]. Afterwards, during my Ph.D. studies I focused on the correlation between accelerating diffusion of innovations and increasing number and range of their spatial side effects. I assumed that both aspects' correlation are determined by causation, thus I begun to investigate their relations. My chosen subjects were emerging technical and organizational solutions in personal mobility. It appears to me that in many cases creating solutions, which solve particular problems, may generate additional problems, which demand the creation of other solutions etc. [57], as presented on Fig. 1. This observation goes along with conclusion of emergence of an unbound circle. It reflects the theory of induced demand and Jevons' paradox of efficiency [26], also known as rebound effect—in transportation e.g. Downs-Thomson paradox [for more information, see the recent complex study: 67] and Lewis-Mogridge law [36, 48].

The objectives of the following study are both to describe the relations and to evaluate the impacts between technological diffusion and spatial structures understood as physical, functional, social and economic aspects of space. The aim of this paper is also to emphasize the mistakes caused by blinded trust in data. Quantitative data research is mostly correct for a narrow scope of studied area, however it may lack a holistic approach to the problem, for instance due to the lack of: research time, funds, and text volume to present wider scope of results. As a consequence, the implementation of such data may induce unexpected results including side effects (for example improving street capacity may result—e.g. due to avoidance of crossing to the opposite site—in mental separation of neighbourhoods).

This chapter results from logical thinking method based on literature review of historical and contemporary diffusion of emerging urban modes of transport. Thus, it presents analogical assumptions for the near future based on historical facts. The presented impacts may occur physically in the built environment as well as in the

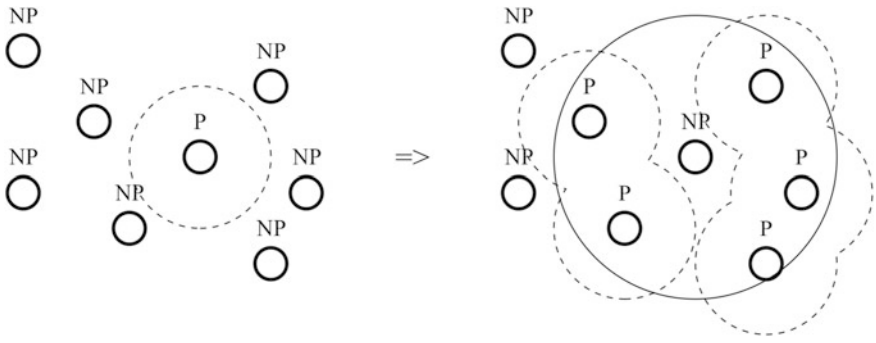

Fig. 1 Spatial problem generation: after solving the problem (P) of particular location the side effects spread to previously non-problematic areas (NP). *Source* Author

quality of citizens' life. The study scope of a metropolis includes both urbanized and rural areas. I focus on negative impacts, although each technology solves, as mentioned before, particular problems. Ultimately I propose short- and long term mobility-related solutions for enhanced urban development, and thus higher quality of urban life.

Environmental impacts of transportation is the wide topic avoided in this chapter in purpose, just to mention products life cycle (vehicles and infrastructure), including resources mining and their transportation, production and transportation of: materials and their later reuse (such as aluminium); parts needed for each technological stage, and the final product; as much as the need of resourses (materials, energy, costs) for everyday use, maintenance and service.

2 Urban Mobility in History

Many authors referred to the diffusion of technologies, including mobility innovations, when studying cities. Historically spatial development of cities and their population growth (except from few examples) were limited by the availability of resources in their closest surrounding—outreach of everyday travels to and from their agricultural hinterland. Only few had their own horses—mostly farmers for supporting food produce and delivery [5, 19, 40, 56]. Cities and countryside were walkable [60] until the 19th century, when railways started to conquer traditional urban and rural space, as much as sprawling the city for the distances unreachable by walking—thus inducing demand for more railways and popularizing other modes of transport [50]. Henry David Thoreau wrote about rail: "a few are riding, but the rest are run over", thus "we do not ride on the railroad; it rides upon us" [64]. Since then, the cheapest mode of transport—that facilitated passing distances between "neighbours" or to work—was a bicycle [11].

In 1831 the first horse-drawn omnibuses appeared, which one year later were put on railways as horse-drawn trams [4]. In the U.S. in 1887 first electric trolleys opened, which turned into transit lines connecting shoppers with commercial centres [52]. Every single innovation that helped to reduce the time needed for traveling any distances, enabled and justified the growth of suburbanization, peri-urbanization, urbanization of rural areas (rurbanization) and separation of functions. The vicious cycle of unbridled spatial development has begun.

At the same time an essential, yet vertical mobility innovation appeared, and had a great impact on cities—the elevator. Elisha Otis presented his invention of a safe elevator during the New York Crystal Palace exposition of 1853-54; in 1889 he co-worked in constructing lifts for Eiffel Tower [23]. Elevator along with other building technologies allowed the construction of the highest buildings of those times: from the 1902 twenty-one-story Flatiron Building, to the 1913 fifty-seven-story Woolworth Building, to the 1930 seventy-seven-story Chrysler Building [47] and the like. Later in 1933 the idea of high-rise buildings was used by modernists in Athens Charter, and the concept of multifamily flats spread around

the world. In 1972 the St. Louis Housing Authority began demolishing infamous Pruitt-Igoe high-rise district, due to social problems [39]—casting light on the unexpected side effects of modernism. Elevators allowed to use taller (and sometimes over-scaled) housing buildings which in many cases resulted in intertwining negative consequences: neighbours turned out to be anonymous (meeting in silence inside lifts), thus safety declined; streetscape disappeared (conditioned by bigger distances between taller buildings); greenery overgrew (due to insufficient time and funds for maintenance of over-scaled areas); housing was separated from services (justifying automobile use) and the like. Thus, the impact of the invention of the elevator stretched much further than the form of particular buildings: to the neighbourhoods, downtowns, not to mention global scale. Lewis Mumford and other scientists consider the invention of the elevator as the example of vertical mobility technique that changed the city shape as much as the automobile, exaggerating negative spatial consequences [13, 20, 40, 42].

Before the invention of Ford Model T most of the people could not afford mechanized travel and their mobility had not changed much [43]. Henry Ford simplified the automobile structure, thus made it cheaper in the time when cars became complicated and more expensive [41]. Soon automobile owners and producers begun new movement of anti-pedestrian propaganda called Motordom [39]. The General Motors' Highways and Horizons pavilion opened during the New York 1939 World's Fair, presenting the Futurama exhibition—which contained dioramas and a propaganda film To New Horizons about the future motorized world of 1960s—begun a new era of automobile-addicted people and -dependent spatial structures [39, 65]. Personal vehicles created a vast problem of resources and energy use. Until now car weight has tripled, besides less than one percent of energy is used for moving the weight of human body, since most of the time there is only the driver alone in a car with four, five or seven seats [after: 24]. Automakers and researchers invent new types of individual transportation mitigating their footprint and use of resources—the example is the folding MIT car [35]. Nevertheless, improving the idea of automobile is already outdated [30]. Emerging IT solutions enable mobility as a service (MaaS) instead of individually owned vehicles.

Prior to automobile everyday travels were reduced to walking or riding emerging mobility services (omnibus, trolley, tram, rail). Comparing to transit the self-owned car became more comfortable way of everyday travels across and between newly sprawled towns and cities. Moreover, adjustment of space to automobile (roads, highway, parking) in many cases finished with reaching places in walkable scope by automobile [33]. Transportation planning and urban planning has a lot in common, and therefore cannot be considered separately [34]. There are numerous possibilities of mobility needs mitigation [31, 56, 61]. New Urbanists claim that shaping urban form has the impact on mode of transport preferred—the more compact and full of local services, the more non-motorized and non-individual modes of travels are chosen [8]. Thus, examples of so-called compact cities are strongly related with sustainable mobility [62]. Besides, since there is no space in cities for every individual with a car, municipalities sustain urban mobility by

investing in public transit, which may easily generate growth but is as easy potent for cancellation due to economic reasons [12]. Yet, there is still place for private operators of mass transport, such as jitneys, private buses, taxi companies, car renting [45] etc.

Numerous lessons can be brought from the history, just to mention three of them: (1) Overcalling road infrastructure is expensive, does not solve the problem, rather induce demand and borrows from the future like in the Ponzi scheme [33]; (2) Infrastructure is not shaping our cities, rather urban design and legislation is determining necessity of implementing particular infrastructure (new roads, lanes, parking); (3) Changing behaviours is relatively cheap potential for refining cities and infrastructure efficiency, but we have to keep in mind Lesson's 1 paradox of induced demand. Thus, at present we are ready to discuss managing MaaS with the use of contemporary emerging technical and organizational solutions in mobility.

3 Nowadays MaaS

We are in transition of the second century of developing urban transit systems around the world [44] and we are still, if not more, facing emerging urban mobility problems, regardless the infrastructure we built. Part of the solution, if correctly used, may be information and communication technologies (ICT), such as intelligent transportation systems (ITS), and mobile ICTs [38]. Emerging nowadays the new mobility paradigm is based on Internet applications [46] abstracting physicality [32]. Since this decade numerous of mobile apps has appeared offering different solutions for trips [53]. For instance, the Citymapper mobile and web application offers—along with comparing time of different modes of travel (including car-sharing) from point A to B and finding optimal route—counting calories burned by walking and cycling; money spent by driving a car; proposing the most comfortable section of train; and more [9].

Besides, using existing transportation systems cities are managing in real time our moves using ITS with, or without our acceptance or even consciousness [6], while these new technologies operate seamlessly [20]. In contrast, along with ICT implementations, the congestion problems are getting worse [37]. Moreover, Adam Greenfield says that smartphone killed the city [21], but Janette Sadik-Khan adds: it's not what we have in our smartphones but what we have on our streets [51].

A part of the new paradigm (which is actually the evolution of pre-automobile paradigm) is so called shared mobility. Its name comes from sharing economy, which historically was (and still is) stimulated by spatial density [3] but today has few in common with its origin, due to commercialization and anonymity [27]. Recent times the diffusion of shared mobility modes are accelerating, as for example bike- and car-sharing, ride-sharing, carpooling, on-demand ride services (ride-sourcing and e-hail), alternative transit services (ATS, such as micro-transit and paratransit) [53]. Figure 2 illustrates sample relations between urban modes of transport, including shared mobility.

Different scenarios of car-sharing diffusion and its impacts can be considered, including full private services with potential negative spatial consequences, public-private partnership (PPP) services with controlled spatial impacts and public services with limited scope focused on urban renewal [58]. Many examples from the past has shown that diffusion of new technologies along with solving particular problems is followed by side effects, and it speeded up nowadays when new solutions are introduced without reflection [57]. Unfortunately owning a vehicle depends not only of mobility needs but also for bragging owner's wealth [10, 56]. Thus, car-sharing may potentially replace merely small part of automobiles, and complement to the much bigger amount to the car share in traffic, as shown in Fig. 3. Only few, if any may use alternative mobility modes, including walkig—and some may use both their self-owned cars and car-sharing during their everyday travels.

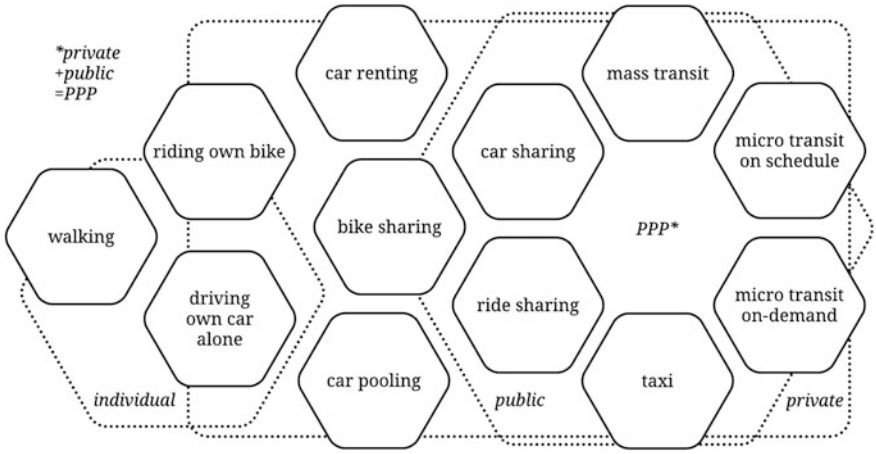

Fig. 2 Sample urban mobility modes diagram. *Source* Author

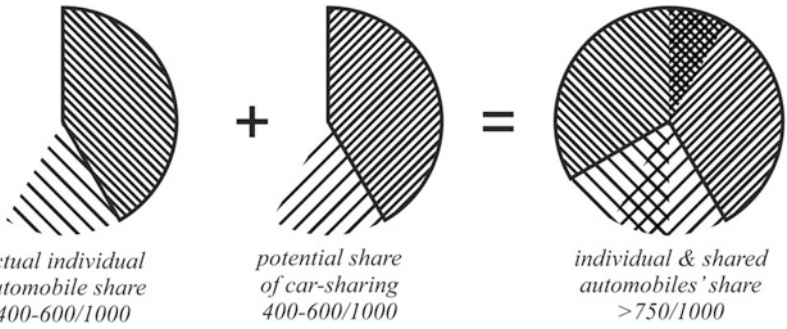

Fig. 3 Potential results in general car share of complementing individual automobile use with car-sharing—in some cases both self-owned automobile use and car-sharing may be used for everyday travells (overlapped). *Source* Author

Another example of the emerging technology is an artificial intelligence allowing the automation or robotizing of transport modes. The automated mobility exists in cities around the world since the beginning of 21st century, yet its operations were mostly restricted to the closed port areas [28]. Nowadays, the automotive and IT industries introduce this technology into the urban public spaces [59]. There are different names with intertwining meanings, and therefore with diverse impacts on spatial structures, depending of the pursued or emerged scenario, for instance: autonomous- or automated automobiles (AAs), driverless cars, self-driving vehicles [59]. Due to the automation the second major automobile expansion with all its "devastating consequences" may occur [17]. Replacing individual automobiles with autonomous taxis fleet could generate additional traffic [7], as it occurred analogically in the New York with emerging car-sharing services [16]. In recent survey up to 54 percent of respondents would not wish to replace their favoured mode of transport [18]. Yet, congestion from seeking parking place is estimated to 30 percent of traffic flow [54], thus autonomous fleet, if managed well, could reduce this number. If mismanaged could work opposite—adding additional vehicles (shared) to the already existing (self-owned and self-used). Unfortunately, as another recent research has found, most of the cities and regions are not mentioning mobility automation in their development strategy documents [22]. Moreover, municipal and regional governments are rarely investing on technology supporting individual transport. For instance, electric vehicles (EVs) which might be charged wirelessly both on parking places and riding on the road [15]. However, we have to be aware that vehicle automation technology (and other mobility inventions) could get obsolete every few years—demanding replacement [52], and thus generating repetitive costs. These costs could be taken by private sector, as the 'mobility' developer which is proposed later in this chapter.

It has to be mentioned that driverless cars ease travelling to any destination at any time, thus making vehicles ubiquitous everywhere (perhaps complementing the traditional automobile)—and they may be in almost constant move (occupied or empty), instead of short moments of letting passengers in or out. On the other hand, the liveable urban streets invite primarily the people (understood also as the commuters), not the vehicles (nor adjacent to them infrastructure). Therefore, to avoid analogical mistakes to those done for the period of automobile emergence the municipalities must pay more attention to pedestrian-friendly (accessible, inclusive) spatial structures (including road infrastructure, especially the so called complete streets [29]).

4 Managing Mobility Behaviours

Worldwide city urban form follows more or less the radial model of connections between the city centre and its surrounding. This spatial model generates traffic flows with the two peaks. Yet in most cases congestion emerges in particular directions: morning into the city and afternoon outside. Thus, the road infrastructure

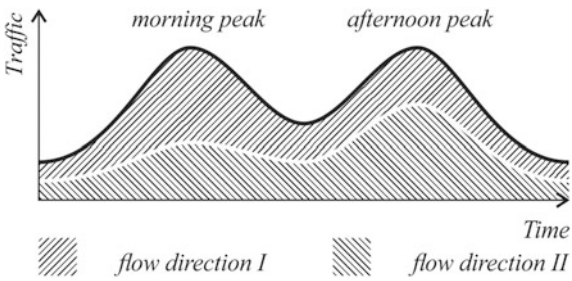

Fig. 4 Sum of two traffic flow directions. *Source* Author

is used inefficiently—lanes in one direction are congested, when second direction may be underused. Figure 4 presents the theoretical graph of traffic flow as the sum of two flows in opposite directions. Just to mention, occurring of such ineffective and inefficient traffic problem would be primarily solved in the private sector.

Presented in the previous module examples show how increasing capacity of road infrastructure may have opposite results due to promotion of more intensive use—induced demand [36]. User behaviours influence how infrastructure is used, thus changing human actions seems to be important part of mobility management. This module will discuss the possibilities of reshaping the theoretical model of existing urban traffic situation with proposals of changing user behaviours—in contrary to investing in road infrastructure. Moreover, proposed solutions could solve problems in both short- and long-term.

Some municipalities manage traffic by charging drivers, e.g. for entering city core or parking places, but in many places it may be difficult political decision due to the accuse that drivers are charged in particular reason—to heal local budget. Nowadays gamification appears as the new way of mobility management. The Fun Theory initiative, which states that fun can change behaviour for the better, brings some brilliant examples: (1) The Speed Camera Lottery—the camera photographs all drivers, speeders are fined and money gathered goes through the lottery to those who drives under speed limits; (2) Piano Staircase promotes stair use instead of escalator by turning steps into playing piano keyboard [66]. A different example of mobility management is the Project Interzone which provides idea of three time zones inside the city for every user to choose: −2 h, standard time and +2 h—thus, traffic from peaks stretch for longer period, as shown at Fig. 5 [49].

1. My first proposal is to combine ideas of gamification and ITS mobility management. Since the congestion appears mostly on the lanes in particular direction drivers can be charged when using more congested lane, and collected money can be transferred to those driving in opposite direction. This will make congestion-makers yet more envy of people travelling opposite direction, who sustain traffic flow. In long-term period it may promote housing location in the city centre and spread the businesses across the city until it will reach the level near balance. Thus, it could convince people (in general) to choose urban core

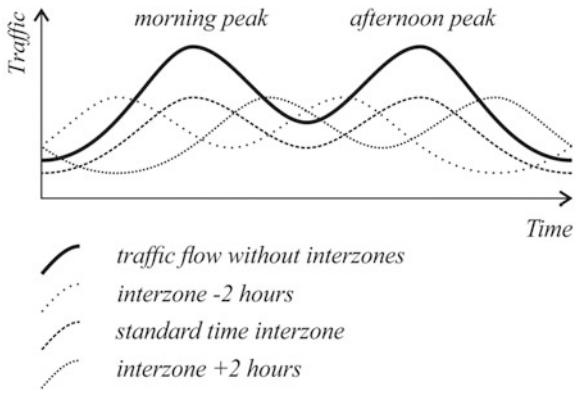

Fig. 5 Traffic flows before and after introducing interzones. *Source* Adopted from [49]

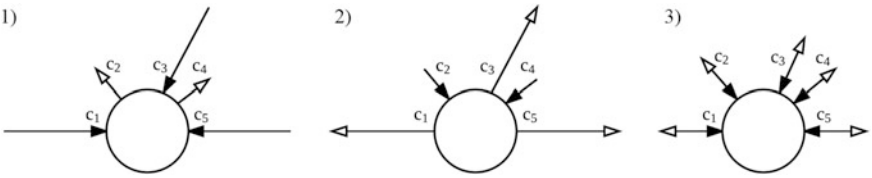

Fig. 6 Theoretical models of traffic flows on five different roads (c_1–c_5) to the city centre: **1** morning, **2** afternoon, and **3** sustained (expected). *Source* Author

for living and using no-central areas for the work-place. This behaviour changing model may have two major big impacts. In short term, it may reduce car use in the most congested directions, when promoting use of underused infrastructure, as shown in Fig. 6—making it more cost-efficient investment. In long term it may change the urban form for the better by promoting mixed-use —instead of modernist-like single-function districts which generate peak congestion. The idea is even more possible nowadays with flexible transit based on MaaS, due to the possibility of introducing adaptable pricing.

2. Thus, I propose second solution, which should be excluded from above drivers' charging. The idea is to adapt prices e.g. for sharing a car or a ride, dependent on direction travelled. This solution requires private-public partnership (PPP) for providing transit, due to the needs of non-market operations and private capital.

Since above proposal supports sustainable urban development it cannot be considered without other parties, for instance developers. Traditional developer faces the problem of parking requirements, which not only reduce the scale of potential development but also impacts negatively on costs, aesthetics, and users' behaviours and their quality of life. Moreover, researchers estimate that in average 30% of urban traffic in high density structures is actually generated by drivers looking for parking place [54]. A part of the problem solution is the Transit

Oriented Development (TOD), which emerges as the cooperation between private (developer) and public (municipality) investors [25] or Transit Adjacent Development (TAD) [1].

3. Thus the third proposal is the Mobility Oriented Development (MOD) approach, which focus on delivering MaaS included in development. That means developer organizes mobility (e.g. vehicle sharing included in development) instead of the place for it (single-use functions such as garages, parkings and inner streets).

Audi at Home is an example of cooperation between developers and automotive company, allowing residents to use the car implemented to the real estate [2]. Yet, it allows to use one car by many users, the car is unavailable when parked outside of the property. Thus, acceptance of autonomous vehicles on streets will allow developers to introduce their own fleets. One can say that Lyft, Uber, ZipCar and similar companies give the solution in global scale. However, there are many car owners, who won't give up their own cars until they will feel their property fleet belongs to them [10] (similarly, the jet planes are shared by businessman). These cars will be considered as cleaner and safer, since they will be shared within neighbours, besides supporting social interactions in neighbourhood. For instance, neighbours could schedule their home-work-home travels in advance through the application and travel together if suitable and invite their trustworthy friends to the system.

The application could be introduced by the metropolitan municipality which should promote MODs by giving them construction permissions conditioned by including mobility service instead of automobile infrastructure. This will promote the system due to common tool for users and vast savings for investors. Moreover, the municipality will liberate of creating its own mobility fleet moving costs to the private sector, including costs of every-few-year updates due to the predicted fast obsolescence of automation technology. And the last but not least, the application should complement with public transport system and follow presented earlier in this chapter adaptive pricing for sustaining traffic (for instance in some conditions the joined trip of car-sharing and transit could be priced the same as transit-only trip to convince possible drivers for using the MaaS[1]).

There are several benefits of this solution: (1) MOD generates vast savings by reducing costs of building underground parking (although he may for sure hide these costs in property prices, rents etc.) as well as revenues from additional floor area for filling it instead of outdoor parking or landscaping this area which will at the same time flourish urban streetscape, generate profits from local services (including car-sharing service), as shown on Fig. 7; (2) *property's residents* generates savings from not owning a car, which include: car costs and amortization,

[1]According to 17 Aug 2016 Lyft Blog post—after the submission of this chapter manuscript for peer review—Lyft introduced free rides to the nearest light rail stop in the City of Centennial, CO, USA.

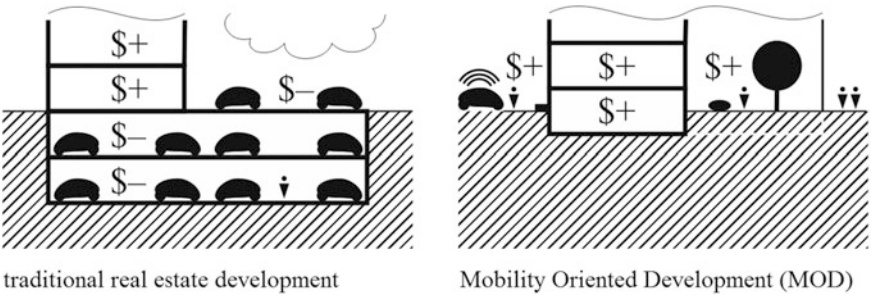

Fig. 7 Theoretical example models of traditional real estate developer and the Mobility Oriented Development (MOD). *Source* Author

maintenance, repairs, insurances, and addiction of on-every-occasion car use; users socialize by sharing common cars and rides with their neighbours (3) *neighbourhood inhabitants* receive profits from not as much of car-dominated streetscapes (less parked vehicles and reduced congestion, and extra greenery and multi-services structures), together with the opportunity of joining development (or developer's) car-sharing system; (4) *municipality's* reimbursements remain from reduced congestion due to less frequent use of individual transportation, which comes from greater use of public transport, due to the complementarity of sharing mobility with nearby transit stops.

5 Conclusions

Historical evidence proves that investing in the transport infrastructure capacity turns into the rebound effect which forces next investments (e.g. Downs-Thomson paradox, Lewis-Mogridge law) [14, 36, 63]. Similarly results the enhancing of automobile (eco-)efficiency, which turns into more sales and higher usage of the car [after: 48]. Its grounded in the focus on the objects (infrastructure capacity and accessibility, vehicles efficiency) instead of the subjects who are the commuters. Therefore, I foreworn from repeating the mistakes from the past during today's implementation of MaaS. The way to take advantage of rebound effect with positive results is managing mobility behaviours of people. It can be occurred with the use of existing infrastructure and with building-up new mixed-use structures with less physical and more organizational solutions included, such as the presented MOD solution which should complement in partnership the existing public services.

The future research is required to evaluate the public acceptance of the proposed solutions, as much as the commercial analysis are necessary to calculate the costs of investments and possible profits. Concluding, the proposed *Mobility Oriented Development (MOD)* is the solution for both short- and long-term problems creating the positive rebound effect of sustaining the actual parking and traffic as much as the future urban development.

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References

1. Altoon RA, Auld JC, Egan N (2011) Urban transformation. Images Publishing Group, Mulgrave, Vic, Transit oriented development and the sustainable city
2. Audi AG (2016) Audi at home. https://www.audiathome.com/us/service/en_athome.html. Accessed 22 May 2016
3. Badger E (2013) Share everything. Collaborative consumption arises from urbanization, and it's here to stay. In: Mathis S, Cary J (eds) City 2.0. The habitat of the future and how to get there, eBook; Kindle Edition, Ted Conferences
4. Bain B (2001) City and Regional Planning. In: Finkelman P (ed) Encyclopedia of the United States in the nineteenth century, vol 1. Charles Scribner's Sons, New York, pp 217–219
5. Benevolo L (1995) Miasto w dziejach Europy. Tworzenie Europy. Krąg; Volumen, Warszawa
6. Berg N (2013) Citizens as sensors. Our cities are talking, and we're talking back. In: Mathis S, Cary J (eds) City 2.0. The Habitat of the Future and How to Get There, eBook; Kindle Edition, Ted Conferences, pp 423–463
7. Bischoff J, Maciejewski M (2016) Simulation of city-wide replacement of private cars with autonomous taxis in berlin. Procedia Comput Sci 83:237–244. doi:10.1016/j.procs.2016.04.121
8. Cervero R, Kockelman K (1997) Travel demand and the 3Ds. Density, diversity, and design. Transp Res Part D: Transp Environ 2(3):199–219. doi:10.1016/S1361-9209(97)00009-6
9. Citymapper. The ultimate transport app. https://citymapper.com/. Accessed 12 May 2016
10. Czapiński J (2013) Diagnoza społeczna 2013. Warunki i jakość życia polaków. Główne wyniki i wnioski, 7th edn., Warszawa
11. Daly Bednarek JR (2001) Bicycling. In: Finkelman P (ed) Encyclopedia of the United States in the nineteenth century, vol 1. Charles Scribner's Sons, New York, p 142
12. Docherty I, MacKinnon D (2013) Transport and economic development. In: Rodrigue J-P, Notteboom T, Shaw J (eds) The SAGE handbook of transport studies. SAGE, London [etc.], pp 226–240
13. Doctoroff D (2015) Event welcome and keynote session. Disrupting Mobility Summit, Media Lab Building, Cambridge, MA
14. Downs A (2004) Still stuck in traffic. Coping with peak-hour traffic congestion, Rev. ed. James A. Johnson Metro Series. Brookings Institution, Washington D.C., Great Britain
15. Eberle W, Musavi F (2014) Overview of wireless power transfer technologies for electric vehicle battery charging. IET Power Electron 7(1):60–66. doi:10.1049/iet-pel.2013.0047
16. Emerson S (2016) Uber wants us to think it's environmentally friendly, But is it? http://motherboard.vice.com/read/is-uber-good-or-bad-for-the-environment. Accessed 25 May 2016
17. Fox S (2016) Planning for density in a driverless world. SSRN J. doi:10.2139/ssrn.2735148
18. Fraedrich E, Lenz B (2016) Taking a drive, hitching a ride: autonomous driving and car usage. In: Maurer M, Gerdes JC, Lenz B et al (eds) Autonomous driving. Springer, Berlin Heidelberg, Berlin, Heidelberg, pp 665–685
19. Frey H, Yaneske P (2007) Visions of sustainability. Cities and regions. Taylor & Francis, London, New York
20. Greenfield A (2013) Against the smart city. The city is here for you to use. Kindle 1.3, Do projects

21. Greenfield A (2015) Transforming cities. Implications for an Urban Age, Disrupting Mobility Summit, Media Lab Building, Cambridge, MA
22. Guerra E (2015) Planning for cars that drive themselves metropolitan planning organizations, regional transportation plans, and autonomous vehicles. J Planning Educ Res: 0739456X15613591. doi:10.1177/0739456X15613591
23. Hall PA (2003) Designing non-space. The evolution of the elevator interior. In: Goetz A (ed) Up down across. Elevators, escalators, and moving sidewalks. Merrell Publishers Limited, pp 59–78
24. Heck S, Rogers M (2014) Resource revolution. Amazon Publishing, Seattle, How to Capture the Biggest Business Opportunity in a Century, Kindle
25. Institute for Transportation & Development Policy (2014) TOD Standard. v2.1, Nowy Jork
26. Jevons WS (1866) The coal question. An inquiry concerning the progress of the nation, and the probable exhaustion of our coal-mines. Macmillan and Co., London
27. Kessler S (2015) The "sharing economy" is dead, and we killed it. Five years ago, everybody was excited about the idea of using tech to borrow things like power drills. In practice, though, not so much. https://www.fastcompany.com/3050775/the-sharing-economy-is-dead-and-we-killed-it. Accessed 15 Sep 2015
28. Krośnicka K (2015) Comparison of technical parameters of automated container terminals in Europe. Logistyka(3), pp 5695–5703
29. Laplante J, McCann B (2008) Complete streets. we can get there from here. institute of transportation engineers. ITE J 78(5):24–28
30. Larson K (2015) Event welcome and keynote session. Disrupting Mobility Summit, Media Lab Building, Cambridge, MA
31. Maat K (2009) Land use and travel behaviour. Expected effects from the perspective of utility theory and activity-based theories. In: Built environment and car travel. Analyses of interdependencies. IOS Press, Delft University Press, Delft, pp 27–47
32. Mahfouda D (2015) Technology disrupting mobility. Disrupting Mobility Summit, Media Lab Building, Cambridge, MA
33. Marohn Charles L Jr (2012) Thoughts on building strong towns. CreateSpace Independent Publishing Platform, Lexington, KY
34. Martens K (2015) Accessibility and potential mobility as a guide for policy action. Transp Res Rec: J Transp Res Board 2499:18–24. doi:10.3141/2499-03
35. Mitchell WJ, Borroni-Bird CE, Burns LD (2015) Reinventing the automobile. Personal urban mobility for the 21st century. The MIT Press, Cambridge, Mass, London
36. Mogridge MJH (1990) Travel in towns. jam yesterday, jam today and jam tomorrow? Palgrave Macmillan UK, London
37. Mokhtarian P (2013) If telecommunication is such a good substitute for travel, why does congestion continue to get worse? Transp Lett 1(1):1–17. doi:10.3328/TL.2009.01.01.1-17
38. Mokhtarian PL, Tal G (2013) Impacts of ICT on Travel Behavior. A tapestry of relationships. In: Rodrigue J-P, Notteboom T, Shaw J (eds) The SAGE handbook of transport studies. SAGE, London [etc.], pp 241–260
39. Montgomery C (2013) Happy city. Transforming our lives through urban design, Kindle edition; Reprint edition (November 12, 2013). Farrar, Straus and Giroux, New York
40. Mumford L (1961) The city in history. Its origins, its transformations, and its prospects. A Harvest/HBJ book. Harcourt Brace Jovanovich, New York
41. Nash B (2005) Car tech of the future. Modern Marvels, Cambou, Don, History Channel
42. Negroponte N (2015) Event welcome and keynote session. Disrupting Mobility Summit, Media Lab Building, Cambridge, MA
43. O'Toole R (2011) Using markets to enhance mobility. Response essays. In: Kuznicki J (ed) There ain't no such thing as free parking (Cato Unbound Book 42011), eBook; Kindle Edition, Cato Institute, pp.331–399
44. Ovenden M (2015) Transit maps of the world, 3rd edn. Penguin Books, New York
45. Papandreou T (2015) Presenta estudio de caso de la Ciudad de San Francisco—California

46. Papandreou T (2015) Mobility and the sharing economy. Disrupting Mobility Summit, Media Lab Building, Cambridge, MA
47. Petroski H (2003) Vertical, horizontal, diagonal. In: Goetz A (ed) Up down across. Elevators, escalators, and moving sidewalks. Merrell Publishers Limited, pp 37–46
48. Polimeni JM, Mayumi K, Giampietro M et al (2008) The jevons paradox and the myth of resource efficiency improvements. Research Editions, Earthscan
49. Project interzone. http://www.projectinterzone.com/. Accessed 21 May 2016
50. Reichard DA (2001) Cities and Urbanization. In: Finkelman P (ed) Encyclopedia of the United States in the nineteenth century, vol 1. Charles Scribner's Sons, New York, pp 209–217
51. Sadik-Khan J (2015) Transforming cities. Implications for an Urban Age, Disrupting Mobility Summit, Media Lab Building, Cambridge, MA
52. Schwartz SI, Rosen W (2015) Street smart. The rise of cities and the fall of cars, First edition; eBook; Kindle Edition, PublicAffairs, New York
53. Shaheen SA, Chan ND, Bansal A et al. (2015) Shared mobility. A sustainability & technologies workshop: definitions, industry developments, and early understanding. Transportation Sustainability Research Center, University of California, Berkeley
54. Shoup D (2011) Free parking or free markets. Lead essay. In: Kuznicki J (ed) There ain't no such thing as free parking (Cato Unbound Book 42011), eBook; Kindle Edition, Cato Institute, pp 56–329
55. Smolnicki PM (2012) Pruszcz 2020 +. Studium koncepcyjne rozwoju i przekształceń miasta. Master's final project, Politechnika Gdańska| Gdansk University of Technology
56. Smolnicki PM (2015) Aquaponics based artificial biosphere included in architecture. From mitigation of negative impacts to positive added values of urban spatial structures on local, regional and global Scale. In: Fikfak A (ed) Keeping up with technologies to make healthy places. [2nd International Academic Conference]. Narodna in univerzitetna knjižnica, Ljubljana, pp 288–296
57. Smolnicki PM (2015) The influence of modern technologies on spatial structures. In: Czubenko M, Tatara M (eds) PhD Interdisciplinary Journal. Special Issue. BIOTech Conference 2014, 1st edn. Gdansk University of Technology Press, Gdańsk, pp 67–75
58. Smolnicki PM, Sołtys J (2016) Car-sharing. The impact on metropolitan spatial structures, Manuscript, Gdańsk
59. Smolnicki PM, Sołtys J (2016) Driverless mobility. The Impact on Metropolitan Spatial Structures, Manuscript, Gdańsk
60. Solnit R (2001) Wanderlust. Penguin Books, London, A history of walking. Always Learning
61. Sołtys J (2008) Metody planowania strategicznego gmin z uwzględnieniem aspektów przestrzennych i rozwoju zrównoważonego. Monografie, vol 87. Wydawnictwo Politechniki Gdańskiej, Gdańsk
62. Stangel M (2013) Kształtowanie współczesnych obszarów miejskich w kontekście zrównoważonego rozwoju. Monografia, vol 478. Wydawnictwo Politechniki Śląskiej, Gliwice
63. Thomson JW (1972) Methods of traffic limitation in urban areas
64. Thoreau HD (1985) Walden; or Life in the Woods. In: Sayre RF (ed) A week, walden, the maine woods, cape cod, 6th edn. The Library of America, New York, pp 321–587
65. Van Dort PM (2016) GM futurama. http://www.1939nyworldsfair.com/worlds_fair/wf_tour/zone-6/futurama-1.htm#. Accessed 06 Apr 2016
66. Volkswagen (2009) The fun theory. http://www.thefuntheory.com/. Accessed 21 May 2016
67. Zhang F, Lindsey R, Yang H (2016) The Downs-Thomson paradox with imperfect mode substitutes and alternative transit administration regimes. Transportation Research Part B: Methodological 86:104–127. doi:10.1016/j.trb.2016.01.013

Eco-Innovations in Sustainable Waste Management Strategies for Smart Cities

Agnieszka Rorat and Małgorzata Kacprzak

Abstract With waste management strategies constrained by strict laws and ecological requirements, new holistic approaches have attracted great interest. The main focus is now on converting organic wastes into renewable energy sources or "biosoils". Biological waste disposal alternatives have a huge environmental potential, coming as a substitute for expensive, hazardous methods, such as landfillling or incineration. Their possible impact on the environment can be assessed from the ecological, economical and sociological point of view using decision-making tools, e.g., Life Cycle Assessment (LCA), which seek to identify the best practices for a sustainable development of smart cities.

Keywords Waste management · Bio wastes · Renewable energy · Life cycle assessment · Eco-innovations

1 Introduction

Eco-innovation can be understood as any new (or significantly improved) solution that leads to an important reduction of negative environmental impacts, by decreasing the consumption of natural resources or the release of harmful substances. The eco-innovation trend fits perfectly into a sustainable development strategy, in terms of environmental and, consequently, economic and social impacts. It is a must for most industries, where it helps further the development of green technologies, while taking into account the full life cycle of innovation. The life cycle perspective allows for an important reduction of environmental impacts by means of waste prevention [56], and it therefore has become a keypoint of the environmental policy of the European Commission, with special emphasis on strategies that follow the "3R" concept (reduce, reuse and recycle) [17]. Among

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those three major factors, the "reduce" aspect is a priority for a sustainable society, and it should be considered the most preferable strategy in the waste management (WM) hierarchy.

Nevertheless, it is the growing municipal solid wastes (MSW) production that today poses a serious challenge for environmental engineering, reflecting a rapidly increasing global population, urbanization and industrialization. Between 2007 and 2011 it went up 37.3% [24], and in 2025 may exceed the current level by up to 67%, posing problems especially in developing countries [34]. In Poland, each inhabitant may generate even 1 kg of wastes daily—while in 2011 as much as 70.9% of MSW were still landfilled, with only 16.7% being biologically treated, 11.4% recycled and just 1% thermally treated, according to the Central Statistical Office. The second stream of bio wastes, sewage sludge, also plays a significant role on the waste market. In 2015 urban wastewater treatment plants (WWTPs) in Poland produced 556,000 Mg d. m. of sewage sludge, with almost half of this mass stored at WWTP premises, waiting for disposal. The implementation of European Union directives has led to some important changes, forcing all member states to adopt new, effective, low-cost strategies. Moreover, the potential use of bio-wastes as a resource for energy generation and nutrient recovery has been increasingly reflected in renewable energy policies.

The main objective of the present review is to identify the most sustainable options for smart-city waste management, which would help achieve the "zero-waste" goal within the particular areas. The term "eco-innovation" is precisely defined in terms of waste management, taking into account the current trends in European countries. The main decision making tools are then presented, namely End-of-waste criteria (EWC) and Life cycle assessment (LCA), underlining the necessity of environmental, economic and technical evaluation of each of the proposed solutions. Finally, several integrated models for waste management strategies in smart cities are described in order to create a specific value chain that includes smart collection, processing, energy recovery and smart final disposal.

2 Eco-Innovations

According to OECD [39], innovation can be defined as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations". Eco-innovation should additionally result in a significant reduction of environmental impact and can include larger social arrangements that cause changes in existing socio-cultural norms and institutional structures. Recently, new technical (for products and processes) and non-technical (for marketing, organizations and institutions) solutions are being investigated in order to counteract the climate change, problems related to energy security and scarcity of natural resources. In this context, new policies shall focus on resource and energy use and promote innovations that improve environmental performance.

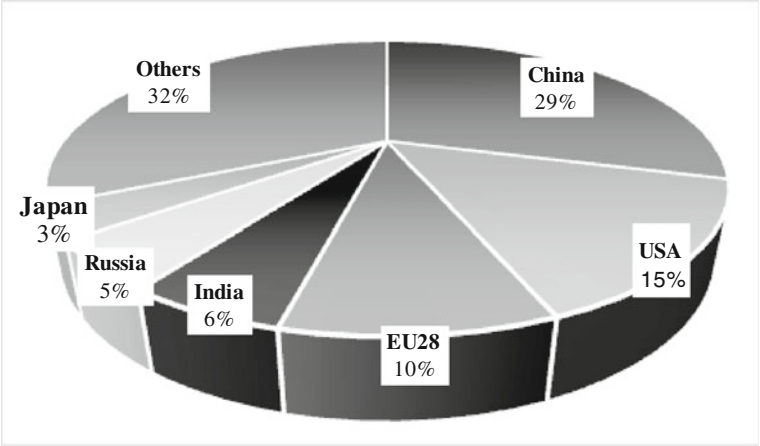

Fig. 1 Total CO_2 emissions from fossil-fuel burning, cement production, gas flaring

Those actions may allow to resist the global greenhouse emissions effect, which is expected to increase up to 70% by 2050 [36]. Currently, the major greenhouse gases (GHG) that are emitted to the atmosphere mostly due to human activities are carbon dioxide, methane, nitrous oxide, and fluorinated gases [26]. According to Boden et al. [10], the top carbon dioxide producers in 2013 were: China, the USA, European Union, India, Russian Federation and Japan (Fig. 1). Those countries should especially investigate the new technologies and solutions that will overcome the upcoming danger of growing GHG emissions with wide range of environmental impacts. Government policies shall indicate key challenges for eco-innovations and lead to significant economic opportunities.

In order to appreciate the environmental impacts of existing production systems, benchmark their performance and define specific objectives some identifications, some sets of indicators can be combined. This holistic view can allow both, business and policymakers to identify system-wide impacts of the existing solutions and encourage them to investigate for new strategies. The Eco-innovation performance across the EU Member States can be assessed using The Eco-Innovation Scoreboard (Eco-IS). This tool allows to indicate the different aspects of eco-innovation using 16 indicators grouped into five thematic areas: eco-innovation inputs, activities, outputs, resource efficiency and socio-economic outcomes. Though, Eco-IS is a very useful measure of strengths and weaknesses of individual EU Members in terms of different dimensions of eco-innovations. This approach allows for the most holistic view on economic, environmental and social performance. Figure 2 shows a ranking of all European countries in an index with the EU average of 100. According to the latest ranking (2013), 10 countries surpass the average value ($I > 100$) with top 5 countries, which index exceeded value of 121. Eastern Europe countries are still characterized with the lowest values of eco-innovation index, with Bulgaria, Poland and Cyprus being the countries

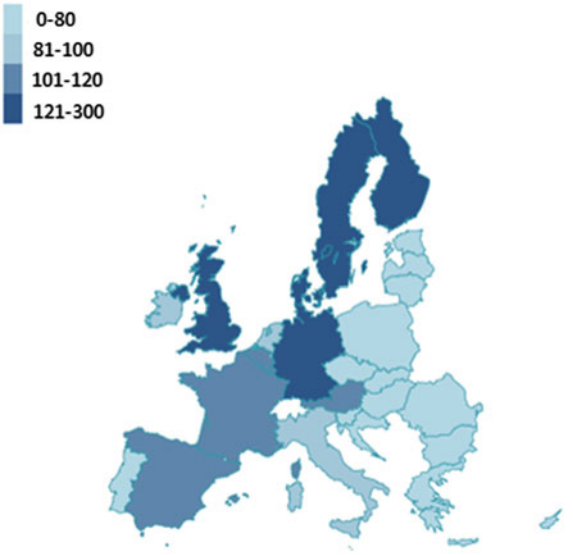

Fig. 2 Overall Eco-IS of all 28 EU members in 2013 [25]

particularly weak in research and development and innovation investments in green technologies. Though, for those countries, there is an economic opportunity in modernizing the production processes through implementation of eco-innovations. These technologies can allow for cost savings and higher resource productivity, so their application should be a priority for the countries characterized with low Eco-IS.

3 Waste Management Sector

With the prevention as top priority in the waste hierarchy, European countries are obligated to implement the fundamental changes in socio-technical system of waste infrastructures. Waste management requires though a major improvements in economic, legal, social and cultural element and constitutes one of the main branches of eco-innovation sector. The revised Waste Framework Directive [17] forced all the Members to develop and implement national waste prevention programs and strategies.

According to Eurostat, in 2014 the average person in European Union generated 474 kg of wastes per year, ranging from 758 kg per capita in Denmark to 272 kg per capita in Poland (Table 1). The differences between particular countries reflect the consumption patterns and economic wealth and are also depended on municipal wastes collection and management.

The growing stream of waste forces Member States to reuse resources and restrain less sustainable options, nevertheless in 2014, still 27% of waste in Europe

Table 1 Generation and treatment of municipal wastes [kg per capita] for EU 28, Poland and Denmark in 2004 and 2014

	EU 28	Poland	Denmark
Waste generated	474	272	758
Total waste treatment	465	272	758
Landfill/disposal	132	143	10
Total incineration (including energy recovery)	127	1	412
Incineration/disposal	14	10	0
Material recycling	131	57	204
Composting and digestion	75	30	132
Others	14	31	0

was landfilled/disposed. Initially, most of Member States considered landfilling as a common practice for waste disposal. Mixed MSW were landfilled without pre-treatment or separation of potentially recyclable fractions. Currently, following the Landfill Directive, European countries put a lot of effort in order to limit the percentage of total treated wastes that are landfilled. The adverse environmental impact of this solution is mostly related to landfill gas characterized by a high greenhouse gas potential (methane), leachate and space usage.

The reduction in landfilling rate observed during the last decade occurred mostly due to implementation of European legislation, i.e.:

- Directive 62/1994 [19] on packaging and packaging waste that resulted in minimum 50% recovery of all packaging released to the market
- Directive 31/1999 [21] on the landfill of that obligated Member States to reduce the amount of biodegradable MW being landfilled to 35% by 16 July 2016.

The latter directive enhanced the involvement of European countries in the investigation of strategies that can replace landfilling and consequently recover the organic fraction of municipal waste. The proposed solutions are mainly based on composting (including vermicomposting), fermentation, incineration and pretreatment (e.g. mechanical-biological treatment including physical stabilization). The applied strategies already allowed to increase the amount of recycled wastes from 25.0 million tonnes (52 kg per capita) in 1995 to 66 million tonnes (132 kg per capita) in 2014. Similarly, an important increase of recycling of organic matter by composting was observed on European scale with an average rate of 5.3% from 1995 to 2014. The recycling of MW requires though specific and accurate strategies from collection of wastes through logistics network and final management.

According to EPA, wastes can be divided into particular groups: municipal wastes (coming from households and commerce), industrial wastes, hazardous wastes, construction and demolition waste, mining waste, waste from electrical and electronic equipment, biodegradable municipal waste, packaging waste, end-of-life vehicles and tyres and agricultural waste. Among them, biowastes have a great potential as a source of nutrients, carbon and energy. Currently, the production of biowaste in EU is around 140 million tonnes and is expected to increase on 10% by

2020 [17]. Its proper management contributes powerfully to sustainable use of the resources and is directly involved into battle against climate change. Next to biodegradable fractions of municipal solid waste, following items can be defined as biodegradable wastes: commercial food waste, forestry residues, waste from agriculture, food and beverage industry and sewage sludge [44]. The latter has become a huge challenge in environmental engineering. Sewage sludge may contain an alarming amounts of contaminants such as heavy metals, trace organic compounds [7] and microorganisms including dangerous human pathogens [27, 31]. Moreover, it constitutes a reservoir of precious nutrients, like nitrogen, phosphorus and organic matter, that should be recovered and reused [40]. The implementation of two EU directives has led to big changes in European law and enhanced the investigation of new solutions in sludge management that will fulfill legal requirements. The Council Directive 91/271/EFC concerning urban waste-water treatment [23] focuses on environmental protection related to adverse effects of urban waste water discharges, effecting in increased volume of produced sewage sludge. Another important legislation restrictions were introduced by Council Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture [20], that limits the usage on sludge for environmental purposes in order to prevent harmful effects on soil, vegetation, animals and humans.

The modern and innovative pathways should mainly improve the technologies used at wastewater treatment facilities, and lead to the practices that minimize their quantity [48]. Nevertheless still huge quantities of sewage sludge are being produced worldwide. It was estimated, that the volume of produced sewage in Poland can increase from 540,292 Mg d.m./year in 2013 to 642,400 Mg d.m./year in 2015 [8]. According to Central Statistical Office of Poland, the main directions for sewage sludge management in Poland in 2013 were: storage, agriculture and land reclamation, thermal, and others, while European Union completely forbid the storing of sewage sludge from 2016. Thus, new solution for its management are of great interest.

4 Decision Makers

Legislative pressure put on Member States by European Community forces to respect the common waste management hierarchy, in which prevention, reuse, recycling and recovery are the most preferable pathways, while landfilling and disposal should be strictly limited. Environmental assessments should be applied by authorities, communities, industry and waste management companies as decision-making tools next to economic and technical evaluation of each proposed solution.

4.1 End-of-Waste Criteria

An approach of end-of-waste criteria (EWC) can be used in order to eliminate the administrative loads of waste legislation for safe and high-quality waste materials, and consequently to improve the existing management systems. By definition, EWC can be understood as "requirements that have to be content by a material derived from waste to confirm that the quality of the material is such that its use is not detrimental for human health or the environment" [38]. Though, some specific qualifications and requirements need to be recognized by wastes in order to obtain an end-of-waste (EoW) status. The methodology of this approach includes five steps [57]:

- Concept analysis
- Waste stream analysis
- Preparation of guidance for EWC; criteria: environmental leaching, contamination, metal concentration etc.
- Impact assessment
- Stakeholder analysis and involvement, procedure development

In the terms of waste management, strict EoW criteria should be established for each stream of waste in order to determine its further application e.g. compost with a sewage sludge as a main ingredient needs to be routinely monitored for certain pollutants, which presence can have a negative environmental impact [44]. Establishment of those criteria can facilitate recycling and consequently they may help to obtain environmental and economic benefits. EWC leads to improvement of harmonization and legal certainty in the market by law standardization. Moreover, implementation of this approach eliminates false waste status, so it facilitates the application of the compost/digestate in various way. Life cycle assessment technique should be additionally applied in order to assess the possible environmental and health impacts of the potential pathways of the end product. In this case, assessment can allow to compare EoW scenario with "no action" scenario [57] in order to estimate the emissions related to EWC process. The recovery chain can be considered as reasonable only if it does not have a greater impact on environment than the waste itself.

4.2 Life Cycle Assessment

The Life Cycle Assessment (LCA) can be a useful decision-making tool that helps to select the most suitable option for management of resources and wastes and consequently can be assessed in order to set a strategy for WM policies on industrial and governmental scale. This methodology allows for a comparison of the potential environmental impact of particular solutions and indicates the opportunities for environmental improvements. As a results, LCA gives an environmental profile of

total and single life cycle stages [16] that considers selected environmental aspects (mainly considering resource use, human health and ecological consequences) but not economic or social factors.

The LCA study should include the following steps according to ISO 14040 series:

- Principles and framework
- Definition of goal and scope
- Life Cycle Inventory (LCI) analysis combining data of energy and material flows and emissions
- Life Cycle Impact Assessment (LCIA, assessment of the potential impacts)
- Life Cycle Interpretation—Interpretation of the results in relation to the objectives of the study.

The whole pathway leads to the direct applications: system development and improvement, strategic planning, public policy making, marketing or others. In WM sector, LCA can be used especially to analyze the different chains of waste treatment and identify: the most environmentally significant process and the most significant environmental burdens during particular scenarios [9]. Using LCA tools, Cherubini et al. [16] compared four different possible scenarios of waste disposal for Rome city: landfilling without any further treatment; collection of part of the biogas released by the landfill for electricity production; landfilling with a presence of sorting plant and electricity, biogas and compost production; wastes incineration for electricity production. According to the results obtained by authors, a sorting plant with electricity and biogas production is the most proper option for waste management. Authors suggest that an efficient "waste-to energy" plant constitutes a possible substitute for electricity from power supply system. Similarly, Mendes et al. [37] have used LCA approach in order to compare the environmental impact of the incineration and landfilling of MSW in Sao Paulo, Brazil and demonstrated superiority of incineration strategy with an accent on the possible energy recovery. Other authors compared 12 different strategies of waste management systems on a provincial scale in Southern Italy [18] characterized by different percentage of separated collection or/and different alternatives in the disposal of treatment residues. Considering different impact categories (renewable energy use, non-renewable energy use, total energy use, water, suspended solids and oxydable matters index, mineral and quarried matters, greenhouse gases, acidification, eutrophication, hazardous waste and non-hazardous waste) authors selected one scenario (80% separate collection, no RDF incineration, dry residue sorting) with the most environmentally profitable options. The LCA was proofed to be a powerful tool that allows for a comparison of different MSW management systems for a specific area taking into account economic and technical possibilities. Though, it should be used while planning of new urban settlements. Five different possibilities were examined for a case of Trondheim, Norway [46]: connection to existing WM system (1), introducing of centralized biogas plant (2), introducing local biogas plant (3), increased recycling (4), centralized biogas plant combined with increased

recycling (5). Applying industrial ecology tools (combined LCA and scenario building) authors were able to approve the possible connection to the existing system, but also appreciated the increased source separation of paper and metal as environmentally beneficial.

5 Waste Management Strategies for Smart Cities

Smart cities (SC) development is becoming a necessity worldwide. This relatively new concept assumes the co-existence of high—tech intensive and advanced technologies in the city that connects people and helps to create sustainable, greener city, competitive and innovative commerce and, consequently, an increased quality of life [5]. Due to economic and technological changes caused by progressive urbanization, cities all over the world face the challenge of sustainable urban development at economic and environmental level. While population of the cites intensively grows, mostly in developing countries in Asia and Africa, and by the year 2050 it is expected to increase by around 2.5 billion [45], over 60% of the infrastructure that is required till this time needs to be constructed [50]. At the same time, existing infrastructure often needs replacement. Modern cities should effectively counteract impacts of urban sprawl that directly causes deterioration of living conditions. Policy directives should though propose strategies of optimal management of resources like "smart growth" and "smart, intelligent city" that provide a high quality of life to the citizens.

Key infrastructure sectors: systems that provide water, energy, food, shelter, transportation and communication, WM and public spaces are crucial in order to reach a smart, sustainable and healthy urban future [41]. WM sector constitutes an important part of modern societies and it has a huge impact on quality of life of inhabitants. Adequate strategies for this sector are especially investigated for the main stakeholders: national or local governments, municipal authorities, city corporations, non-governmental organizations, households, private contractors, Ministries of Health, Environment, Economy and Finance, recycling and waste processing companies [2].

Smart MSW technologies should include all phases of waste management: collection, processing, energy recovery and disposal (Fig. 3).

Currently, even 43% of the existing global MSW is treated (overall or partially) with technologies that can be considered as "smart". Navigant Research estimated, that 44 million tons of MSW was managed by smart MSW technologies in 2014 [33]. The whole strategies need to contain some important points considering collection of wastes, generation of renewable energy, optimization of the environmental performance of landfills that require the adaptation of smart, integrated technologies for the collection, processing and disposal of MSW [3]. The integrated models should be linked with other branches in order to create a specific value chain [33]:

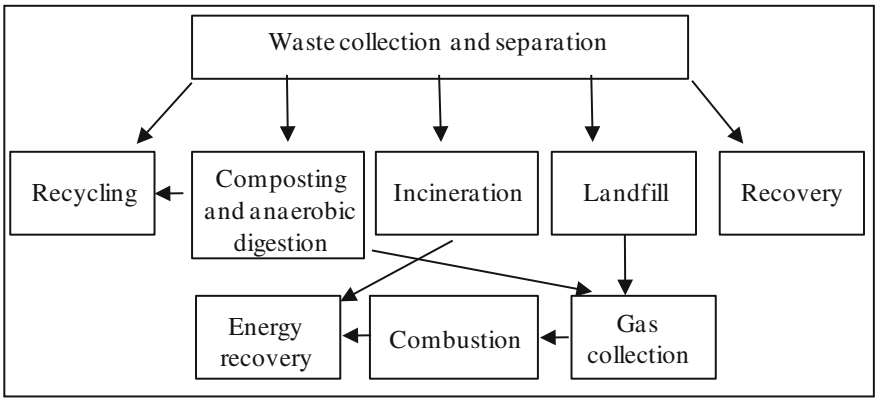

Fig. 3 Waste management phases (adapted from [9])

- Smart collection: radio frequency identification, tagging, global positioning system routing, pneumatic tubes
- Smart processing: advanced material recovery facilities and mechanical biological treatments, refuse derived fuel production facilitates
- Smart energy recovery: waste-to-energy, waste-to-fuels, landfill gas-to energy
- Smart disposal: sanitary landfilling, bioreactors, slar integration.

5.1 Smart Collection

The variety of Information and Communication Technologies (ICT) tools provide a support for the daily operation of waste collection, mostly for mapping, routing, dispatching trucks, track inventory, scale management & invoicing. Modern Radio Frequency Identification technology (RFID) can be used for a wireless non-contact use in order to transfer data useful mostly in collection of waste, recycling and recovery of materials [1]. Combined with Pay-As-You-Throw (PAYT) pricing programs referring to the user's actual waste generation, RFID can lead to waste reduction mostly due to increased waste prevention. Moreover, RFID is being used for a better organization of waste collection routes by measuring the trash bin filling level. Some of the EU municipalities also use the integrated RFID and Waste Sorting systems, in which a scanner placed in the trash container automatically records what type of waste has been disposed, so supports the proper recycling. The rising waste volumes, increased hygienic and amenity demands connected with the environmental issues forced engineers to utilize the urban subsurface space in order to effectively manage the collected wastes. This type of systems appears in well-developed metropolis, mostly in residential areas, healthcare facilitates, town

shopping centers, airports. The underground system can operate either as a stand-alone collection points or incorporate automated vacuum collection schemes (AVAC), in which wastes are transported pneumatically to a centralized facility, where they are further processed [32]. Wastes are temporarily stored using the system, and then transported through the pipeline to waste collection terminal. The main benefit from the usage of underground systems like AVAC is reduction of economic and environmental costs of traditional vehicle—operated waste collection.

Similarly, high priority waste collection models involves the immediate collection of waste form high priority bins, related to the bins placed in the critical areas in the cities that contain waste dangerous for humans or/and are located in sensitive areas, like schools, gas stations [2]. The proposed models allow to design a highly effective system of waste collection, including pro-active responses in the demand for collecting waste from high priority bins, dynamic re-allocation of routes in relation to the load of a truck.

5.2 Smart Processing and Smart Energy Recovery

Processing phase of MSW value chain shall involve the following stages: the sorting of waste materials for recycling, composting and preparation for the final application i.e. energy recovery. This segment of waste processing has a highest innovation potential with a strong accent on zero-waste technological solutions. The accurate sorting is a crucial step for any further strategies of a final waste disposal.

5.2.1 Mechanical Biological Treatment (MBT) and Mechanical Biological Stabilization (MBS)

Mechanical biological treatment (MBT) are the techniques that integrate biological and mechanical processes commonly used in other waste management facilities, such as Materials Recovery Facilities (MRFs), composting and anaerobic digestion plants. the main goals of this strategy are [47]: mass and volume reduction, resources recovery, decomposition of organic matter (low emissions, small amounts of leachate, reduced settlement of the landfill body), the potential usage of the "thermal fraction". In general, MBT include processes of: grinding and shredding, sorting, classification and separation in different configurations, applied in order to segregate the waste stream into individual fractions [54]. Then, the biodegradable material is being composted or anaerobically digested (stabilized) and non-biodegradable part is firstly split in order to sort out recyclable materials and then landfilled or incinerated. The output product of the biological treatment can be either landfilled/combusted or preferably recycled (in agriculture or remediation of polluted areas). In this case, the complex technology resulting in obtaining of the

stabilized compost/digestate is often called Mechanical Biological Stabilization (MBS) with a high demands on the quality of the final product.

The biological treatment is either aerobic (composting) with a compost as a final product or anaerobic (digestion) with energy recovery from wastes.

5.2.2 Composting

The strategy of turning organic wastes into a product intended to be sold in the market includes two trends: production of heat, electricity etc. and "bio—soils". Those products can be used directly by facilities or they could be sold on the open market. Composting as a method of biological decomposition of biowaste in the presence of oxygen contributes powerfully to the re-cycling and conservation in the soil of several macro- and micronutrients. Vermicomposting has recently been appreciated as a modern biotechnology of degradation of bio solids [52], in which earthworms play an important role as natural bioreactors in the process of decomposition of organic matter [43]. Some of earthworm species are able to transform a variety of organic wastes, which constitute 46% of global solid wastes [30], like solid paper mill waste [14], human feces [55], domestic waste [49], sugar production wastes [6] and sewage sludge [4] into a valuable product named vermicompost.

Composting processes may lead to emissions of greenhouse gases, which is mostly related to the energy that is needed for classical composting and by the production of CO_2, methane and nitrous oxide as a result of biodegradation [28]. Introducing earthworms into the process helps to decrease the emissions of ammonia and nitrous oxide and methane, which helps to reduce the greenhouse effect of the process [35]. Moreover, [15] has shown the lower emission of nitrous oxide while using vermicomposting system, probably due to the reduction of anaerobic denitrification as a result of earthworms burrowing.

Being a relatively environmentally-friendly method of waste management, vermicomposting is also known as a low-cost strategy, with more revenues comparing to traditional composting [34].

5.2.3 Anaerobic Digestion

Anaerobic digestion is one of the most essential solutions in organic waste treatment that uses the natural process of organic material break down in the absence of oxygen with the use of microorganisms. This bacterial fermentation process results in a biogas that contains mostly methane and carbon and dioxide [42]. Naturally, the process occurs in anaerobic niches e.g. marshes, sediments, wetland. The systems using anaerobic digestion are used frequently at wastewater treatment facilities in order to stabilize and reduce the volume of sewage sludge produced in primary and secondary treatment of municipal water [53]. Recently co-digestion with sewage sludge as a main substrate was recognized as beneficial over traditional

mono-digestion. For example, the addition of fat-rich grease trap sludge improved the efficiency of the anaerobic digestion process [29]. The application of anaerobic digestion for MSW can be used in order to reduce the amount of landfilled material, stabilize organic material before final disposal and recover energy. Two main products of the process are:

Digestate: a semisolid or liquid product, sanitized and stabilized, that can be used as a fertilizer due to high amounts of nutrients that should be recycled [51].

Biogas that can be used directly onsite (for boilers, dryers, process heaters or greenhouses) or to produce electricity with gas or converted diesel-fueled ICEs technology; biogas converted to biomethane can be used as an alternative transportation fuel for different types of vehicles.

5.2.4 Incineration

Incineration is one of the waste-to-energy strategies that include the combustion of wastes in order to recover energy. Firstly, MSW incinerators were intended mostly to reduce the volume and sterilize the wastes. The process was conducted without material separation or energy recovery, so basically it was rather harmful for the environment. Currently, facilities are able to chemically bind energy of MSW to transform it into heat and/or electricity. In the process, the organic carbon and hydrogen are oxidized to CO_2 and H_2O, which are subsequently discharged to the atmosphere.

Even though the public acceptance of incineration plants increases recently, there are still some economic and environmental issues that need to be solved before considering this solution as a strategy. Waste incineration Directive [22] aims on prevention and reduction of possible negative effects caused by the incineration and co-incineration of waste. Application of operational conditions, technical requirements and emission limit values should allow to reduce pollution caused by emissions into the air, soil, surface water and groundwater, though, indirectly reduce the risks for human health. The Directive distinguished between two types of facilitates connected to incineration: incineration plants dedicated to the thermal treatment of waste with/without heat recovery and co-incineration plants, e.g. cement or lime kilns which focus on energy generation or the production of material products. For the latter, wastes can be treated as a fuel/substrate. According to Brunner et al. [13], the main advantages of this method are: full hygienisation, mineralization of organic substances to carbon dioxide and water, conservation of some resources (e.g. energy materials like iron, stainless steel) and overall environmental protection. However, the high-tech advances in this types of technologies shall mainly focus on the air emissions control level. The existing facilitates should be upgraded in order to reduce the pollution effect caused be their functioning. The advanced thermal treatment methods includes: gasification, pyrolysis, plasma arc gasification and W2F plants.

5.3 Smart Disposal

Landfilling is being considered as a less preferable pathway for waste management, but still some fraction of waste needs to be disposed. In order to fulfill the increasing environmental requirements, the LFG capturing and active landfill management practices should be implemented. Sanitary landfilling can be understood as a controlled disposal of waste on the land, which controls the exposure of the environment and humans to the detrimental effects of solid wastes [12]. Their proper functionality integrates a number of strategies technologies in order to reduce the danger of chemicals release and GHG emissions. There are still many issues and concerns associated with this method of waste disposal and it is rather suited to developing countries due to its simplicity and flexibility. The main area for possible innovations are mostly related to reduction of negative effects of methane production and leachates by integration of remote monitoring networks, sensors and IT that enhance the biological, chemical and physical process that are normally related to landfills. Alternative solutions like bioreactor landfills or enhanced leachate recirculation allow to obtain faster solid waste decomposition by addition of supplement water [11] and consequently to mitigate the climate change by reduction of gas emissions. In bioreactor landfills, the potentially dangerous GHG gases (mostly methane and carbon dioxide) can be used to produce clean energy. The further recultivation of municipal waste landfills shall include modification of the shape of the landfill to the suitable morphology, landfill gas separation, landfill lining, technical recultivation, drainage and final biological recultivation with plants commonly used to phytoremediation techniques.

6 Conclusions

The success of smart cities lies mostly in the development and integration of networks and services that bring higher efficiency and benefits for residents and businesses. The concept includes embracing ICT and eco-innovations in pursuit of a more efficient use of resources and lower emission levels. The EU member states have been investing in research and innovation in order to improve the quality of life by upgrading water supply, urban transport networks and waste disposal facilitates, and by deploying more efficient ways to light and heat buildings. The models of waste management shall include smart collection, processing, energy recovery and disposal, with strong emphasis on strategies that lead to the reduction of GHG emissions, and consequently mitigate the climate change. The discussed scenarios for waste treatment are mainly focused on sustainability, understood as a full matter and/or energy recovery that fits perfectly in the pro-ecological trend observed at the level of society and legislation. The most suitable option for a particular area should be selected judiciously, according to careful economic, sociologic and environmental criteria.

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References

1. Abdoli S (2009) RFID application in municipal solid waste management system. Int J Environ Res 3(3):447–454
2. Anagnostopoulos T et al (2015) Assessing dynamic models for high priority waste collection in smart cities. J Syst Softw 110:178–192
3. Arnold M. et al (2015) D2. 1 Regulatory and integrative aspects in smart cities. BlueSCities Report
4. Azizi AB et al (2013) Vermiremoval of heavy metal in sewage sludge by utilising lumbricus rubellus. Ecotoxicol Environ Saf 90:13–20. doi:10.1016/j.ecoenv.2012.12.006
5. Bakıcı T et al (2013) A smart city initiative: the case of Barcelona. J Knowl Econ 4(2):135–148. doi:10.1007/s13132-012-0084-9
6. Bhatnagar A et al (2016) Multidisciplinary approaches to handling wastes in sugar industries. Water Air Soil Pollut 227(1):1–30. doi:10.1007/s11270-015-2705-y
7. Bień J (2007) Sewage sludge–theory and practice. Wyd. Politech. Częstoch, Częstochowa, p 289
8. Bień J et al (2011) Kierunki zagospodarowania osadów w Polsce po roku 2013. Inżynieria i Ochrona Środowiska 14:375–384
9. Bjarnadóttir HJ et al (2002) Guidelines for the use of LCA in the waste management sector. Nordtest, Finland
10. Boden TA et al (2016) Global, regional, and national fossil-fuel co2 emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn, U.S.A
11. Broun R, Sattler M (2016) A comparison of greenhouse gas emissions and potential electricity recovery from conventional and bioreactor landfills. J Cleaner Prod 112 Part 4:2664–2673. doi:10.1016/j.jclepro.2015.10.010
12. Brunner D et al (1970) Sanitary landfill guidelines-1970. US Department of Health, Education and Welfare, Bureau of Solid Waste Management
13. Brunner PH, Rechberger H (2015) Waste to energy–key element for sustainable waste management. Waste Manag 37:3–12. doi:10.1016/j.wasman.2014.02.003
14. Butt KR (1993) Utilisation of solid paper-mill sludge and spent brewery yeast as a feed for soil-dwelling earthworms. Bioresour Technol 44(2):105–107. doi:10.1016/0960-8524(93)90182-B
15. Chan YC et al (2010) Emission of greenhouse gases from home aerobic composting, anaerobic digestion and vermicomposting of household wastes in Brisbane (Australia). Waste Manage Res. doi:10.1177/0734242X10375587
16. Cherubini F et al (2009) Life cycle assessment (LCA) of waste management strategies: landfilling, sorting plant and incineration. Energy 34(12):2116–2123. doi:10.1016/j.energy.2008.08.023
17. Commission E (2008) Directive 2008/98/EC of the european parliament and of the council of 19 november 2008 on waste and repealing certain directives (Waste framework directive, R1 formula in footnote of attachment II): http://eur-lex.europa.eu/LexUriServ". LexUriServ. do
18. De Feo G, Malvano C (2009) The use of LCA in selecting the best MSW management system. Waste Manag 29(6):1901–1915. doi:10.1016/j.wasman.2008.12.021
19. Directive A (1994) 94/62/EC on packaging and packaging waste. Available on the Internet: http://europa.eu.int/scadplus/leg/en/lvb/l21207.htm. Cited 10:02-05

20. Directive C (1986) Council directive on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture. Offic J Eur Comm 181:0006–0012
21. Directive C (1999) 31/EC of 26 April 1999 on the landfill of waste. Official journal L 182 (16):07
22. Directive E. W. I (2000) Directive 2000/76/EC of the European Parliament and of the Council on Incineration of Waste. European Commission, Brussels
23. Directive U. W. W. T (1991) Council Directive 91/271/EEC concerning urban wastewater treatment. OJ L 135
24. Dorado AD et al (2014) Inventory and treatment of compost maturation emissions in a municipal solid waste treatment facility. Waste Manag 34(2):344–351
25. EIO (2016) http://www.ecoinnovation.eu. Accessed 4 July 2016
26. EPA US (2014) Climate change indicators in the United States, 2014. Third edition. EPA 430-R-14-004
27. Fijalkowski K et al (2014) Occurrence changes of Escherichia coli (including O157: H7 serotype) in wastewater and sewage sludge by quantitation method of (EMA) real time—PCR. Desalin Water Treat 52(19–21):3965–3972
28. Friedrich E, Trois C (2013) GHG emission factors developed for the recycling and composting of municipal waste in South African municipalities. Waste Manag 33(11):2520–2531. doi:10.1016/j.wasman.2013.05.010
29. Grosser A, Neczaj E Enhancement of biogas production from sewage sludge by addition of grease trap sludge. Energy Convers Manag. doi:10.1016/j.enconman.2016.05.089
30. Hoornweg D, Bhada-Tata P (2012) What a waste: a global review of solid waste management
31. Kacprzak M et al (2015) Escherichia coli and Salmonella spp. Early diagnosis and seasonal monitoring in the sewage treatment process by EMA-qPCR method. Pol J Microbiol 64 (2):143–148
32. Kaliampakos D, Benardos A (2012) Underground solutions for urban waste management: status and perspectives. National Technical University of Athens Lab of Mining and Environmental Technology
33. Lawrence M, Woods E (2014) Smart waste. advanced collection, processing, energy recovery, and disposal technologies for the municipal solid waste value chain: global market analysis and forecasts". In Navigant Research
34. Lim SL et al (2016) Sustainability of using composting and vermicomposting technologies for organic solid waste biotransformation: recent overview, greenhouse gases emissions and economic analysis. J Cleaner Prod 111, Part A:262–278. doi:10.1016/j.jclepro.2015.08.083
35. Luth et al (2011) Earthworm effects on gaseous emissions during vermifiltration of pig fresh slurry. Bioresour Technol 102(4):3679–3686. doi:10.1016/j.biortech.2010.11.027
36. Marchal V et al (2011) OECD environmental outlook to 2050. Organization for Economic Co-operation and Development
37. Mendes MR et al (2004) Comparison of the environmental impact of incineration and landfilling in São Paulo City as determined by LCA. Resour Conserv Recycl 41(1):47–63. doi:10.1016/j.resconrec.2003.08.003
38. Muchová L, Eder P (2010) End-of-waste criteria for aluminium and aluminium alloy scrap: technical proposals. Publications Office of the European Union, Luxembourg, Institute for Prospective Technological Studies, p 66
39. OECD (2009) Sustainable manufacturing and eco-innovation: towards a green economy. Accessed 3 July 2016
40. Placek A et al (2016) Improving the phytoremediation of heavy metals contaminated soil by use of sewage sludge. Int J Phytorem 18(6):605–618. doi:10.1080/15226514.2015.1086308
41. Ramaswami A et al (2016) Meta-principles for developing smart, sustainable, and healthy cities. Science 352(6288):940–943. doi:10.1126/science.aaf7160
42. Rapport J et al (2008) Current anaerobic digestion technologies used for treatment of municipal organic solid waste. University of California, Davis, Contractor Report to the California Integrated Waste Management Board

43. Rorat A et al (2015) Interactions between sewage sludge-amended soil and earthworms—comparison between Eisenia fetida and Eisenia andrei composting species. Environ Sci Pollut Res :1–10. doi:10.1007/s11356-015-5635-8
44. Saveyn H, Eder P (2014) End-of-waste criteria for biodegradable waste subjected to biological treatment (compost & digestate): technical proposals. Publications Office of the European Union, Luxembourg
45. Seto KC et al (2014) Human settlements, infrastructure and spatial planning
46. Slagstad H, Brattebø H (2012) LCA for household waste management when planning a new urban settlement. Waste Manag 32(7):1482–1490. doi:10.1016/j.wasman.2012.03.018
47. Soyez K, Plickert S (2002) Mechanical-biological pre-treatment of waste: state of the art and potentials of biotechnology. Acta Biotechnol 22:3–4. doi:10.1002/1521-3846, (200207)22:3/4<271:AID-ABIO271>3.0.CO;2-I
48. Styka W, Beńko P (2014) Wdrażanie dobrych praktyk w gospodarce osadami ściekowymi. Inżynieria i Ochrona Środowiska 17(2):165–184
49. Suthar S, Singh S (2008) Vermicomposting of domestic waste by using two epigeic earthworms (Perionyx excavatus and Perionyx sansibaricus). Int J Environ Sci Technol 5 (1):99–106. doi:10.1007/BF03326002
50. Swilling M et al (2013) City-level decoupling: urban resource flows and the governance of infrastructure transitions. United Nations Environment Programme
51. Tampio E et al (2016) Agronomic characteristics of five different urban waste digestates. J Environ Manage 169:293–302. doi:10.1016/j.jenvman.2016.01.001
52. Wang L et al (2009) Vermicomposting Process. In: Wang LawrenceK, Pereira NormanC, Hung Yung-Tse (eds) Biological treatment processes. Humana Press, Handbook of Environmental Engineering, pp 715–732
53. Wickham R et al Biomethane potential evaluation of co-digestion of sewage sludge and organic wastes. Int Biodeterior Biodegradation. doi:10.1016/j.ibiod.2016.03.018
54. Worwąg G et al 2012 "Mechaniczno-biologiczne metody przetwarzania odpadów komunalnych-perspektywy rozwoju. In Gospodarka Odpadami Komunalnymi", ed. Wydawnictwo Uczelniane Politechniki Koszalińskiej, 403–418. Koszalin
55. Yadav KD et al (2010) Vermicomposting of source-separated human faeces for nutrient recycling. Waste Manag 30(1):50–56. doi:10.1016/j.wasman.2009.09.034
56. Yano J, Sakai S-I (2016) Waste prevention indicators and their implications from a life cycle perspective: a review. J Mater Cycles Waste Manage 18(1):38–56. doi:10.1007/s10163-015-0406-7
57. Zorpas AA (2016) Sustainable waste management through end-of-waste criteria development. Environ Sci Pollut Res 23(8):7376–7389. doi:10.1007/s11356-015-5990-5

Part IV
Policy and Regulations

Smart City Landscape Protection—EU Law Perspective

Justyna Bazylińska-Nagler

Abstract Close relationship between city dwellers' lives quality and urban landscapes' qualities is undisputed. Beginning with mapping smart cities in the EU, I lay out goals of urban landscape protection in EU law. Then, I turn to issues of public participation in urban landscape protection and depicture smart cities as public places where traditionally certain articles of Landscape, Aarhus conventions and Directive 2003/35/EC have applied. Drawing on relevant CJEU case law I argue expectations of right to fair justice in landscape protection that are both recognized by EU law and needed by urban dwellers.

Keywords Urban landscape protection · Sustainable development · Spatial planning · European Landscape Convention · Aarhus Convention

1 Introduction

Landscape is a component of the environment, just like water, air and biological diversity. Consequently landscape policies must be so formulated as to fit in with the objectives of sustainable development. Council of Europe Recommendation of 30 January 2002 accordingly states: "The Guiding Principles for Sustainable Spatial Development of the European Continent take account, in accordance with the concept of sustainability, of the needs of all the inhabitants of Europe's regions, without compromising the fundamental rights and development prospects of future generations. They aim in particular at bringing the economic and social requirements to be met by the territory into harmony with its ecological and cultural functions and at contributing in this way to long-term, large scale and balanced spatial development" [1]. Through this work I would like to demonstrate that smart city environment—means green urban planning, since close relationship between

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the quality of life of city dwellers and the quality of urban landscapes leaves no doubt [2]. I would also like to present relevant European legal provisions designed to foster the emergence of a landscape culture among the authorities and the population-improving public participation in landscape protection, management and planning.

My paper falls into three main sections. At the beginning I sketch the rise of smart cities, especially in the European Union, and discuss the key technological, economic and political drivers which have made them an unstoppable part of the future landscape policies. Afterwards, I lay out common European goals of urban landscape protection within the EU law. Finally, I turn to narrower issues of public participation in smart cities landscape policies and lay out what may be perceived as a basic underlying theoretical problem, i.e., that smart cities are, in essence, public places where traditionally laws such as Landscape Convention [3], Aarhus Convention [4] and implementing them EU law provisions i.e.: Directive 2003/4/EC on public access to environmental information [5], Directive 2003/35/EC providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment [6] and Regulation (EC) No 1367/2006 on the application of the provisions of the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters to Community institutions and bodies [7] have applied. Drawing on relevant Court of Justice of the European Union [8] case law I argue that reasonable expectations of right to fair justice in landscape protection in public spaces, are now recognized by European law and needed by urban dwellers. The analysis has been confined to European—precisely European Union law on purpose. Widening context outside the EU law would be interesting, however would incline towards presentation of all contracting—parties to both Landscape and Aarhus Convention legal solutions. This would make legal framework of this work imprecise and too broad.

2 The Rise of European Smart Cities

Future cities more responsive to their citizens and more efficient in their use of resources were the substance of vision of William J. Mitchell's—one of the world's leading urban theorists [9]. He perceived cities of tomorrow as living organisms or very-large-scale robots, with nervous systems that enable them to sense changes in the needs of their inhabitants and external conditions, and respond to these needs [10]. In 2011, 240 out of the 468 EU-28 cities with at least 100,000 inhabitants (51% of the total) had at least one smart city characteristic and could therefore be classed as smart cities [11].

Overview of the key smart city definitions in the literature let us define "a smart city" as a city seeking to address public issues via ICT-based solutions [information and communications technology] on the basis of a multi-stakeholder, municipally based partnership [11, 12]. We may perfectly say that information and communications technology is a key enabler for cities to address their challenges in a 'smart'

manner i.e.: to optimize the efficiency and effectiveness of useful and necessary city processes, activities and services. At the same time, a smart city is the one with at least one initiative addressing one or more of the following six characteristics: smart governance, smart people, smart living, smart mobility, smart economy and smart environment [13].

In the global profile of urban development, the smart city is emerging as an important basis for future city expansion. Europe's global competitors among the emerging economies are pursuing large smart city programmes. European Union has its own particular need for smart city thinking. The openness and connectivity of the European Internal Market [14] have allowed its cities to become hubs for creative economy, technological and societal innovation, welfare enhancement and sustainable development. They do this by attracting resources, income and other benefits throughout European common market. This complex ecosystem is robust and resilient, but it faces serious challenges, including economic and societal inequality, environmental change and profound demographic transition. Other changes, including increased mobility–because of Internal Market fundamental freedoms and greater access to information, may both help and hinder this development. These developments directly affect the sustainability and the European contributions of urban environments at the same time they may be turned to advantage by smart city initiatives.

In view of the challenges associated with growing European urbanization, as well as the wider agenda to tackle economic recovery poverty, unemployment and environmental damage, the Europe 2020 strategy [15] incorporates a commitment to promote the development of smart cities throughout European Internal Market and to invest in the necessary ICT infrastructure and human and social capital development. Smart cities may play a part in helping to meet the targets set out in Europe 2020 [16] by adopting scalable solutions that take advantage of ICT technology to increase effectiveness, reduce costs and improve quality of life. They may serve as incubators for new ideas and approaches through supporting sustainable development within their boundaries, providing direct and indirect assistance to other cities and less-urbanized areas. Cities are key to the sustainable development of the European Union, at the same time the European model of sustainable urban development is under threat. Urban sprawl and the spread of low-density settlements is one of the main threats to sustainable territorial development. Public services become more costly and difficult to provide, natural resources are overexploited, public transport networks are insufficient and car reliance and congestion in and around cities are heavy. Urban ecosystems are under pressure—urban sprawl and soil sealing threaten biodiversity and increase the risk of both flooding and water scarcity [17].

Smart cities offer solutions for a more sustainable—in EU law meaning [18] way of life. But despite improvements in air and water quality, as well as efforts to mitigate and adapt to climate change, European cities still face a number of environmental challenges. As engines of growth and generators of wealth, cities are also drivers of consumption and use of material resources. The density and compactness of cities reduce energy needs for heating and mobility, and offer possibilities for

more efficient land use. Natural eco cycles, especially those for water, are being disrupted by a lack of natural soil and wetlands. The scarcity of land within cities creates pressure for an uncontrolled expansion outside the city cores driven by price rather than environmental considerations. Waste generation leads to land being used for landfills [19].

European Landscape Convention [3] prevents urban sprawl and supports green urban planning, promotes a vision of the compact and green city and sets out a legal framework for European smart cities development. A compact settlement structure is an important basis for efficient and sustainable use of resources. This can be achieved by spatial and urban planning, which prevents urban sprawl by strong control of land supply and of speculative development. The strategy of mixing housing, employment, education, supply and recreational use in urban neighborhoods has proved to be especially sustainable [11]. The compact and green city offers an interesting urban landscape, a healthy functional mix, and a good quality of architecture and design in its built environment—public spaces, buildings and housing. It offers easy access to green areas and open space for everyone. It takes care of and makes use of its historical sites and monuments. People who no longer need to search for green areas outside the city may move back to the centers and no longer need to go to work or to leisure facilities by car. Alternatively, they can easily use clean and convenient public transport. These savings in transport free up more public space, and make cities cleaner and quieter. Furthermore, it has prevented the countryside from suffering from urban sprawl, preserving it for agriculture, forestry and nature.

3 Common Goals of Urban Landscape Protection Within the EU Law

Most Europeans live in towns and large or small cities, the quality of whose landscapes greatly affects their lives. Preamble to the European Landscape Convention [3] says that the member states of the Council of Europe express their desire to "respond to the public's wish to enjoy high quality landscapes and to play an active part in the development of landscapes". A European vision of the territorial development of cities includes certain human rights protection i.e.: right to live in clean environment, right to access to information, right to public participation in making environmental decisions, right to access to justice in environmental matters. These rights belong to third generation human rights and as such are crucial for pursuing sustainable development principle [20]. Democratization of landscape is not just a question of the new scope which the European Landscape Convention introduces—it is also reflected in collective and individual appropriation of all landscapes, through the requirement that there be direct participation for all in all phases of decision-making regarding landscape alteration, supervision of landscape evolution and prevention of reckless landscape destruction [21].

A landscape policy involving only experts and administrators, who themselves are often specialists, would result in landscapes imposed on the public, just as in the days when landscape was produced by and for an elite.

The European Landscape Convention is the first and only international treaty devoted exclusively to the protection, management and enhancement of all European landscapes. Signed at Florence on 20 October 2000, it requires the states concerned to define a genuine landscape policy in partnership with the public [22]. In particular, Article 5.c of the convention provides that "each party undertakes to establish procedures for the participation of the general public, local and regional authorities, and other parties with an interest in the definition and implementation of the landscape policies mentioned in paragraph b above". Article 6.D adds that "each party undertakes to define landscape-quality objectives for the landscapes identified and assessed, after public consultation in accordance with Article 5.c." In this sense, the European Landscape Convention is an extension of the Aarhus Convention of 25 June 1988 on access to information, public participation in decision-making and access to justice in environmental matters [4], to which it refers in its preamble.

The European Union has been a contracting party to the Aarhus convention since 2005 but has never been a party to aforementioned Florence Convention. All the EU member states are contracting parties to Aarhus Convention, but there are three states who neither signed nor ratified Florence Convention i.e.: Germany, Austria and Estonia. According to Article 216(2) TFEU [14] international treaties concluded by the European Union bind its institutions. They are part of EU law [23, 24]. Aarhus Convention was approved on behalf of the European Community by Council Decision 7/370/EC [25]. In 2006 Regulation 1367/2006 [7] was adopted—that made the provisions of the Aarhus Convention applicable to Community institutions and bodies. As regards the Member State level, in 2003 two Directives concerning the first and second "pillars" of the Aarhus Convention were adopted, respectively: Directive 2003/4/EC on public access to environmental information [5] and Directive 2003/35/EC providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment [6]. Both Directives 2003/4 and 2003/35 contain provisions on access to justice. The aforementioned Regulation 1367/2006 covers not only the institutions, but also bodies, offices or agencies established by, or on the basis of the Treaty. They need to adapt their internal procedures and practice to the provisions of the Regulation. The Aarhus Regulation addresses the "three pillars" of the Aarhus Convention [26]—access to information, public participation and access to justice in environmental matters—where those are of relevance to the EU institutions and bodies and lay down related requirements. Regarding access to environmental information, the Aarhus Regulation extends Regulation 1049/2001 regarding public access to European Parliament, Council and Commission documents to all Community institutions and bodies [27]. The Aarhus Regulation furthermore requires those institutions and bodies to provide for public participation in the preparation, modification or review of "plans and programmes relating to the environment". The Regulation also enables environmental non-governmental organizations meeting certain criteria to request an internal review [28] under environmental law of acts

adopted, or omissions, by Community institutions and bodies. Requests for internal review of an administrative act or relating to an administrative omission are to be sent by mail or e-mail to the department responsible for the application of the provision on the basis of which the administrative act was adopted, or in respect of which the administrative omission is alleged.

The European Union does not have a direct treaty-based competence in urban and territorial development, however, economic, social and territorial cohesion all have a strong urban dimension. The EU has had a growing impact on the development of cities over recent decades, exactly through cohesion policy. With the Lisbon Treaty [14, 18], territorial cohesion was recognized as a key objective of the European Union. Article 3(3) TEU [18] says: "the EU promotes economic, social and territorial cohesion, and solidarity among Member States." Therefore we may perfectly notice that the EU besides its international obligations flowing from the aforementioned international conventions is bound to follow the general principles of EU law-primarily sustainable development principle. At the same time Article 4 (2)(e) TFEU has made it plain that environmental policy is a competence shared between the EU and the Member States. However, that provision merely confirmed the pre-Lisbon reform situation.

The European Union aims to promote economic, social and territorial cohesion. The key role of cities in all aspects of cohesion plays their territorial development. Although the EU lacks a formal competence in spatial planning, there is a consensus on key principles which may form the basis of a shared European vision. The future urban territorial development pattern reflects a sustainable development of Europe based on balanced economic growth and balanced territorial organization with a polycentric urban structure. This model promotes strong metropolitan regions and other strong urban areas, such as regional centers, especially outside the core areas of Europe, which provide good accessibility to services of general economic interest. Future European city is characterized by a compact settlement structure with limited urban sprawl through a strong control of land supply and speculative development. It also enjoys a high level of protection and quality of the environment around cities—nature, landscape, forestry, water resources, agricultural areas.

Especially the last two decades have witnessed an increasing importance of the EU law in both urban and territorial development. The 2007 Leipzig Charter on Sustainable European Cities [29] has been the chief outcome of this process. It stresses the importance of an integrated approach to urban development and a focus on deprived neighborhoods in order to remedy vicious circles of exclusion and deprivation. In 2010 this was taken further with the Toledo Declaration [30], which not only underlines the need for an integrated approach in urban development, but also promotes a common understanding of it. The Toledo Declaration effectively links the Leipzig Charter to the objectives of Europe 2020—which is the EU's strategy for boosting growth and jobs across the region in order to create a smart, sustainable and inclusive economy. Smart city initiatives can be considered a useful vehicle for cities to achieve their Europe 2020 targets. In reality, a smart city initiative aims to make improvements in relation to a number of the Europe 2020

targets. The alignment of smart city characteristics with Europe 2020 targets provides a more nuanced view of the strength of contributions of smart city characteristics to the objectives of Europe 2020.

The European Commission defines its approach to smart cities as 'coordinated'. Various parts of the EU administrative machine are collectively and independently involved in supporting smart cities at international and national levels. For example, the Directorate-General for Communications Networks, Content and Technology (DG CONNECT) has funded smart city projects through 7th Framework Programme (FP7) projects and the ICT-Policy Support Programme (PSP) which is part of CIP. It has also worked together with the Directorate-General for Research & Innovation (DG RTD) and the Directorate-General for Energy (DG ENER) on cross-cutting PPPs including the European Green Cars Initiative and the Energy-Efficient Buildings Programme. The European Commission has provided policy support through particular policies of the Directorate-General for Mobility and Transport (DG MOVE) and via several communications that specifically refer to the role of smart cities.

4 European Landscape Convention and Aarhus Convention with Regard to Public Participation in Smart Cities Landscape Policies

To begin with the question—what does the public participation involve and when should it take place? The answers to this question may be found in a parallel study of the Landscape Convention and the Aarhus Convention. Indeed, the principle of public participation in landscape matters ties in with the Council's of Europe desire to develop local citizenship and reinforce the practice of democracy [31, 32]. Articles 5.c and 6.D of the European Landscape Convention highlight the need to put in place procedures for participation [33]. Article 5c of the Landscape Convention reads as follows:"Each Party undertakes: (c) to establish procedures for the participation of the general public, local and regional authorities, and other parties with an interest in the definition and implementation of the landscape policies mentioned in paragraph (b) above. Whereas Article 6.D states: "Each Party undertakes to define landscape quality objectives for the landscapes identified and assessed, after public consultation in accordance with Article 5(c). The Aarhus Convention gives greater substance to the European Landscape Convention by specifying the basic terms such as: "the public", "the public concerned", "participation in landscape policy-making through either landscape plans or landscape-quality objectives". The concepts of "the public" and "the public concerned" are especially important. They are defined in Article 2(4) and (5) respectively. The crucial point here is that environmental nongovernmental organizations (NGOs) are deemed to be part of the public concerned, so long as they meet "any requirements under national law." Since breaches of environmental law are

frequently of concern to the population as a whole without any particular persons being singled out, it is frequently very difficult, if not impossible, to enforce environmental law in judicial proceedings on the basis of the traditional rules of locus standi. In other words, the "environment has no voice of its own" [34]. The purpose of this reform, which is arguably the greatest innovation introduced by the Arhus Convention, is to surmount this obstacle by granting such NGOs to bring certain judicial proceedings "on behalf of" the environment.

Three pillars of the Aarhus Convention set forth certain rights of the public in environmental matters i.e.: "access to environmental information", "public participation in environmental decision-making" and the right to review procedures to challenge public decisions that have been made without respecting the two aforementioned rights or environmental law in general—"access to justice". Access to justice is undoubtedly the pièce de résistance of the Aarhus Convention and the area which gives rise to the most delicate questions. As already mentioned, this is perhaps the most revolutionary innovation introduced by this convention. Article 9 (3) reads as follows: "In addition, and without prejudice to the review procedures referred to in paragraphs 1 and 2 above, each Party shall ensure that, where they meet the criteria, if any, laid down in its national law, members of the public have access to administrative or judicial procedures to challenge acts and omissions by private persons and public authorities which contravene provisions of its national law relating to the environment". This, not very detailed provision applies to all disputes relating to matters outside both the first pillar of the Convention and Article 6 (public participation in decisions on specific activities). Thus even disputes relating to Article 7 (public participation concerning plans, programmes and policies relating to the environment) are caught by Article 9(3), even though Article 7 is part of the second pillar. Unlike most of the provisions of the Convention, Article 9(3) applies not merely to the acts and omissions of public authorities, but also to those of private persons.

It is generally acknowledged, that the Aarhus Convention calls for the recognition of a number of procedural rights for individuals and NGOs with regard to the environment. However, in some aspects, the implementation of the requirements for access to justice has been left to the Member States, resulting in great disparities from one legal order to another. For instance, Article 9(1) of the Aarhus Convention was implemented with respect to the Member States by Article 6 of Directive 2003/4. While the language of Article 6(2) of the Directive 2003/4 is faithful to the wording of Article 9 of the Convention, it is arguable that this language cannot be taken at face value: insofar as it appears to allow Member States to preclude access to the courts altogether, it would seem to be at variance with the principle of effectiveness enshrined in Article 19(1) TEU and the right of access to justice laid down in Article 47 of the Charter of Fundamental Rights of the Union [35, 34, 36]. For ease of reference we may consider that environmental NGOs are deemed to have locus standi, in national legal orders—under the above mentioned directives: 2003/4/EC and 2003/35/EC implementing certain provisions of the Convention. However, there have been a significant number of cases before Court of Justice of the European Union concerning procedural rights of individuals and NGO's in

environmental matters both at national and EU level. As an example, the rulings of the Court of Justice of the EU Grand Chamber of 13 January 2015 on MRL case [37] settle a long-running dispute between environmental NGOs and the European Commission about the effectiveness of the Aarhus Regulation in improving access to justice in environmental matters at the EU level [38]. Pursuant to that regulation, review of measures adopted by EU institutions is limited to administrative acts. Two NGOs challenged the legality of that limitation and filed legal action. The case was related to the establishment of EU maximum residue levels for active substances contained in crop protection products. The Commission refused to review this measure which it considered to be no administrative act. Finally, the Court of Justice made clear that one of the key provisions of the Aarhus Convention cannot be relied upon by NGOs that seek to challenge the legality of the Aarhus Regulation. The Court confirmed that Article 9(3) of the Aarhus Convention does not provide for unconditional and sufficiently precise obligations. This is in line with the CJEU's findings in the Slovakian Brown Bear case [39]—when the Court declared that it has jurisdiction to interpret the provisions of the Aarhus Convention and that Article 9(3) of this Convention has no direct effect. Further, the CJEU clarified that the case law developed in the Fediol case [40] and in the Nakajima case [41] was justified solely by the particularities of the free trade agreements that provided the relevant legal framework in those cases—only in very exceptional cases may individuals rely on the provisions of international treaties concluded by the EU. Hence, the judgment on MRL case is a landmark decision. Unfortunately, it will prevent NGOs from future attempts to directly invoke the Aarhus Convention in court [42, 43].

The results of the research done for the purpose of this work incline to notice a strong need for a new EU directive on access to justice in environmental matters. From the national reports [36] it is obvious that a common legal framework is needed to bring all Member States in line with Articles 9.3 and 9.4 of the Aarhus Convention. There is a basic uncertainty and also opposing opinions about the requirements of the said Article 9.3—what measures are needed, what kind of decisions are covered, what kind of body (administrative or judicial) should undertake the review, what kind of review is needed, etc.? In order to promote predictability and legal certainty, there is a need for the EU directive on access to justice in environmental matters. There are no alternatives—to rely on Article 258 TFEU alone surely would be too ineffective and time consuming, and the result too piecemeal. Something similar could be said about waiting to see how the case law of the CJEU under Article 267 would develop. Member States are very reluctant to adapt their legislation to case law. Thus, to rely on the CJEU and the national adaption to its decisions alone would be too uncertain and slow. However, the jurisprudence of the CJEU will continue to play a dynamic role in this area, as a legislative framework at the European Union level on access to justice will have to be quite basic—due to the EU limited powers in the area, dealing only with the main elements of judicial review of administrative decisions in a general way [36].

To conclude, the concept of public participation in landscape policies perfectly suits to social innovations typical for smart cities. Undoubtedly, future city

solutions accommodate basic and third generation human rights i.e.—not only right to live in clean environment, but also right to bring a legal action when the certain standards of environmental protection are on the line.

5 Conclusions

People form the core of cities. Future cities need to be designed for all citizens and not just for the elite, for the tourists, or for the investors [44]. Smart city initiatives regard people as the key city asset-landscape contributes to their individual and social well-being. Half of the medium-sized European Union cities have at least one smart city characteristic. Analysis of smart city goals vis-à-vis Europe 2020 targets demonstrates that a lot of smart city initiatives, especially those that span multiple countries, are funded by the EU. It is perfectly visible that, the characteristics used to classify these initiatives align with Europe 2020. In addition, some initiatives explicitly reference Europe 2020 targets or aims in setting their objectives.

Modern urban landscape policies encompass more than spatial planning based on strong forward-looking action to enhance, restore or create landscapes—these policies provide for human rights—derived from the European Union treaties, the Charter of Fundamental Rights of the Union, from the Council of Europe conventions and programmes, etc [45]. The common denominator is sustainable development principle and democracy principle. Environmental democracy involves people—members of the public who have access to information, are allowed to participate and have access to judicial review.

In my view, Article 47 constituting right to an effective remedy and to a fair trial of the European Charter of Fundamental Rights and Article 19 TEU stating principle of effective judicial protection are the given starting points in discussing access to justice in environmental matters within the Union. In addition, by ratifying the Aarhus Convention in 2005 the EU committed itself to guaranteeing sufficient access to justice in environmental matters. Evaluating the EU's role as an Aarhus convention environmental norm diffuser we should keep in minds that EU shares legislative powers within the area of environmental protection with the EU member states. Paradoxically, cited within this work synthesis reports on the implementation of certain articles of Aarhus convention in member states show that states are not very eager to guarantee that everyone could speak for environment before a court. The judgments of the Court of Justice of the European Union of 13 January 2015 indeed should be called-missed opportunities for environmental democracy at the EU level. These rulings may be qualified as a significant step backwards for judicial protection in environmental matters at the EU level. It is established that, instead of addressing the current failings of the EU with respect to access to justice in environmental cases, the CJEU's hands-off approach paves the way for yet another decade of noncompliance by the EU in the realm of access to justice in environmental cases.

To conclude: "The reason for the European Landscape Convention's insistence on the participative approach is a desire not so much to fall in with prevailing fashion as to give legal recognition to the special features of landscape. Landscape exists because it is visible. A landscape policy which involved only experts and administrators, who themselves are often specialists, would result in landscapes that were imposed on the public, just as in the days when landscape was produced by and for an elite. Democratization of the landscape is not just a question of the new scope which the European Landscape Convention introduces. It is also reflected in this collective and individual appropriation of all landscapes, through the requirement that there be direct participation for all in all phases of decision-making regarding landscape alteration, supervision of landscape evolution and prevention of reckless landscape destruction" [46].

References

1. Recommendation Rec (2002) 1 of the Committee of Ministers of the Council of Europe of 30 January 2002 to Member States on the guiding principles for sustainable spatial development of the European Continent. Paragraph 8
2. Sargolini M (2013) Urban landscapes: environmental networks and the quality of life. Springer, pp 11–17
3. European Landscape Convention, Florence 20.X (2000) Council of Europe. European Treaty Series—No176
4. Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, Aarhus, Denmark, 25 July 1998, vol. 2161. United Nations, Treaty Series, p 447
5. Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC, OJ L 041 of 14/02/2003, pp 0026–0032
6. Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC, OJ L 156 of 25/06/2003, pp 0017–0025
7. Regulation (EC) No 1367/2006 of the European Parliament and of the Council of 6 September 2006 on the application of the provisions of the Aarhus convention on access to information, public participation in decision-making and access to justice in environmental matters to community institutions and bodies, OJ L 264 of 25.9.2006, pp 13–19
8. Court of Justice of the European Union. Article 19 of the Treaty on European Union, OJ 2012/C 326/13. Further: CJEU
9. Mitchell WJ (2007) Intelligent cities. UOC Papers, e-J Know Soc 5:3–8
10. Szabłowski M (2016) Ekologia konstruktywnie, Rozwój zrównoważony terenów zurbanizowanych. Collegium Mazovia, Siedlce
11. Manville C et al (2014) Mapping Smart Cities in the EU. European Parliament, DG for Internal Policies of the Union. Publications Office, Luxembourg, p 11
12. Edwards L (2016) Privacy, security and data protection in smart cities: a critical EU law perspective. Eur Data Prot Law Rev 2(1):28–58, 4–5
13. Deakin M, Al Waer H (2012) From intelligent to smart cities. Routledge, Abingdon

14. Treaty on the functioning of the European Union, OJ 2012/C 326/01. Further: treaty or TFEU. Article: 26(2)
15. European Commission (2010) Communication from the Commission. Europe 2020. A strategy for smart, sustainable and inclusive growth. COM 2020 final. Brussels, 3.3.2010
16. European Commission (2013) Europe 2020 targets. http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/targets/index_en.htm
17. Yokohari M, Murakami A, Hara Y, Tsuchiya K (eds) (2017) Sustainable landscape planning in selected urban regions. Springer
18. Treaty on European Union, OJ 2012/C 326/13. Further: TEU. Article: 3
19. European Environment Agency (2015) The European environment—state and outlook 2015: synthesis report. Copenhagen
20. Shaw MN (2008) International law. Cambridge University Press, p 265
21. Siemiński W (2007) Cele i zasady partycypacji społecznej w planowaniu przestrzennym - przegląd literatury. Człowiek i Środowisko 31(1–2):37–59, 7–13
22. (2000) Explanatory Report to the European Landscape Convention. European Treaty Series—No. 176
23. Jendrośka J (2011) Public participation in environmental decision-making. Interactions between the Convention and EU law and other key legal issues in its implementation in the light of the Opinions of the Aarhus Convention Compliance Committee. In: The Aarhus Convention at ten: interactions and tensions between conventional international law and EU environmental law. Edit.: Marc Pallemaerts. Europa Law Publishing, p 143
24. Jendrośka J, Radecki W (1999) Konwencja o dostępie do informacji, udziale społeczeństwa w podejmowaniu decyzji oraz dostępie do sprawiedliwości w sprawach dot. Środowiska. Centrum Prawa Ekologicznego, Wrocław
25. Council Decision 2005/370/EC of 17 February 2005 on the conclusion on behalf of the European Community, of the Convention on access to information, public participation in decision-making and access to justice in environmental matters (2005) OJ L 124 of 17.05.2005, p 1
26. Ebbesson J (2002) Information, participation and access to justice: the model of the Aarhus Convention. In: Stockholm University joint UNEP-OHCHR expert seminar on human rights and the environment, 14–16 January 2002, Geneva: Background Paper No. 5. http://www2.ohchr.org/english/issues/environment/environ/bp5.htm
27. Regulation (EC) No 1049/2001 of the European Parliament and of the Council of 30 May 2001 regarding public access to European Parliament, Council and Commission documents, OJ L 145 of 31.05.2001, p 43
28. Requests for internal review. Practical guide. http://ec.europa.eu/environment/aarhus/requests.htm
29. Leipzig Charter on Sustainable European Cities of 02 May 2007. http://ec.europa.eu/regional_policy/archive/themes/urban/leipzig_charter.pdf
30. Toledo Declaration. Toledo informal ministerial meeting on urban development declaration. Toledo, 22 June 2010. http://ec.europa.eu/regional_policy/archive/newsroom/pdf/201006_toledo_declaration_en.pdf
31. Recommendation Rec (2002) 12 of the Committee of Ministers of the Council of Europe of 16 October 2002 to Member States on education for democratic citizenship
32. Recommendation Rec (2001) 19 of the Committee of Ministers of the Council of Europe of 6 December 2001 to Member States on the participation of citizens in local public life
33. Prieur M, Durousseau S (2006) Landscape and public participation. In: Landscape and sustainable development: challenges of the European Landscape Convention. Council of Europe Publishing, Strasbourg, pp 166–206
34. Oliver P (2013) Access to information and to justice in EU environmental law: the Aarhus convention. Fordham Int Law J 36:1423–1470
35. Charter of Fundamental Rights of the Union, OJ C 326 of 26.10.2012 p 2

36. Darpo J (2013). European Commission. Effective justice? Synthesis report on the implementation of articles 9.3 and 9.4 of the Aarhus convention in seventeen of the Member States of the EuropeanUnion. http://ec.europa.eu/environment/aarhus/studies.htm
37. Judgment of the Court of 13 January 2015. Joined cases C-404/12 P and C-405/12 P. Council of the European Union and European Commission v Stichting Natuur en Milieu and Pesticide Action Network Europe
38. Opinion of Mr Advocate General Jääskinen delivered on 8 May 2014. Council of the European Union and European Commission v Stichting Natuur en Milieu and Pesticide Action Network Europe. Joined cases C-404/12 P and C-405/12 P
39. Judgment of the Court of 8 March 2011. Case C 240/09. Lesoochranárske zoskupenie VLK v Ministerstvo životného prostredia Slovenskej Republiky
40. Judgment of the Court of 22 June 1989. Case 70/87. Fédération de l'industrie de l'huilerie de la CEE (Fediol) v Commission of the European Communities. ECR 1989–01781
41. Judgment of the Court of 7 May 1991. Case C-69/89. Nakajima All Precision Co. Ltd v Council of the European Communities. ECR 1991 I-02069
42. Garçon G (2015) Limits of NGO rights to invoke access to justice under the Aarhus convention. European J Risk Regul 6(3):458–469
43. Schoukens H (2015) Access to justice in environmental cases after the rulings of the court of justice of 13 January 2015: Kafka revisited? Utrecht J Int European Law 31(81):46–67
44. Boraine A (2011) Presentation of cities of tomorrow
45. Recommendation Rec (2008) 3 of the Committee of Ministers of the Council of Europe of 6 February 2008 on the guidelines for the implementation of the European Landscape Convention
46. Prieur M (2002) Landscape policies: contribution to the well-being of European citizens and to sustainable development—social, economic, cultural and ecological aspects. In: Second conference of the contracting and signatory states to the European Landscape Convention, Strasbourg, 10 October 2002, T-FLOR 2 20

The Legal Aspects of Intelligent Cities

Anna Orzeł

Abstract Legal solutions do not keep up with modern technology, causing inflations to the legal code. Law is one of the factors determining how the idea of Smart Cities is implemented, as exemplified by the amendments made to the legislation on public tendering, and the adaptation to the ISO 37120:2015-03 standard, carried out by the Polish Committee for Standardization (Polish acronym: PKN). Moreover, the management of data resources, wherein the virtual world intertwines with the real world, generates countless quantities of data requiring effective legal protection. Technology provides vast prospects for development but also creates real dangers, thus necessitating effective legal sanctions to help enforce safety and legal requirements.

Keywords Law · Big data · Public tender · Smart cities · Technology · Slow city

1 Introduction

The world is moving to cities—54% people lived in cities in 2015 [1]. By 2050, 66% of the world's population is expected to live in urban areas. The challenge will be to supply these populations with basic resources like safe food, clean water and sufficient energy while also ensuring overall economic, social and environmental sustainability [1]. The forecasts for Poland are not as optimistic and a systematic decrease in the population size of the country is assumed to take place between 2013 and 2050, as there might be 3.8 million less Poles. The largest decrease in the population size will concern the cities. In the result of that, in 2050, the population of the city areas will constitute only 80% of the population of the year 2013 [2] i.e. approximately 18 million people in Poland.

The other important aspect is the aging of the society, understood as the increase in the proportion of the older people with the simultaneous decrease in the proportion of children. It is estimated that in 2050 every other man living in the Polish

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cities will be over 54 years old, and every other woman will be over 56 years old [2]. Such perspective is additionally encourages to prepare such projects which will facilitate the functioning in the city. It is obviously not the only reason, but it is worth considering the fact that the aging society will be able to take advantage of the possibilities the development of technology might bring. The smarter utilization of the infrastructure and the intelligent teams, allowing for a more effective management of a city, the access to information or the intelligent communication, is just the beginning of all that technology offers or may offer as its development is so dynamic that we might not even know now what functionalities it may bring us.

Changes in the way of working are to be expected. In 2020 almost half of all employees will be from generation Y (persons born between 1980–1990) and generation C (connected—born after 1990) [3] which were growing up among the latest technologies and in the virtual world. In the literature, this generation is often referred to as Z [4]. This generation, which grew up with digital technologies, changes the needs and methods of using smart systems which can facilitate the life and tourism in a city.

The contemporary cities are saturated with technology and electronics which control the systems of the technical infrastructure which aims at the creation of a friendly environment of the urban space, in which life and work are to facilitate the functioning for the residents. In a wider perspective, smart city means the spaces within which the residents can utilize the collective intelligence through interaction and, most of all, the self-learning systems.

The solutions which are promoted by the European Union the most are aimed at the intelligent cities. Besides the enthusiastic attitude, the risk related to the technology implemented on a large scale cannot be disregarded. The local governments will need a strong cooperation between the organizations and the enterprises in order to manage a city, because the integration of technology is a unique challenge which requires the organization of the systemic infrastructure and services. Even though the majority of cities aspire to become smart, they have to face various problems, expectations of their residents and various conditions in order to achieve that. In order to clarify approaches to technologies presented in reference books, we can distinguish three encountered types of views:

- smart cities 1.0—new technologies are the priority. Boyd Cohen compared them to fans of new Apple appliances, who buy the devices without acknowledging their possible applications. In his book Smart Cities, Anthony Townsend presents a thoughtful critique of Smart Cities 1.0, arguing that tech-driven futuristic urban visions were missing out on the key dynamic of how cities interact with their citizens.
- smart cities 2.0—management is the priority—city administrators look for new technologies to diagnose needs more quickly. It is a conscious approach to technologies' applications. The second generation is characterised by incorporation of the city into the Internet of Things.

- smart cities 3.0—participation of residents in further development. Local authorities create a space for realising the residents' potential of various kinds. Such cities are also called "Human Smart Cities" or "Sharing Smart Cities".

Incorporation of cities into the smart cities rating by rating agencies undoubtedly increases their credibility on financial markets, clearly signalising investment possibilities to national and international entities.

In the European smart cities rating for 2015 in which cities with populations of between 300,000 and 1 million were taken into consideration, the following Polish cities were included: Bydgoszcz, Gdańsk, Katowice, Kraków, Łódź, Lublin, Poznań, Szczecin and Wrocław [5]. The cities that fit the smart concept and which were not included, but made advanced smart implementations are: Warsaw, whose number or residents is more than 1.7 million, and Rzeszów with over 187 thousand residents. The number of Polish cities included in the rating is growing every year and it only confirms the validity of the smart city concept, encouraging authorities of other cities to implement improvements there. The Learning Cities report published by Europolis mentioned 66 cities, among which the three top ones were Warsaw (with a 54.9 index), Rzeszów (53.3 index) and Poznań (51.0 index) [6].

The development of intelligent technologies in cities will be supported by European Union, which have allocated 18 billion Euro for implementation of this purpose between 2014–2020. The funds have been allocated for intelligent transportation systems, modern lightening and power management systems as well as investments in development of the knowledge and digital skills of residents, availability of e-services, efficient management of information and communication with residents in public offices as well as participation of residents in decision-making processes. Another 3 billion euros have been allocated for information and communication technologies development (ICT) [7], while 2 billion PLN have been allocated for a government program which is currently being implemented, that is Digital Poland concerning availability and quality of public e-services. Such great funds should result in a development of smart cities in the near future.

2 The International Standards Based on ISO

In 2014, the International Electrotechnical Commission published its White Paper, *Orchestrating infrastructure for sustainable Smart Cities*, the purpose of which is to provide and popularize a number of answers about the way the intelligent cities should look like. The paper's recommendations operations are based on three pillars:

- Economic sustainability—the cities must facilitate the economic development as well as attract business and capital.
- Social sustainability—the attractiveness of the city to the people and the business closely related to the quality of life.

- Environmental sustainability—the cities must strive towards the environmental sustainability.

The indications of the White Paper should especially be of interest to the city authorities, the operators of the public services or the private suppliers of technology as well as the residents. The organization of the process of creating the intelligent city requires the collaboration of many stakeholders interested in different things. While implementing intelligent strategies, a city undertakes the obligation of an integrator which will plan and implement the new cooperating systems in a holistic way. Each stakeholder, on the other hand, while it offers a service to the city, it cares for its own business. Hence, the cities are faced with a great challenge and pressure accommodating different interests in a way that is most beneficial to the city. The documents governing the approach of the intelligent cities, such as the international standards of ISO, are very helpful in that respect. Interoperability facilitating the concurrence of technology of different producers, the exchange of information and the possibility to learn those systems will be indicative of the city's level of intelligence. It is the exchange of information and the multitude of technology which may pose as the biggest barrier in the implementations. The collaboration of systems is crucial; therefore, the proposed standards are about the cooperation between the stakeholders for the purpose of helping the city authorities implement the concept of an intelligent city.

The international standards regarding intelligent cities were published on May 15, 2014, as a set of standards, ISO 37120:2014. Sustainable development of communities Indicators for city services and quality of life, determining the standards of safety and digitalization. On March 12, 2015, this standard was approved by the President of the Polish Committee for Standardization under the number of PN-ISO 37120:2015 who also made the Environment Management Technical Committee nr 270 responsible for that standard, mission of which is the effective organization of the standardization activity within the area of environmental management in the country with the active participation of experts [8].

The sustainable development resulting from the increased social awareness and involvement has a significant influence on the practices undertaken by enterprises. When introducing additional regulations within the area of the environment protection, the state enforces the organizations participating in the implementation of a technology to adjust to the legal requirements as well as the expectations of the stakeholders, such as the local community, in order to sustain their position in the market or create a competitive advantage while respecting the environment. The introduction of standards is aimed at the improvement of the quality of life and the sustainable development in implementing the strategy of an intelligent city.

The standards constitute the auxiliary tools. They are interdisciplinary and concern all private and state entities. It is important to remember that standards are not legal sources exhaustively indicated in Art. 87 of the Polish Constitution. The standards act as a model of correctness for any activities which aims at regulating the particular area of interest through the establishment of regulations designated for the common and multiple application. Thus, the state authorities can

utilize the standardization included in the national standardization of the Polish Committee for Standardization (Polish abbrev. "PKN" for Polski Komitet Normalizacyjny). The application of standards is voluntary and there is no pressure to use them, because they do not constitute the statutory law. The Polish Standard may introduce the European or International standard in the original language, but, according to the provisions of law, the Polish Standard can be invoked only after its publication in the Polish language. Unfortunately, only the English version is available so far; therefore, the standard cannot be invoked in the provisions of law. This only points out to the freedom of applying the standard by the state authorities. The voluntary application of standards by the local authorities also makes it impossible to make an effective accusation based on the legal standards or invoke the premises resulting from the standard. The enterprise which does not agree with the technical indications of standards may disregard them without any negative consequences. At the same time, this means that this body is not authorized to impose the obligation on a party to comply with the standards consistent with the Polish Standard (see judgments WSA in Łódź November 14, 2012, file ref. II SA/Łd683/12). This aspect is important in organizing tenders, because in case of public expenditure in implementing the intelligent technologies, they will have to be conducted based on the provisions of the Public Procurement Act.

This standard PN-ISO 37120:2015-03 includes 17 areas regarding the aspects of the functioning of a city [9]:

1. Economy,
2. Education,
3. Energy,
4. Environment,
5. Finance,
6. Fire and emergency response,
7. Governance,
8. Health,
9. Recreation,
10. Safety,
11. Shelter,
12. Solid waste,
13. Telecommunication and innovation,
14. Transportation,
15. Urban planning,
16. Wastewater,
17. Water and sanitation.

A standard is defined by methods and measuring indicators preferred in the strategy of creating intelligent cities. It is a very important document, because previously there have been no clear definitions and indications of the way to evaluate whether a city is intelligent as well as there was no example to compare it to. The point of reference seems to be crucial here as the authorities can work on the

strategy of an intelligent city as an organization only this way which is learning and implementing the regulated processes. Moreover, granting a city with the standard is important in applying for the European funding between 2014 and 2020. A city possessing ISO 37120:2014 guarantees the capabilities of that city to present the attributes of the functioning of a city. Furthermore, the cities will be able to use the benchmarking to indicate the development.

What will be helpful in the development of smart cities 3.0 will be ISO 37101 international standard Sustainable development of local societies—Sustainable development management system—Requirements and guidelines, which is aimed at helping local societies in application of a sustainable development strategy, taking into consideration their economic, social and environmental conditions. Standard ISO/TS 37151:2015 is also of a great significance as the concept of smartness is addressed in terms of performance relevant to technologically implementable solutions, in accordance with sustainable development and resilience of communities as defined in ISO/TC 268 [10].

ISO/TR 37152:2016 outlines the basic concept of a common framework for the development and operation of smart community infrastructures. The framework describes the planning, development, operation and maintenance methodology to facilitate the harmonization of each infrastructure as a part of a smart community and ensures that the interactions between multiple infrastructures are well orchestrated. The framework is applicable to all processes of smart community infrastructures' life cycle (from conceptual design through planning, development, operation, maintenance, redevelopment and feedback). The infrastructures to be covered are energy, water, transportation, waste management, ICT and others [10].

Implementation of the nationwide ePUAP system (Electronic Platform of Public Administration Services) which standardises communication between residents and public administration units is also an example of facilitation of a resident's functioning. A smart city is a city which can notice and solve its own problems and the problem of its residents sooner than the human factor by itself would suggest.

An intelligent city is a city which can notice and solve the problems of the citizens as well as its own earlier than the human factor can indicate it. Prediction and forecasting are part of the process which cannot be ignored. The effective method of gathering information effectively is therefore crucial. A city possesses a lot of information within the particular units; however, lack of access to the entire system results in wastefulness or making decisions without sufficient information. As an example, let us look at the public transportation of the city of Wrocław. We can predict with high accuracy the location of the highest need for this type of services by using the information about the areas of new investments of developers or the areas where the so called city "bedrooms" or, to be more specific, the single family homes are going to be built. Correlating the city transportation such as the busses or tramways as well as the railway transportation and the water transportation would help decrease the traffic congestions during the rush hours of driving towards work or driving kids to school. This problem has not been solved due to the process of decision-making taking place on different levels of the public administration. There are two companies operating within the area of the regional

railway transportation in Wrocław. Koleje Dolnośląskie S.A., the local government project, operates under the responsibility of the Province Governor. Another operator, Przewozy Regionalne Sp. z o. o., with its headquarters located in Warsaw, was established in the result of the restructuring and privatization of the state enterprise, "Polskie Koleje Państwowe", the shareholders of which are the local governments of all provinces and the Agency of Industrial Development (Pol. Agencja Rozwoju Przenysłu). Each province, then, has a few shares and some influence on the functioning of the rail carrier, Przewozy Regionalne. The owner of the city buses and tramways in Wrocław is the municipality; therefore, the decision-making and financing falls under the responsibility of the President of the city of Wrocław. Joining those three providers of transportation is most certainly reasonable when considering the life improvement aspects for the residents as well as it is difficult from the point of view of the management people.

The municipal railway requires an understanding between the local governments as well as it needs capital outlays. Different business ideas are being created here as well as the possibilities to finance the particular projects. In 2008, there was an announcement of the project of creating the municipal railway by the Marshall Office of the Lower Silesia Province.

The process of establishing the common vision, the implementation of the projects and the cooperation has been going on for 7 years, and the important transportation project of the big city still remains on paper. Despite the declarations made by the authorities of the city of Wrocław as well as the authorities of the Lower Silesia Province, the self-government competencies seem to constitute the main barrier there.

Building smart cities is very complex; therefore, the International Standards could significantly simplify this process providing the expected level of efficiency and compatibility between different technologies. Standards allow also for the comparative analysis to be conducted between the cities with similar parameters; therefore, they are the sources of the knowledge about the level of intelligence of a city.

3 The Intelligent City and the Provisions of Public Procurement Act

The Polish Civil Code was enacted in 1964 and has since been constantly changing; nevertheless, the changes of law do not seem to keep up with the development of technology. The provisions of the contract law were prepared for the purposes of regular sale, and the knowledge about the wide area networks and clouds was rather moderate and even unknown at that time. That is why we are dealing with the inflation of law understood as the production of an excessive number of provisions which prevent the stabilization of the administrative and judicial practices. "The law

has lost its ability to motivate entities to behave within the prescribed legal norms due to the amount of the applicable provisions, their inconsistency, ambiguity and instability. The addressees of a legal standard cannot learn about its context; therefore, they are not able to know their rights and responsibilities resulting from the applicable standards without the help of experts" [11]. Only in 2015, eight changes had been made in the civil code and as many as 19 changes had been made to the code of civil procedure, in that one year. Those frequent changes indicate the instability of law in the system provisions. Currently, we observe the tendency where the volume of law exceeds the ability to learn about it; therefore, how can we even relate to Art. 83 of the Polish Constitution which prescribes straightforward that "*Everyone shall observe the law of the Republic of Poland*"? We are observing the inflation of law not only in Poland. The debate on regulations in the Western countries has been going on since the '70's. The European Union is concentrating on simplifying the provisions and their transparency aiming at "better regulation". Gathering knowledge regarding the regulated aspects and the information about the real needs of the society is needed. What is important for the residents of the intelligent cities is the efficacy of the introduced changes and their effects. The enterprises are interested in the performance and the quality of the particular service they want to render. The most important thing for the local governments is to satisfy the needs of the residents to the full extent and for the lowest price possible. While guarding their budgets, the local governments must also remember about the budgets they designate for investments. Those three aspects are connected by the Public Procurement Act.

In light of the provisions of the Public Procurement Act of 2004, it is important to remain transparent with public expenditure. We can assume that such act should stabilize and regulate the tender procedures. Analyzing the provisions of the Public Procurement Act, one of the main criteria in selecting the operator is to maintain the competition. Art. 7 paragraph 1 indicates that the *Ordering Party prepares and conducts the procedure for granting the procurement in a way that ensures fair competition and equal treatment of operators consistently with the principles of proportionality and transparency*. Therefore, the access to the public funds should be as broad as possible and to the largest number of operators possible. This way the largest number of enterprises possible will be able to use the public funds which is the main goal of the public procurement legislation.

Furthermore, the contracting authorities face the difficult task related to the description of what they want to purchase. The provisions indicate that the contracting authorities cannot describe or indicate the particular trademarks, patents or the origin of products or services of the particular producers or products. Should there be such indication, justified by the specification of the subject matter of the procurement, it then must be described together with the expression "or similar". Such construction of a provision imposes on the contracting authorities the obligation of accepting the offertory able to deliver a product or service of equal value. When it comes to the innovative solutions a city might want to implement as part of the concept of smart cities, this is where doubts start piling up. It concerns a situation when an offeror wins a previous tender with its original project of transport management. In case of the need of the post-warranty service which extends

beyond the original tender contract, referring to the principle of competitiveness, the previous service provider will not be able to receive such service order through some continuation of the previous contract, even though this provider possesses the best knowledge about its product and is considered a trusted partner. Although, the rationality of such procedure would be in place here, the contracting authority must prepare a new tender in which the offers ensuring the services of equal value would have to be included. Such situation is acceptable, because the contracting authority may determine the necessity of assigning the intellectual property rights or granting a license. This allows other entities in pursuit of rendering such services to apply for such new tender procedure. What we are observing here is the meeting of the principle of competitiveness, resulting from the provisions of law, and the principle of rationality, resulting from the needs of the society.

The changes in the provision will ask the contracting authorities to indicate the functionality criteria which are important to them because of their usefulness. Such simplification of the public tenders may in fact improve the implementation of the intelligent technologies, because it might most likely allow innovative offerors to approach the tenders. It is worth to remember that besides the Public Procurement Act, we must also refer to the fiscal discipline in many tenders. The number of the applicable provisions is thus large.

Although judgments do not constitute the source of law in the Polish legal system, it is worth to mention the judgment of the Polish National Board of Appeals (Krajowa Izba Odwoławcza or KIO). The contracting authority is entitled to describe the subject matter of the procurement in a way which indicates that it can be satisfied by a product implementing the modern technological solutions which are adequate to the purposes it is designated to serve. The fact that not all service providers will be able to place an offer, because they do not meet the requirements determined by the contracting authority, does not constitute the breach of the competitiveness rule. In the judgment No. 1320/14 KIO, it was stated that applying *the provisions of the Public Procurement Act cannot lead to the imposition on the contracting authority of the obligation to pursue a purchase which does not reflect its needs and restricts its freedom in making decisions related to the business activities of the contracting authority. The Public Procurement Act must not be applied and interpreted solely on the basis of understanding the absolute principle of equal competition without considering the other goal of making rational and purposeful purchases. The objective needs of the contracting authority must be analyzed based on the actual situation of the contracting authority. […] each contracting authority is entitled to determine the subject matter of the procurement considering the individual needs justified by its needs based on objective premises* [12].

Such approach of "KIO" (Polish National Board of Appeals) actually meets the proceedings to implement new technologies, because the contracting authority is burdened with the obligation to describe the subject matter of the procurement and its technical requirements in great detail. In this era of a rapid development of technology, the officials are required to possess a very good knowledge about the expectations as well as the knowledge about all that is offered by the market.

Table 1 The evaluation criteria of offers

Selected criteria besides pricing	Average value (%)
Due date	10
Guarantee	10
Payment	5
Experience	5
Response time	10
Technical parameters	10
Price	50

The contracting authorities also possess additional tools, besides the price criterion, which they can utilize, such as the negotiated procedures or the possibility to determine the importance of the significant criteria of the procurement (Table 1).

This procedure is going to be simplified as it is suggested by the amendment draft of May 26, 2016, regarding public procurements which was approved through a resolution adopted by the Senate on June 9, 2016. The introduced changes have a significant meaning for the smart city concept, because the system of granting public procurements will be simplified. Based on the amendment draft to the act, the contracting authority may obtain information about the new technologies by [13]:

- Conducting a public procurement proceeding
- Appointing an expert
- Negotiated procedure
- Competitive dialogue
- Negotiations without the announcement
- Sole source procurement
- Price inquiry
- Innovative partnership
- Electronic bidding, only in cases determined in the act.

What deserves our attention is the official introduction of the competitive dialogue based on which the contracting authorities may be able to determine their needs and their requirements without knowing the method of satisfying and utilizing them. Such procedure will be very helpful in the innovating procurements requiring an integrated infrastructure or computer network processing data.

The contracting authorities have been granted with many possibilities to search for the information regarding their procurement, even when they only have a concept of what it should look like and what its functionality must be or whether the particular technology will communicate with the existing infrastructure.

The amendments in the act which concern the method of determining the criteria will also contribute to the simplification of the procedures in the procurements of new technologies. The previous act provided the contracting authorities with the possibility to accept another criterion besides the price, but the possibility to conduct protests in that respect did not make that proceeding easy. The change, on the other hand, opens up new possibilities in obtaining the object which not only will meet the quality and price criteria but it also will meet the criterion of utilization.

This relates to the "green procurements" which are aimed at the evaluation of the offers according to the broadened criteria, besides the criteria of pricing, related to the ecological requirements which minimize the negative influence on the environment and/or factor in the full life cycle of products which consequently is supposed to facilitate the development of and promote the environmental technologies. Such provisions encourage a broader approach of the contracting authorities after the purchase of the selected products. What we observe is that when purchasing a company car, the aspects of the influence on the environment or the running costs seem to be significant. Thus, it may be that the offer which is originally less expensive eventually is not as beneficial, because the running costs are much more higher than the cost of purchase of the vehicle for a higher price, offered in the tender. Besides the economic aspects, this flexibility allows the contracting authority also to realistically contribute to the sustainable environment if given permission to select the offers which factor in the green technologies.

The problems presented here have been selected considering the procurements for intelligent technologies and indicating the additional tools the contracting authorities are supplied with when buying a product or a service they need. The proposed changes to take effect soon will simplify the procurement procedures; a long and winding road still lies ahead of the ideal legal status. The formulation of law and the imposition of broad range of obligations on contracting authorities is supposed protect public spending against any fraudulent activities. Nevertheless, the changes were necessary not only for the obligatory regulations of the directives of the European Parliament and Council regarding public procurements to be introduced in the Polish Law, based on the directive 2014/24/UE of February 26, 2014, and the directive 2014/25/UE of February 26, 2014, but also because of the dynamic development of technology and the necessity to change the practices applied in public procurements.

4 Big Data and the Protection of Personal Information

It is difficult to imagine the functioning of any business, university or office without processing personal data. Cities process large amounts of data. The innovative utilization of data in the intelligent cities allows for the provision of the improvement of life and, most of all, the ability to control their efficient functionality. It is the multitude of that data, and, actually, connecting it together, that leads to the creation of intelligent cities. The information generated by different public and private entities constitute a challenge in the area of safety towards the protection and reinforcement of the sensitive data of the intelligent cities' infrastructure. Although the information regarding the personal data is protected by the Act of August 29, 1997, as amended, on protection of personal data, the data the residents are constantly leaving in the internet constitute the data base from which analysts could generate information for the purposes of making conclusions and identification. Each click in the internet leaves information which can be used in an

analysis. The method of gathering and securing that data are certainly beneficial for the economy. It is estimated that the "digital me" will be worth approximately 670 billion Euro only in Europe by 2020 [14]. Smart city, therefore, besides the residents' life improvement premises, add another aspect of increasing the residents' involvement in the life of the city. Besides the aspects of transparency and control, education is important in the area of the accessibility of data. The ultimate goal is to increase the citizens' awareness.

Considering the approach to and the search for safety, it is worth to examine the model presented by D. Frei who analyzes the following four elements:

- The state of lack of safety—which includes the real and significant external risk which is adequately understood,
- The state of obsession—which includes some risk, and it is considered as serious risk,
- The state of fictitious safety—in which the significant risk is considered to be insignificant,
- The state of safety—in which the external risk is small, and it is considered to be typical.

Information safety is nothing other than "the protection of information which prevents and hinders the obtainment of physical information about the actual and planned situations and processes within own space of functioning as well as hindering the introduction of the information entropy in the news and the physical destruction of the data storage devices" [15]. The most important criterion of information safety processed by the city is the categorization of the entire basic inflow and then aggregating it to receive concentrated data from the indicated area or region without the possibility to personalize the particular entity. Thus, having safety in mind, maintaining a few independent networks seems to be more reasonable than a centralized application. Such approach forces the necessity of a parallel processing of data. It will contribute to prevent espionage or sabotage activities, and even cyberterrorism. The city of Wrocław spends approximately 63 million PLN annually with the budget of 3,885,745,040 PLN in 2015 [16]. The safety expenses constitute only 1.62%. After applying the intelligent technologies, these costs may and even should increase.

A certain amount of data gathered by the particular units of local governments is processed in a stovepipe manner, which means that each unit is responsible for their data and that data is not exchanged. This is one of the largest barriers as administration deprives itself of the opportunity to make conclusions based on data from different sources. With the help of Big Data, that system can improve and when obtaining information from the Central Statistical Office, such as the one about the area containing the largest number of kindergartens, the number of children to be accepted in schools will be then predictable, or the public transport lines. Based on the historical data regarding crime, the system of police patrols can be changed to improve the safety of the citizens according the algorithm estimating the probability of crime commitments. The benefits are in fact indubitable as long as the analyzed

systems are made more effective by joining information from different areas, i.e. from different departments of public administration.

Together with the development of those systems, we will obviously face the problem with the protection of personal data, because if the amount of data changes, the system to manage them also needs to be changed. The risk of data dictatorship is not abstract as the ability to obtain crucial information from large data bases through certain algorithms is causing a real threat which we cannot even predict today or protect with a legal sanction. Assuming that the access to personal data which does not fall under the data protection law, because it does not allow for the identification of the particular individual, is in fact legal, and if that data is connected with the data available in the internet each user leaves in the form of a "like" of a certain site on YouTube, Ceneo or Facebook, which also is considered legal, this process will allow for obtaining an identification close to being probable, and that cannot be considered a crime according to the currently applicable law. Although they do not consist any personal data, the Big Data analyses may constitute a unique signature which changes the risk type. Currently, we can apply penalties for processing data, but there is no provision which would prevent the processing of legal data together with other legal data which can lead to the risk of identification. That, in fact, is not legal anymore, because it falls under the personal data protection law.

Considering a broader view, we could apply the method of anonymization which is the removal of all information from the collection of data which can be identified, such as the last name, the address or age, but that also is protected by the act on protection of personal data. This results from Art. 7 subparagraph 2 which says that the processing of data shall be understood as any operations conducted on personal data, such as gathering, saving, storing, processing, changing, sharing and deleting, especially if it is done through the information systems. Deleting related to any kind of processing of data, therefore, means that anonymization is also considered to be an activity of processing such data. Such construction of definition of "data processing" constitutes a list of activities open to interpretation. The removal of data as well as their anonymization suggests that the access to that information is restricted, although in a variety of ways. The Big Data connects them together and creates largest databases to change the anonymization through, let's say, sociograms or purchase preferences, and thus obtain identification information.

Large data bases which are supposed to simplify the life of the citizens actually lead to cybercrime which poses real threat. Controlling water resources, public transport, repairs or processing of data by the city authorities allow for making conclusions from large data bases in order to make reasonable decisions faster. The data warehouses experience exponential increase in data which is gathered in zettabytes (1ZB = 10000000000000000000 bytes) [17]. Cities do not possess such developed data bases, but that is just a matter of time and coherence of the state entities; therefore, the information processed by those entities must be particularly protected by administrators.

Criminal law provides for penalties for destroying, damaging, deleting or changing data of particular importance in the form of imprisonment from 6 months to 8 years, pursuant to Art. 269 of Criminal Code. This indicates new forms of committing crimes

and consequently the largest investments in the security of data against any attacks. The growing threat has been reflected in the context of the treatise about the functioning of European Union of October 26, 2012, Official Journal of EU C326/47. This act indicates the types of crimes which should be treated as priority by the member countries. It needs to be pointed out that the computer crimes have been included next to terrorism, corruption, human trafficking, illegal drug trade, money laundering or arms trafficking in Chap. "The Impact of Novel, Innovative Architectural Information Systems Using Balloon Technology on Public Understanding of Air Quality in Urban Areas, with Specific Regard to Transport-Related Decisions" which treats about the cooperation between the departments of justice in criminal cases in Art. 83.

In Poland, a separate department of police law enforcement, called "Department of Cybercrime Prevention" (Pol. Wydział Wsparcia Zwalczania Cyberprzestępczości) was created to detect cybercrimes. The development of technology has made the previous methods of tracking down criminals inefficient, and the new technologies are forcing the law enforcement to adopt a new approach to criminality. There is no clear definition of cybercrime in the Polish legal system, and the intuitive description of it as crimes conducted through the computer seems to be significantly simplified as this category also includes the illegal activities of electronic operations compromising the computer or processing security system or interception.

The European Council adopted the Convention on Cybercrime of November 23, 2001, which was published in Poland on May 27, 2015. The Convention of the European Council on cybercrime delineated 4 computer crimes:

- Computer-related forgery, Art. 7
- Computer-related fraud, Art. 8
- Offences related to the content of the gathered information, Art. 9
- Offences related to infringements of copyright and related rights, Art. 10.

According to the data from the police statistics related to the cases which were ended by an indictment (meaning that it was indicated for the accused in the pre-trial stage), the most frequent crimes are:

- Violation of the secrecy of correspondence—1091 crimes per 100 thousand residents were noted,
- Violation of information safety—572 crimes per 100 thousand residents were noted [18].

We need to consider such low detection of cybercrimes which may be caused by a few things. Either a small number of such crimes are committed or we possess inefficient crime detection and evidence collection systems. It may also result from the low awareness of citizens in regards to the possibility of prosecuting such fraudulent activities of minor social harm. In the era of Big Data, the law will have to adopt new changes which have not been formulated as of yet, because the technology is surpassing the justice system.

The concept of Data Driver City understood as a city controlled by data. Such solutions maybe utilized by obtaining information from the citizens regarding their

opinions on the quality of the services rendered by the city, such as the rights of the city authorities, the public transport, road congestions, etc. The obtained data can be then analyzed and the conclusions made based on them can be used in improving those services. The idea of the concept is actually perfect for the intelligent management of a city. In practice, though, there is no simple legal regulation which could facilitate such processing of data. Sharing information between the administrative units, the city entities, such as transport, education, social assistance or health services is time-consuming. Each of those entities processes data only for its own use.

In light of the applicable law, the exchange of information is regulated by the Act on protection of personal information. At the request of an administrative entity seeking information relating to individuals for which certain proceedings are conducted, these authorities have to identify those individuals. In order to obtain such information or in case when a person wants to apply for certain benefits from the social welfare and has not obtained such benefits from any other unit needs to ask for such information. Such situation is directly related to the processing of personal data, pursuant to Art. 7 of the Act on Protection of Personal Data, according to which collecting, saving, storing, processing, changing, sharing and deleting of such data in the computer systems fall under the provisions of this Act. Art. 3 of the Act, on the other hand, provides for the exchange between the state entities, the units of local governments and the state and municipal organizational units. Art. 23 of the Act on protection of personal data also provides for certain circumstances in which the processing of data is acceptable if it is done for the purpose of improving or fulfilling an obligation resulting from the provisions of law.

The invoked provisions reflect the state of law which is formalized and requires specific requests to be exchanged between the entities for the purpose of obtaining the information regarding a citizen. Introducing the idea of a city driven by data, those provisions will have to change significantly and adapt to the technological possibilities of an intelligent city. The given example is provided here only to depict the extent of the problem the intelligent city will have to face not only technology-wise but also in relation to law. Moreover, a city cannot be identified as an administrative office. The functioning of a city depends on different units which are the decision makers and need a free access to the data in order to improve their functioning and through that improve the life of the citizens. Let us consider the fire department receiving a call about a building set on fire. Accessing information in a short amount of time regarding the materials the particular building is constructed with or the surrounding dangers could improve the process of extinguishing fire as well as the elimination of any threats to the health and life of the residents living in the neighbouring buildings. Such information is processed by the city but obtaining that information cannot be based on requesting it in writing and waiting for the answer within the statutory period of 30 days, pursuant to the Code of Administrative Procedure.

In conclusion, processing of vast amounts of data and obtaining information from that data base in a relatively short amount of time is a wonderful idea which suits the idea of managing the intelligent city perfectly. The process of implementing that depends on many aspects, such as law, the access to technology, and the change in

mentality of the employees of the administrative offices. Law seems to be the weakest link here, because many regulations will need to be changed, and that is a slow process.

5 Slow City

The idea of a Smart City is to improve the life of the citizens, to be friendly in its functioning, and its internal design to be invisible for the residents but felt through the comfort of life. The concept of the smart city in the long run is complemented by the less popular idea of a slow city; the one without rushing, less intense and moving in a slower pace, without the stress that is characteristic for cities. The improvements brought by technology can eliminate the current problems, such as road traffics, long lines in the administrative offices, the lengthy administrative procedures or purchasing theatre tickets. By eliminating the activities which today are time-consuming for the city residents, it will be possible to introduce a slower pace through which the possibilities offered by the city will be appreciated more. Special zones away from the traffic in the downtown areas, the investments in the green areas and the play grounds for children will contribute to a better development of the existing city space where the citizens will be able to slow down and relax in their place of residence. The idea of a slow city also refers to being open to tourists and sharing the cultural and culinary goods in a slow and comfortable atmosphere. Slow does not mean staying behind. It actually facilitates the utilization of new technologies to ensure that the cities become a perfect place to live.

Living in the slow style is based on the ancient hedonistic lifestyle according to which the human being should strive towards attaining pleasure which results form a moment of rest and peace, a time spent among friends, and the pleasure of tasting good food as well as just the depth and the diversity of life [19].

Cittaslow, a non-for-profit organization, is promoting this idea by providing the goals it represents [20]:

- Sustainable development utilizing the local resources,
- Improvement of the quality of life of the residents thanks to creating an appropriate city infrastructure and the places for rest and relaxation,
- Protection of the environment and the promotion of the pro-environment attitude among the residents,
- Caring for the historic setting of the city, the renovation of the monuments and the aesthetics of the cities,
- Promoting hospitality through the provision of rich cultural and recreational offers to the residents and the tourists, as well as an appropriate advertising of those assets,
- Promoting the local produce, products and goods as well as crafts and cuisine,
- Eliminating architectonic barriers which make it difficult for the physically challenged persons to move around,

- Taking advantage of the achievements of the modern times and the newest technologies in ways which can help with the implementation of the goals of the movement of "the cities of good quality of life",
- Improving the work of the local administration and adjusting the work of institutions to the needs of the citizens.

Slow cities implement the environmental policy with the particular emphasis on recovering the raw materials and reusing them. All activities must be oriented towards the improvement of the value of the natural environment. The most important aspect of the idea of a slow city is the support for the cultural diversity and the protection of the natural environment. The organizations which support this concept may apply for the certification based on the standard of the environmental implementation systems of *Eco-Management and Audit Scheme*, EMAS, the basic principles of which are regulated by the Regulation No. 1221/2009 of the European Parliament and of the Council of November 25, 2009, on the voluntary participation by organisations in a Community eco-management and audit scheme. In Poland, the EMAS system has been functioning since May 1, 2004. The legal regulation for that can be found in the act of July 15, 2011, on the national eco-management system and audit (EMAS) in which the state authorities appointed to enforce the law are indicated. The General Director of the Protection of the Environment was entrusted with running the register of the organizations in the EMAS system. The idea of EMAS is to create the culture of sustainable development and the efficient management of resources and energy within the organizations. Certification provides the guarantee of care for the environment which reflects the entities promoting the environmental concepts. Such organizations build their image in the market by indicating the value they promote.

The idea of a slow city has been popularized based on the certification by 147 cities in 24 countries around the world [21]. This way, it has become the international standard promoting the common perspective of slowing down to fully appreciate the resources a city is in a possession of. Until 2016, there were 25 slow cities in Poland [22]. The smallest one was Sępopol with 2,088 residents, and the biggest was Bartoszyce with 24,602 residents. Examples of interesting slow city initiatives include that proposed by Jeziorany, which makes it possible to sightsee the city online, encouraging people to choose it for tourism and relaxation purposes, and the Działdowo Antics, Craftsmanship and Healthy Foods Fair organised by Sępopol. The membership in the association also offers the possibility of obtaining EU funds for 80% of an investment. Such an investment, worth 12 million PLN, has been proposed by the city of Niedzice in relation to modernisation of its pond, market, castle and railway station.

While developing the intelligent cities, it is important to remember about the comfort for their residents so that a city would not only be an efficiently functioning place but also one that can maintain its balance in relaxation and pleasure for the residents and the tourists who will severely judge the improvements and the simplicity of moving around in the city.

6 Conclusion

The smart city concept is about creating innovative solutions that lead to permanent improvements in the city's infrastructure and help raise quality of life for residents. It is a motivating concept for any city. In pursing this goal, cities in Poland can take advantage of the significant assistance provided by the European Union in developing innovation-driven smart strategies. The guidelines of the IEC White Paper on smart city infrastructure are fundamentally important, as is the ISO 37120:2014 standard, described here, which covers different aspects of cities' effort towards sustainable development. The legal standards provide technical guidance in determining the indicators characterizing an intelligent city.

The changes made in the Public Procurement Act to align it with an EU directive —designated to simplify public procurement procedures and offer contracting authorities wider access to knowledge about innovative solutions and services for the city—also come as a result of a strategy aiming at smart city development. Despite the optimism about the legal framework for the process of changes, the smart cities should take certain security measures to guard against problems that may be caused by technology development and a possible exposure of sensitive data. Processing massive amounts of information is something that every city is already faced with. In the process of improving the cities, we must remember that the opportunities provided by Big Data may not only help improve the quality of life for residents, but also pose a threat to them.

In a state governed by the rule of law, a vast regulatory framework is provided to guarantee security for people staying in the city—not only residents but also all other individuals—and for business with presences therein. Firming up this framework and creating a knowledge-based economy will increase the number of interactions and, consequently, the social capital. The simplifications provided by smart city arrangements will invite simplifications in law and its adjustment to the new technologies. Embracing the concept of a smart city requires the adoption of certain legal, organizational and technological objectives.

Improved comfort of life also means slowing down, and this is promoted by the slow city approach which involves a rest-friendly infrastructure. Although the idea is currently confined to smaller cities, in the long run it is going to be contemplated by large agglomerations, too. That is because the smart cities provide comfort at any level, thus making it possible to keep a balance between the speed of action and the deserved rest.

References

1. Baranowska-Skimina A (2015) http://www.egospodarka.pl/122473,6-megatrendow-ktore-wplyna-na-rozwoj-swiata,2,39,1.html, www.egospodarka.pl. Accessed 23 April 2015
2. Potyra M (2014) Population procection 2014–2050. Zakład Wydawnictw Statystycznych, Warszawa

3. Hardey M (2011) Generation C, Connections, creation, connections and choice. Int J Market Res 56:749–751
4. Żarczyńska-Dobiesz BCA (2016) Managing the workforce fron the full of paradoxes generation. Manage Sci 27:196–206
5. http://www.smart-cities.eu/. Accessed 14 May 2016
6. http://www.funduszeeuropejskie.gov.pl/. Accessed 01 July 2016
7. http://www.iso.org/. Accessed 01 May 2015
8. Plan działania Komitetu Technicznego nr 270 ds. Zarządzania Środowiskiem (2015-02-03)
9. PN-ISO 37120 (2015)
10. http://www.iso.org/iso/catalogue_detail.htm?csnumber=66898. Accessed 01 Aug 2016
11. Zoll A (2004) Główne grzechy w funkcjonowaniu państwa prawa, referat na konferencji "Czy Polska jest państwem prawnym?", in Pałac Prezydencki, Warszawa
12. Krajowa Izba Odwoławcza (2014)
13. Tekst ustawy przekazany do Senatu zgodnie z art. 52 regulaminu Sejmu, Ustawa o zmianie ustawy zamówień publicznych oraz niektórych innych ustaw, 13 maj 2016
14. Turowski J (2012) Cyfrowe ja—nowy wymiar relacji między konsumentami a biznesem, in Aula w Akademii Leona Koźmińskiego, Warszawa
15. Blondeau J (2015) Orchestrating infrastructure for sustainble. IEC e-tech, p 41
16. British Standards Institution (2014) PAS 180:2014. BSI Standards Limited, London
17. Chip (2016) http://tech.wp.pl/kat,1009779,title,Ile-jest-danych-na-swiecie,wid,13554214,wiadomosc.html. Accessed 12 May 2016
18. Chylińska K (2015) http://blog.e-odo.pl/2015/08/04/cyberprzestepczosc-statystyki-i-nowe-technologie/. Accessed 4 sierpień 2015
19. Szelągowska A (2014) Slow city jako innowacyjna koncepcja rozwoju miasta, in Innowacje w zarządzaniu miastami w Polsce, M. Bryx, Ed., Warszawa, Oficyna Wydawnicza Szkoła Główna Handlowa w Warszawie, p 216
20. http://cittaslowpolska.pl/index.php/pl/idea. Accessed 15 maj 2016
21. http://cittaslowpolska.pl/. Accessed 20 July 2016
22. Gotlib BBD (2016) Smatr City, Informacja przestrzenna w zarządzaniu inteligentnym miastem. In: Gotlib ROD (ed) Wydawnictwo Naukowe PWN, Warszawa, p 32
23. http://www.umwd.dolnyslask.pl/fileadmin/user_upload/Transport/28_10_Koncepcja_obslugi_pasazerow_z_wykorzystaniem_Dworca_Kolejowego_Wroclaw_Swiebodzki.pdf
24. http://www.cittaslow.org.uk/. Accessed 15 maj 2016

City Debugged. How to Reform Polish Cities so They Thrive Socially and Facilitate Sustainable Growth?

Justyna Glusman and Agata Dąmbska

Abstract Various definitions of the "happy city" utilized in the Western literature on cities and urbanism focus on mutual relations between the citizens and their surroundings. The prescriptions offered based on these aspects do not, however, address the key problems pertinent to Poland's post-transformation reality. For a vast majority of Polish cities, fighting depopulation is the single most important factor determining their social, economic and spatial perspectives. Thus, demographic trend will be used as the key indicator of a city's position on the "happiness axis". While a coordinating and participatory approach to city management is vital to its success, the state's policies towards self-governments may prevent cities from making the first-best choices when it comes to their organizational arrangements.

Keywords Policy · Cities · City management · Self-governments · Social participation · Governance

1 Introduction

The problems most pertinent to the Polish cities are not unique. A number of urban areas in both, Europe and the world, face challenges related either to population loss or uncontrolled growth and residents' influx. While the former is associated with negative social and economic consequences related to changes in the social structure and reduced tax base, the latter is followed by a strain on resources, infrastructure and transport systems, inadequate public services, social inequality and environmental hazards. The range of potential problems is vast and the scope of solutions offered by practitioners and urban literature equally abundant. Yet, evi-

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dence suggests that the first best answers to city problems need to be custom-designed as cities operate in particular regulatory and economic contexts, which are largely country-specific. Secondly, there is an apparent paradox stemming from the fact that only structural, meta-level solutions may provide an effective and lasting response to local problems. Although numerous local projects, community initiatives, best practices in spatial design and the like do carry a value from the local citizens' perspective, even their rapid proliferation will not suffice to overcome the key challenges modern cities face. They are important supplements, contributing to a city's distinct identity. However, they cannot substitute for structural measures in the field of governance, spatial planning and financing of communal undertakings. The effectiveness of the latter is to some extent contingent on national-level regulation, creating a formal base for the operational solutions applied by city authorities. Thus, for grasping the whole picture, a discussion on necessary reforms seeking to turn cities into attractive locations to live in requires consideration of national-level determinants, in particular those related to the financing structure and specific competencies of local self-government.

Nonetheless, this is not to say that city authorities' actions do not matter. Quite to the contrary, apart from the effective national-level regulatory framework, there still remains an ample room for local governance executed by the city leaders. Even acting within the current regulatory context, which does require reforms, they may guide a city towards sustainable development path or to the opposite, a developmental drift. This paper argues that capacity to instigate change depends on the local authorities' own, tailored-made vision of city future, based on strong fundamentals, together with the ability to translate it into a strategic programme and operational measures. The key elements of such development plan resting within the scope of local administration competencies concern in particular spatial planning, transport and infrastructure management (also management of resources such as communal or commercial premises), environmental policies and housing. At the same time, an effective system of financing, organisation structures of self-governmental units, and social and educational systems are largely contingent on the national-level framework. The latter, however, while creating favourable conditions for building strong development fundamentals, will not suffice to make a city great. The combination of both, local and national contexts matter for a city's success.

The conditions that have to be provided to create a city, in which people feel well and want to settle have already been defined in the rich body of research and empirical studies on urban policies [1]. The core values such as participatory governance, tolerance, inclusive character of spatial planning procedures, quality urban design and its role in reducing inequalities, and sustainable transport have to be recognised if local government's action is to prove successful in producing a "happy city" where all inhabitants can thrive and business develop. As already mentioned, there are two intertwined layers to be considered in the context of fostering an environment facilitating urban development and addressing the major challenge Polish cities face, which is shrinkage. Firstly, framework regulations at the national level should be amended, so as to empower local governments, providing them with more flexibility balanced by greater responsibility. Secondly, in

seeking to effectively pursue policies within their competences, city authorities should take a strategic development approach. These two-tier measures are indispensable for enhancing Polish cities' capacity to address depopulation and urban sprawl-the sources of further challenges. It will be impossible to tackle them maintaining the current revenue level and structure, and given the scope of public tasks cities are required to pursue.

Depopulation is the single most common and acute challenge pertinent to the Polish cities across the country. Most of large Polish cities with more than 200 thousands inhabitants have been losing their citizens as a result of migration to the suburbs (or elsewhere), negative birth rates, or a combination of these two factors. According to a Central Statistical Office (GUS) projection, this trend is going to persist, with population expected to grow in only three out of 18 provincial ("Voivodship") capitals [2]. While comprehensive specialist literature [3] offers numerous policy recommendations on how to deal with city shrinkage, two basic approaches may be distinguished. Some scholars advocate countering depopulation and reversing the trend, but others opt for a „shrinking smart" approach, which seems more down to the ground in cases of long-lasting negative population trends. Since Poland faces a demographic downturn, with the Central Statistical Office (GUS) anticipating a population loss of more than 4 million by 2050, and in the absence of a coherent immigration policy, the only source of new potential inhabitants remains the urbanisation process of country-to-town mobility. Thus, the case for expecting the depopulation trend to subside is not particularly strong, although observable tendencies of relocation from villages to cities may help to improve the statistics. In most of Polish cities, however, attempts to revert the population trends are unlikely to bring a spectacular success and the most promising statergy remains to be crisis management, coupled with improved cost-effectiveness, efficiency in resource allocation and a streamlining of administrative structures. Polish cities will have to compete for residents between themselves and seek to reinforce the reurbanisation trends, which generate savings in operating costs by making cities denser.

This paper will demonstrate that, firstly, the governance system shaping urban development is in-built into the central-level regulatory framework. Thus, in seeking an effective mechanism for cities' reform, taking a wider perspective is necessary, with account taken of the faults of the Polish self-governmental system. Without addressing the systemic issues and inefficiencies, concerning in particular the financing structure and institutional set up of the local government administration, as well as transparency standards, progress on the local ground can only be limited. This is not to claim that city authorities are powerless and do not possess tools to drive local economic development and improve living standards. The planning and management of space and infrastructure remain within the sole cities' competences and should be brought to bear to counter depopulation pressures and other challenges. A number of Polish cities have taken efforts to improve living standards and respond to citizens' expectations, for instance by investing in council housing (Ząbki), promoting business (Nowa Sól) and offering preferential arrangements for families (Poznań). However, these fragmentary actions cannot provide sufficient

in terms of scale incentives for relocation, and while helping reform architects to win the elections, they will not suffice as a remedy to the challenges of depopulation.

Therefore, structural reforms at the national level, providing self-governments in general and city authorities in particular with competencies and financial resources corresponding to their anticipated tasks, are necessary for cities to succeed as good places to live in. The following section will demonstrate the enormity of the depopulation problem affecting Polish cities. Then, the systemic flaws of the self-governmental system in Poland will be discussed and some of the most urgent solutions recommended. The closing part discusses the specific actions in the fields of strategic planning and management that city authorities may undertake within the current legal context, which are complementary to the central-level regulatory changes. Leadership and vision are underlined as indispensable components of any successful city strategy, leading a city towards an intentional development path rather than random drift to the future.

2 Depopulation as a Reform Driver of Poland's Cities

The phenomena of city shrinkage is widespread both in Europe and worldwide. According to recent studies, almost 42% of all large European cities are currently shrinking [4]. The causes may vary in individual cases, however, they usually account to combination of factors, such as the structural changes in the economy resulting in economic downturn and loss of jobs, depopulation due to the outmigration, urban sprawl or negative birth-rate. The problem of city shrinkage is particularly common in the post-industrial regions and thus post-communist countries are often associated with the phenomena although much earlier, in the 50s and 60s of XXth century it affected number of the largest US metropolises, such as Buffalo, Cleveland, Youngstown and Pittsburgh, all of which lost more than a half of their citizens [5]. Recently Detroit stands out as the negative example. Cities play crucial role in the global value chains and therefore shifts of the production locations or industry patterns due to technological change and globalization affect their development trajectories. As Richard Florida claims, against the "world is flat" argument [6], the economic activity tends to cluster in the largest metropolitan areas and thus space and location matter nowadays more than ever before. This phenomenon is also noticeable in Poland, where according to the Ministry of Regional Development data half of the country's GDP is produced in the functional areas of 18 largest cities [7]. Although population of Poland is shrinking, the share of urban population will tend to increase in the result of estimated decline of rural population. The former is forecasted to increase up to 73% in 2050, which justifies increasing attention to drivers of economic and social change in cities both from the scholars and politicians (Fig. 1).

In 2011 urban areas were inhabited by 60, 8% of Poles (in comparison to 61, 8% in 2002) and the number of cities above 100 thousand inhabitants after post-war growth dropped from 43 in 1990 to 39 in 2013. Thus, during this period the

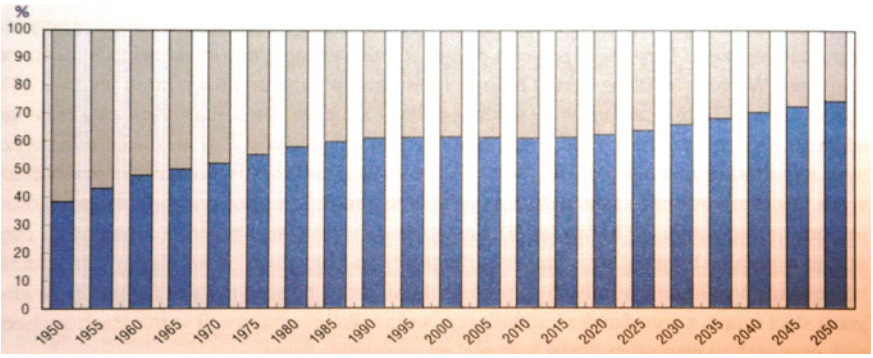

Fig. 1 Share of urban and rural population in Poland (1950–2050). Urban's share of population in the lower part of the column, rural's share of population in the upper one [8]

demographic urbanisation, that is the increase of proportion of urban population and number of cities' inhabitants, slowed down for the first time since 50 years after WWII [9]. Although symptoms of reurbanisation induced by returns to the city centers have been in some places noticed, it is difficult to name it a general trend yet as the magnitude of this process is still negligible from the statistical perspective. The studies of Szukalski [10] demonstrate that between 1995 and 2013 only six Polish cities noted increase in the number of residents and these were the largest, most attractive cities, including Warsaw and Krakow, or the capitals of regions relatively young in demographic terms (Białystok, Olsztyn, and Rzeszów). Rzeszów and Zielona Góra encountered rise in inhabitants' number due to the absorbing the suburban municipalities within their administrative borders. Out of 39 largest cities, in case of 11 the depopulation rate exceeded 10% and Bytom shrank by almost 25%. In general, the depopulation processes have accelerated in recent years, although in some cities, such as Upper Silesia region or Łódź, they have been on-going for years.

Although most of the cities examined by Szukalski in his research conducted during the years 1995–2013 had negative birth-rate, merely one in six was characterised by positive balance of internal migrations and only Warsaw and Krakow could demonstrate positive balance of external migration. There were more people leaving for abroad from Chorzów, Opole, Zabrze, Gdańsk and Gdynia than to other locations in Poland. In turn, more people relocated to Rzeszów, Białystok, Olsztyn, Wrocław and Zielona Góra from other Polish cities than left these cities for abroad. It would suggest they have managed to create a positive image associated with expected higher quality of life, availability of jobs and expanding economic opportunities, which provided these cities with comparative advantage vis á vis the others. At the same time, in case of Białystok, Chorzów, Dąbrowa Górnicza and Gorzów Wielkopolski, Łódź, Rzeszów, Szczecin and Wrocław the key negative factor of change was birth-rate, with the largest impact on Łódź, where less than 20% of population decline is attributable to migration. The studies indicate that only

three Polish cities demonstrate both, a positive birth-rate and balance of migration (Białystok, Olsztyn, and Zielona Góra) [10]. According to the General Statistical Office (GUS) prognosis published in January 2014, only three of the largest Polish cities will grow in population terms [11] (Fig. 2).

The scale of the problem is such that it seems only the strongest cities in economic terms will be able to defy these negative trends. Although share in urban population will likely increase, it is expected that it will concentrate in few largest centers or urban functional areas, which will lead to progressive contraction of the Polish large cities list. The graph below illustrates that internal migration in Poland is highly localized process resulting from phenomenon such as suburbanisation and urban sprawl (Fig. 3).

General economic shifts related to transformation and opening of Poland's economy to foreign competition after 1989 are the key reasons for depopulation of typical communist industrial monoculture cities in Silesia Region, Wałbrzych or Łódź. Combined with absence of new citizens' inflow and migration of people who acquired privileged pensions to their birthplaces brought a result of rapid depopulation [14]. Deteriorating living conditions in the city centers, where old urban fabric remained neglected for decades for ideological reasons [15] and later due to the lack of sufficient financial resources for revitalisation, accompanied by negligence of public space, is one of the reasons for urban sprawl noticeable since the 90s. Rising property prices in central districts, overcrowding, ineffective planning policies resulting in lack of the masterplans, pockets of poverty and urban chaos created critical pressures leading to cities' expansion and suburbanisation as its

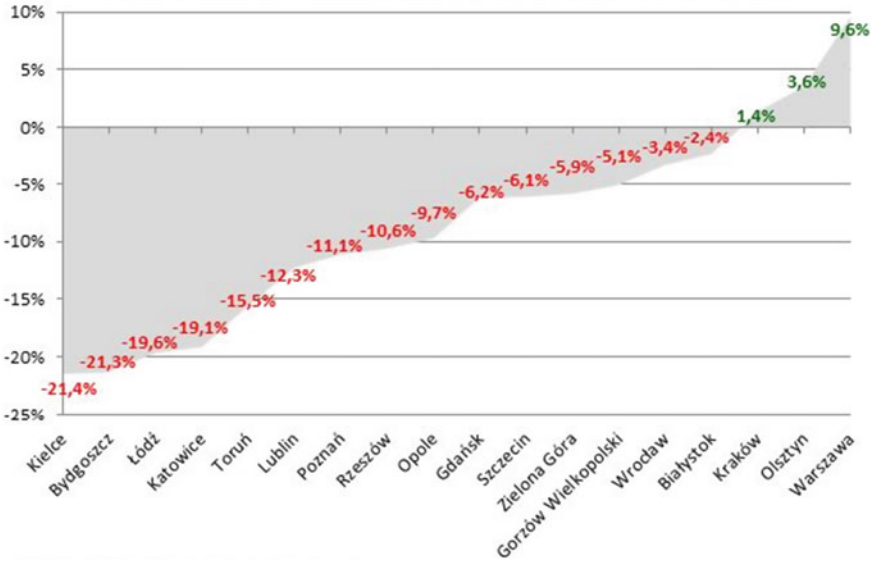

Fig. 2 Prognosis of the population change in Poland's cities (2012–2035) [12]

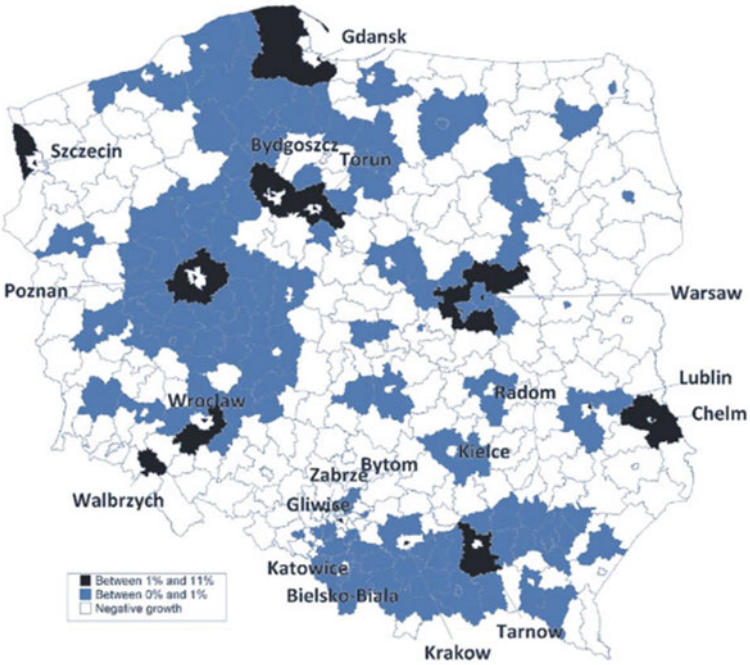

Fig. 3 Population growth in Poland, at county level (average annual growth rate 1998–2008) [13]

result. On the other hand, almost universal belief in liberal paradigms including the primacy of the private over public interest and stemming from that requests for permissions to construct wherever possible brought as a consequence new houses springing up almost everywhere, often without a coherent plan and accompanying infrastructure of any kind. Issuing construction permits was left to the discretion of the lower rank self-governmental administration officers, who did not or could not, according to the law, refuse it without a good enough reason based in the legal acts. The price for such nonchalance would be paid in the later periods by whole communities, directly, in response to fresh citizens' demands for municipal infrastructure in the new settlements and indirectly, through higher costs of construction and maintenance of excessive infrastructure in less compact areas as well as need to reorganize abandoned technical infrastructure in the city centers. This phenomenon affected practically all Polish large cities [16].

2.1 Major Consequences of Depopulation

Urban decline has severe consequences, in particular related to the loss of most active and dynamic citizens. As all migration processes, city sprawl has a selective

nature. In terms of social changes they have two aspects, loss of demographic and human capital. While former is about phenomenon such as falling population and accelerated aging, the latter boils down to the exodus of better educated, active, innovative and entrepreneurial citizens [17]. The latter happens due to the fact that migration decision is taken by most entrepreneurial, usually better educated individuals. The analysis of depopulation process in Krakow area has demonstrated that 23% of this suburban area constitute people of 25–34 years old and the share of newcomers to the suburbs with higher education was around 46% [18]. The processes of departure of such economically strong groups further contributes to the deprivation of city centers feeding into the negative economic loop, which is than very difficult to revert for the city authorities.

Social shifts resulting from depopulation will have profound implications for the urban areas, in particular by posing the strain on infrastructure, housing and delivery of public services and thus on cities' budgets [19]. Falling human base results in shrinking tax base, decrease in demand for some services and rising for others requiring re-orientation of the public service offer, deteriorating scientific base and following innovative potential, which could threaten the position of such city as the local growth engine [20]. Large urban areas already suffer from increased congestion costs while housing market values may fall in the smaller cities. Insufficient connectivity of the urban system may contribute to rising inequalities between poorly connected districts within the urban area [21]. The key questions that city authorities have to answer in response to such scenario is, how to encourage residents to resettle in the city center and enlarge their families. Compact, well-managed cities with intelligent infrastructure are more resource and transport effective but can also be more attractive to footloose workers than suburban or rural communities [22]. The multi-dimensional measures are necessary to strengthen the reurbanisation trends as the city shrinkage is also a multifaceted process.

The effective response require systemic solutions and innovative approaches. Although planning literature is mostly growth-oriented, some ideas of how to go "from grey to green" have been also arising. It is actually only relatively recently that scholars have started investigating the potential innovative solutions proposed by some city authorities to successfully shrink [23] and projects alike German-led Shrining Cities or Cities Regrowing Smaller (CIRES) [24] exploring the phenomena across the countries have proliferated. As survey on nearly 28 respondents conducted by Robert Florida demonstrated, the most important criteria in location choices are the quality public space (aesthetics, natural conditions, parks and playgrounds, climate, lifestyle, cultural offer etc.) and quality of public services (primary schools, healthcare, job market, religious institutions, real estate and transport) [25]. Dan Pitera, director of Detroit Collaborative Design Centre [26], claims that the most promising clue is to tap on the creative, spontaneous solutions that are already happening and turn them into strategies. Thus, an assessment of the city condition based on reliable data, usage of appropriate analytical and mapping tools and identification of the right spatial strategies are the starting point for further actions.

2.2 Range of Possible Solutions

The empirical studies have demonstrated that city leaders who have addressed the shrinking problem in participatory style rather than without social consultations had more chances for success. Such conclusions may be drawn from the comparative study conducted in the framework of the "Shrink Smart" project, where among others, two Polish cities, Sosnowiec and Bytom, were examined [27]. Although suffering from similar trajectories of shrinking, different approaches towards socio-economic actors and their role in problem-solving brought quite different results. While in Sosnowiec the solution has been sought in co-operation with the local actors, mainly economic ones, located in the Special Economic Zone in the city area, multiple but relatively weaker social actors in Bytom stayed largely outside of the decision-making process. In the result, while Sosnowiec has managed to implement more creative policy mix in response to the city crisis and achieved an increase of employment and rise in business taxpayers' base as well as reduction of unemployment combined with development of its brownfield areas, Bytom with its strong domination of city authorities in decision-making processes has not managed to overturn its crisis trajectory.

Inevitably, the concept of a "smart city", making recently an international career, comes here to play. Often mistaken for technological advancement or „smart management", in fact it should be interpreted as ability to use technologies for achievement of the chosen goals. In such scenario technology constitutes rather means than an outcome, while more important is ability of a city to adapt to the changing conditions, mitigate asymmetric shocks, absorb and utilize knowledge. As Martin Barry of reSITE has put it, it is important for the city authorities to act in a way that makes their citizens smarter, so they demand for themselves a smarter city, not the other way around [28]. The other way to define the nexus between a smart city and the citizens is to see the city as one mechanism where authorities use the knowledge and intelligence of citizens, their energy, in the decision-making processes. The latter dispose the simple tools allowing to fulfil their needs in often more effective way than local administration [29]. Accordingly, the key features of a smart city is ability to re-create itself in response to varying external contexts and exogenous pressures. City authorities need to act in such a way as to facilitate bridging the gap between the city hall officials and the citizens as well as experts in relevant academic disciplines, sociologists, demographers, economists and urbanists for better city management. The effective channels of communication and extended social networks are thus prerequisite of the resilient smart cities.

A combination of economic policies (in particular in housing sector, support for jobs creation, measures strengthening higher education institutions), social (social infrastructure, poverty-alleviation measures in healthcare and education,) and spatial (spatial strategies, infrastructure links between high and low income neighbourhoods, great public spaces and efficient transport system) are to be implemented in order to shift the negative population trends. This may only happen if two preconditions are fulfilled. Firstly, the city authorities actually possess formal

powers and financial means to implement such solutions. Secondly, the city administration should act on the one hand in efficient and on the other, in participatory way. The challenge has a different magnitude in various cities. While in some cases only small corrections are needed as a city already possess comparative advantage due to its location or special status like Warsaw, the country capital, other cities need to truly re-invent themselves in order to survive as an attractive locations offering good living standards for their citizens. The following section will propose some answers to those questions concerning formal contextual conditions, within which Polish cities' authorities operate.

3 Limited Self-Governance of the Local Self-Governments

When it comes to the public expenditures, Poland belongs to the most decentralized countries in Europe. Self-governmental sector consumes, similarly to Norway, around 33% of the public finance. However, the process of public tasks' decentralisation to the units of territorial self-governments was not conducted in a well-thought manner, so the actual responsibilities granted to self-governments would correspond with the actual amount of public finance transferred. In effect, appropriate mechanisms of impact on self-governments' actions have not been established. Similarly, there is no single, coherent strategy of the central government towards self-governments, which would counterweight actions of the individual ministries. It is ever more important today, when self-governments, apart from securing the basics, such as water supply and sanitation or local roads maintenance, became also the main provider of other public services, such as education, social care and are in charge of distribution of state benefits.

Division of powers between the central government and the units of territorial self-government determines the actual room of manoeuvre for the city authorities to act. In line with the subsidiarity principle, central authority should perform only those tasks, which cannot be performed effectively at the local level. Theoretically, Poland's regulations on self-governmental system conform to this principle. Firstly, Polish constitution contains so-called general clause (Art. 164 par. 3) anticipating that all competencies not reserved for other units of territorial self-governments are executed by municipalities (gmina) [30]. Furthermore, the Act on the Municipal Self-Government [31] provides in Art. 7 (1) and in Art. 6 an independent grounds for the municipality to resolve local problems by undertaking relevant activities of a managerial nature [32]. Despite these provisions, the question whether specific legal provisions are indispensable as legal basis for municipal councils' resolutions remains highly contentious. While creators of Poland's self-governmental system argued that measures taken with a view of satisfying the collective needs require setting up relevant goals in municipal resolutions and do not need any specific legal grounds [33], the position of institutions supervising self-governments states the contrary. Voivodes representing the central governments in 16 Polish regions and supervising the legality of self-governments' actions as well as the Regional Audit

Chambers (RIO) usually refer to the case law of the administrative courts holding that specific legal provisions are indispensable for the legality of municipal councils' resolutions [34].

Such constraint makes it difficult for the self-governments to "perform public tasks on their own behalf and responsibility [35]. It also has significant practical consequences, which boil down on the one hand to the real limitation of self-governments' competencies in the matters not regulated in detail in the primary laws and on the other, to proliferation of exhaustive legal provisions regulating every aspect of self-governmental actions. In the result, in number of policy fields self-governments' role is thus reduced to that of a clerk, transferring financial handouts from the government to the final beneficiaries. Often, in areas such as education, self-governments are to take formal responsibility for the system's management but on the other hand, their role in governing of the institutional structures, for instance schools, is very limited. Regulations at national level, the so-called "Teachers Card" but also recent amendments to the procedure of appointment of school directors, in fact prevent self-governments from taking decisions about employment and thus, controlling the costs of the institutional structures. There is a clear disproportion between the responsibility of the local authorities and formal room for manoeuvre defined by the state-level regulations when it comes to system management, which should be removed.

Self-governments' problems with self-governing also have a source in the procedures used for creation of legal provisions at the state level. Instead of designing the network of local institutions acting under one self-governmental umbrella, each governmental ministry is predominantly interested in consolidating autonomy of the sectoral institutions acting in policy areas under their respective supervision. In effect, institutions theoretically subordinate to the unit of territorial self-government act formally as semi-autonomous bodies within the self-governmental structures. This concerns in particular schools, social assistance centers, job centers, public libraries and cultural institutes. There is no reason, for which the local services of institutions acting under self-government's formal authority could not be provided directly, by municipality employees.

Local self-governments should have more extensive decision-making power over the choice of the optimal mode, in which their services are provided. For instance, instead of self-governmental structures, local non-governmental organisation could manage a cultural institution. There is also no viable justification for employing of a separate accounting services for a local library. Similarly, one cannot speak of an autonomy in already mentioned primary education area, where a governmental employee, a curator, has to give his consent in case of schools' merger under one organisation conducted by a unit of territorial self-government. On top of that, state laws limit another important competence of the self-governments, which is the right to delegate or to withdraw delegation for particular actions within their own structures. It is the citizens, who shall assess whether such decision is correct rather than the central government as otherwise it conflicts with the subsidiary principle.

Apart from limiting the decision-making powers at the local level and thus responsibility of the local authorities for their own actions, such constraints are counterproductive when it comes to effective resource management. Moreover, a tacit assumption that the extensive system of self-governmental structures in charge of particular public tasks guarantees execution of those tasks has led to steady rise of employment in public institutions at the local level. At the same time it was not necessarily accompanied by adequate improvement of the service level for citizens. Instead of the current system and its focus on formal institutional structures, attention should be redirected into the execution of self-governmental tasks, setting the qualitative indicators and transparency of conduct, all of which would create contextual conditions conducive to local authorities becoming truly accountable to their local citizens rather than subjected to elusive formal control of the government.

System of units of territorial self-governments' financing constitutes yet another impediment to effective resource management and delivery of the best service price-for-value ratio from the citizens' perspective. The decentralisation of public tasks conducted in the 1990s was not followed by a corresponding level of finance decentralisation with empowerment of the local self-governments. The income of self-governments is based on the transfers from the state and the "own resources" constitute only 49% of their income (171 billion 2011), mainly from the share in personal taxes paid by the residents of the local units. The local taxes collected by self-governments themselves are insignificant part of the revenue while state transfers, subsidies and grants constitute over 40% of the local budgetary resources. This mechanism of financing is not conductive to higher efficiency in resource allocation, among the others due to the fact that it promotes spending the whole sum of grants, notwithstanding the needs. Otherwise, financial resources need to be returned to the state budget. Additionally, high number of envelopes, for which the subsidies and grants are allocated significantly increases the costs of the system. It is also strongly pro-cyclical and does not protect against the economic shocks. In addition to that, ministries regularly add new tasks to the self-governments' portfolio without appropriating adequate financial resources, consequently subjecting self-governmental resources to considerable strains.

3.1 Reforms Proposal for the Local Governance System

One of the major challenge to be addressed in order to improve effectiveness of local self-governments is the reform of the self-governments' financing system. The reform proposal put forward by think tank Forum Od-nowa [36] boils down to replacement of the current system of shares in the personal income taxes (PIT) accruing to self-governments by the fully self-governmental local personal tax (local PIT), which would be specified in a tax declaration of each citizen. This solution, by visualizing of how much of an actual personal income accrues to the self-governmental authorities is expected to trigger citizens' interest in their

communities and improve the record of participation in the public life at local level. The proposal assumes allocation of the whole sum collected from the citizens falling within the first tax threshold for the self-governments, while income from the second threshold would accrue to the central government [37]. Proportional part of the taxes paid for personal economic activity (19%) would also be a source of income of the self-governments.

In this way, each taxpayer, according to the residence place, would contribute with his taxes first of all to the local self-government, which is in fact in charge of providing gross of the public services. Such construction of the tax system would establish a link between the public service and the price paid for it. Moreover, introduction of a rule that the income were protected from government's tampering with tax breaks would also warrant secure and stable source of revenue for the self-governments. The reform would have to entail shifts in the entire system of state subsidies and grants, so it stays neutral for both, the state budget and the citizens. Self-governmental authorities should have a right to regulate to some extent (2–3% points) the height of their local personal tax. While small brackets would be insufficient to initiate real tax competition between the municipalities, such solution would further reinforce the link between locally delivered services and tax payment. This mechanism would, on the one hand, demonstrate to the citizens how they contribute to their local community and on the other, create powerful incentive for demanding better service quality in exchange. Certain privileges for the local taxpayers, such as "citizens cards" already introduced by some Polish cities (e.g. Warsaw, Krakow, Grodzisk Mazowiecki and Konstancin Jeziorna) include for instance, discount for public transport, priority in the kindergarten admissions etc., would be than more understandable and justified rather than perceived as discriminatory.

Another vital issue discussed at the beginning of this section, which requires correction, is insufficient ability of the self-governments to decide about their own structures. Currently the state laws constrain local authorities in terms of construct of the local structures and even their naming, often going as far as listing concrete job positions within these local institutions. There are over 700 of such positions, so this may pose considerable administrative burden. Instead of such detailed system, the scale of possible legal forms for particular institutions should be defined in the framework regulatory acts for self-governments as a closed catalogue. The positive example of the consequences that greater autonomy could have on self-governments is art. 5 g of the Act on the Education System, providing municipalities with some degree of autonomy and possibility to rationalize their expenditures for education. The provision enables municipalities to transfer management of the small schools (less than 70 pupils) to external institutions, such as parents' associations. This solution has allowed to evade closing down the number of local schools, a step which would have had numerous negative social consequences for the local communities and the teachers employed, who would otherwise lose their jobs.

In parallel, removal of strict obligation for the self-governments to run several kinds of institutions, enlisted in the current legal regulations, would make the whole system more flexible and cost-effective. Some activities could be carried out in

different than currently manner, for instance by specialized non-governmental organizations or in co-operation of two neighbouring self-governmental units. Such provision would encourage co-operation with a goal of service improvement and cost effectiveness at the same time if certain conditions were met. Constraints with respect to such decisions should be maintained in some, particularly sensitive areas, such as public safety.

These systemic changes would equip the self-governments with real autonomy to decide about the mode of delivery of public services, so to allow them to adapt the mechanisms and institutional structures to the individual conditions individual for each community. The current legal set up, despite its all systemic flaws enlisted above, additionally perpetuates the universal conviction that the central ministries warrant provision of those public services, which theoretically fall within the scope of self-governments' competencies further confusing their recipients.

In fact, coherent and integrated institutional structure of the local self-governmental units remains one of the most important issues to be tackled. The community consists of a set of variety of institutions, services and activities carried out for the benefit of citizens. Despite constitutional endowment of the local government units with the legal personality, regulations do not consistently treat self-government as a coherent entity. There are 59 thousands of organisational units active in 2.8 thousands of self-governmental units. Although the former do not have legal personality, they do possess number of attributes of administrative and financial autonomy, granted by law. This means that they function in some separation from the self-governmental unit. As far as the autonomy concerning essential decisions of chiefs of these institutions is understood, it is accompanied by unnecessarily exposed role of the economic entities (operators). This strengthens the sectoral division between the self-governmental institutions and their relations with line ministries to the cost of the unity of the whole self-government and hindering its efficient management. This organisational model inhibits introduction, among the others, of uniform IT and structural solutions, leading to higher bureaucracy and proliferation of internal reports produced annually, number of which reaches absurd 1.5 million (when it comes to budgetary reports). The ruling of the National Administrative Court from 2013 [38] confirming that the units of the local self-governments themselves rather than subordinated budgetary units were subject to VAT payments confirmed the underlying irrationality and internal incoherence of the current system. Possibility to create from 2016 onwards the common administrative centers, gathering in one place technical services for number of self-governmental units, for instance accounting services, envisaged in the recent amendment to the Act on Municipal Self-governments was a modest step in the right direction of enhanced flexibility. It should eventually lead to the overhaul shift of the institutional set up of this system.

The territorial unit of self-government should eventually become one coherent administrative structure, one tax payer and employer, assembling under one umbrella all institutions providing locally assigned public services. This unity should be confirmed by putting all of its economic activity under one budget while specific provisions on budgetary units should be removed from the Act on the

public finance. The territorial self-government should also be in charge of the accounting services for all of its institutions. Competence delegation to other units should lie within the powers of the self-governmental authorities themselves. The current assumption about the obligation of self-governmental unit to 'deliver' the public service should be replaced by obligation to 'provide' it. In such a way the unit of territorial self-government would take a real leadership and true responsibility for tasks' execution. These enhanced powers should be balanced by better information standards and higher transparency, so to permit a meaningful social control. In turn, more effective mechanisms of financing could lead to better efficiency without the need to increase taxes.

3.2 Transparency, Citizens and the City

There is an undisputed need to include citizens to a greater extent into the co-decision-making about their local communities. The most visible indicator of social participation, that is the participation rate in the local elections stays in Poland at the stable low level below 50%. Instead, there is noticeable growth of the local activists and contesters to the municipal governments' decisions organising around the relatively new social and urban movements [39]. The discussion on who is entitled to represent the citizens, the council members elected in the democratic elections or the local activists becomes since ever more acute. The problem in some Polish cities, in particular the largest ones, stems from unduly privileges of major political parties in the local elections (due to the national structures and budgets on their disposal), the electoral law and generally weakening role of political parties as transmission belts between the governing and the citizens. Their local representatives in the councils have structural incentives to promote party interest rather than the local one. Their promotion, place on the election list and available employment opportunities depend on larger extent on party leaders' decision than citizens' assesment of public performance. This especially concerns the situation when the president and the council majority are associated with the same political force. In such cases the supervisory role of the council becomes elusive. This situation encourages more active citizens, self-proclaimed defenders of the general public interests, often co-operating in the framework of the local urban movements, to take over this function.

However, one of the key problems instigating the conflicts, which arises along the line of division between the city authorities and the citizens is insufficient transparency, in terms of assets, procedures, contracts with third parties and employment. The state reforms with regard to policies towards self-governments proposed in the previous section, boiling down basically to a higher autonomy of the local authorities, should be balanced by better control mechanisms at the local level.

As it was already stated, citizens should have their role in cities' governance as this secures better match between cities' development scenarios and needs on the ground as well as diminishes the chances for the social protests. The IT metaphor may well conceptualize the interdependence between the key elements of a city.

It consists of the software (power), the interface (appearance and functions) and the final users (citizens). The software is the way city is managed: the authorities, city hall officials, communication channels with the citizens and development strategy. Interface contains all elements allowing citizens to use the city, such as the technical infrastructure, service availability and sense of security while a citizen is the final user. These three elements are interdependent and cannot exist one without another. The question a rising is how to create the environment facilitating smooth co-operation or even symbiosis between all these elements.

The basic relationship, which should connect the software, interface and the user is based on finance. The citizens pays for his/her city, which in turn provides this person with certain services, such as public transport, education or access to culture. This relation in Poland has been under strain, in particular due to the negligible importance of the taxes paid to the community. Self-government running the city relies on state handouts (subsidies and grants) rather than income from its citizens. Such financing structure is not conducive to increasing the payers' knowledge and awareness about the costs of public services provided to the citizens as linkage between the price and the cost of services provided locally is blurred. This leads to numerous confusions, for instance the conviction of the citizens that the city is obliged to provide them with some particular service or particular good, such as piece of infrastructure, free kindergarten or subsidised meals in the local bars. If each citizen would have a clear idea, based on the annual tax statement, how much money did he/she contribute to his city, his/her interest would be extended to the question on how these funds are being distributed. It would enhance the understanding of the fact that "there are no free lunches" and awareness about budgetary condition of a city. Thus, it is very likely that acknowledging citizen's own financial contribution to the city budget would encourage him or her to participate with bigger enthusiasm in the process of preparation of developmental strategy, decisive for programming of financial flows. On the other hand, such situation would also be conducive to greater responsibility of the authorities in front of inhabitants, by whom they are chosen on their post (in case of the local council members and mayors in the course of direct elections).

One of the mechanisms to improve engagement of the citizens in the city governance, practiced since a few years by growing number of Polish cities is the mechanism of so-called participatory budget. It is a fraction of a city budget, allocation of which is decided by the citizens. They pick up, in the course of universal vote, their favourite projects submitted by the social actors, individuals, associations or groups of friends. As the first years of functioning of participatory budgets in Polish cities demonstrated, although this mechanism has some very positive effects in terms of one-off social mobilisation, it does not suffice as a tool of city co-operative management. First of all, only small fraction of the local budget (up to 1%) is usually subjected to the social control of this magnitude and as such the measure cannot in itself improve or make the budgetary procedure concerning aggregated city budget more transparent. Secondly, the process of the project choice in fact mobilises the groups that already dispose higher social capital. It is a mechanism that does not necessarily enhance co-operation between variety of

groups, thus contributing to development of denser and more complex social networks, which would improve overall city's social capital [40]. Rather, such small-scale competition between various stakeholders may, as a paradoxical outcome, enhance mistrust between them. It should be noted that some scholars, for instance Ann Minton (after Jane Jacobs), warn against overuse and idealisation of the notion of 'social capital' (popularised by Robert Putnam) as such networks may also be highly exclusive. Minton argues that an increase of trust in the result of closer co-operation does take place but between people from the groups alike each other while the negative externality may be the actual decrease of trust towards the 'other' remaining outside of that group [41].

It may also be argued that there is a viable risk that the participatory budget serves as a scapegoat for the real social participation and involvement in the strategic planning of the cities. Instead of promoting sustainable inhabitants' engagement in the governing process, it serves as a sort of a safety valve for social emotions and gives an illusion of power instead of real social participation. Indeed, the participatory budgets may also potentially have contradictory effects when it comes to improvement of the quality of local governance. The local authorities may assume that after transferring the power to decide upon a fraction of the city budget to the citizens, they may feel free to dispose remaining 99% according to the pre-defined (not always correctly) needs in non-participatory way. Far more effective measure promoting social participation is higher transparency demonstrating to the citizens how does the city actually work facilitated for instance by creation of open platforms gathering various groups, which could exchange their experience. Number of projects in the cities are already realised with this goal. As an example may serve reSITE project established in 2011 in Czech Republic with a goal to promote understanding of design, policy, culture and economy in an urbanising world though bridging the gap between politicians, investors, designers and the public.

Achievement of a meaningful involvement of the social actors in budgeting, building awareness about both, development options and the costs of their realisation (and operational costs of running the city) requires more complex solutions than fragmentary measures such as participatory budgets. The prerequisite is more transparent budgetary procedure concerning aggregated budget, which should start from publication of subsequent budgetary proposals in BIP (official Public Information Bulletin), so average citizen could trace changes to the document and rationale behind them. This could be a spark for more permanent and better-informed, as well as more spontaneous, social involvement bringing up the demands for a smarter city.

3.3 Good Governance Approach to City Management

The subsequent models of self-governance, from nobles' administration, through bureaucracy, new public management until good governance approach, have arisen from the merger of some elements from their predecessors and adding up the new

elements. The good governance model prevalent in the modern world also adopted in particular the efficiency principle from the new public management (but discarded simple cost-oriented effectiveness) adding on top of it underlying importance of social participation, along with such values as inclusiveness, transparency of decision-making processes, responsiveness to the real needs of the citizens and consensus-orientation. In fact, the shift towards more social involvement can partially be attributed to the grass-root city movements claiming their "right to the city".

Social participation is an indispensable element of democratic governance as it warrants against the risk arising from potentially anti-social city authorities' practices. In theory, mayor or a city president elected in the course of the democratic election process governs the city in the name of all citizens of the local unit. The residents are the ones who decide upon the future of their city and the elected representative's task is to implement this vision of development in the best or most efficient way. In practice, this picture sometimes looks slightly different. Citizens' representatives start behaving opportunistically, pursue their own vision and goals, rule in their own or their political party name, shifting away from the initial goals coinciding with those of their constituency. This phenomenon is well known in political science as the principal-agent framework and concerns all power delegation situations, in particular in the field of international relations. It is related to the asymmetry of information and difficulties in setting appropriate incentives for change [42]. The theoretical framework explains how systemic deficiencies in-built in relations between the delegating body (the citizens) and the implementing institution (mayor, city council) may, and often do lead to non-compliance and in effect failure to accomplish the stated goals of the programme. From this perspective social participation in the decision-making may be seen not solely as an element of 'good governance' approach to city management but also, or more importantly, as a mechanism to ascertain social control over the elected bodies, so the goals predefined during the election time are pursued.

Co-governance is also the process of interests' mitigation between various groups, which takes place though common actions (UN-Habitat). In order for the citizens to be able to participate in decision-making processes they need to be "aware of the city", the procedures and the assets on city's disposal. Knowledge about these elements, which becomes available through transparency allows the postulate, as stated above, necessary for the flexible, smart city governance to be realised. Sharing the knowledge makes people smarter citizens, who in consequence start demanding a better city. It reduces unfounded demands, for instance for free services, as the citizens gain knowledge on the city functioning, income and spendture. Therefore, apart from controlling function, participatory governance may also help in closing the gaps in relations between the citizens and the officials, which are often characterised by mutual distrust.

Current very complex structure of the local self-governments and duplication of responsibilities at all three self-governmental level is not conducive for the citizens to involve in the public affairs. The model of self-government existent in Poland is unclear and lacks transparent rules. It creates real barriers for citizens' involvement as people do not tend to engage in matters, which they do not understand.

Moreover, uncertainty about the fact, whether they do have any impact makes them in particular unwilling to spend their time and energy on local affairs.

Therefore, the uniform standards with regard to transparency should be implemented for the sake of greater involvement of citizens in the local public affairs. As it was already mentioned, complete information about the self-governmental unit and its subordinate institutions should be available in one place, as one Public Information Bulletin (BIP). The programme of the council meetings should be available online in advance and deliberations of the city councils live-streamed but also posted on the unit website, so to enable every citizen who cannot participate personally in the meeting to listen and watch the discussion. Entire financial economy of the unit, all inflows and outflows should also be assembled in one budget, which should be published in an easy to understand and readable form. The performance budget, reflecting the input of resources and the output in the form of services for each unit of an organisation should be an operating standard. It would allow to demonstrate the link between the public funding and the outcome. Moreover, the city council should adopt a resolution setting up the goals and the financial results for each self-governmental institution and monitor their execution.

4 Powers of the Cities to Structure Their Development Trajectory

The largest cities in Poland act formally as urban municipalities with county (powiat) status. It was conferred upon 65 out of 306 urban municipalities, based on the number of inhabitants (over 100 thousands), status of a former provincial capital and to some cities belonging to conurbations. The attributes of the city with county status were expanded to include attributes of both, municipalities and counties [43]. In consequence, the county status implied extension of the responsibilities and some institutional changes. Authorities of a city, council and the mayor (or president), execute competencies of respectively, of the municipality council and county council and mayor and foreman. The city executives, mayors and presidents are elected directly and the council does not have authority to recall them.

According to the Act on municipal Self-government (Art. 6.1), the municipality is to serve the collective needs of the community. The law enumerates in an open-ended list the tasks of municipalities, which include in particular spatial order, municipal property management, local roads, basic services such as water and sewage, public health, transport and culture, which top the list. Municipal council is also in charge of adoption of the spatial management plans and city masterplans. In case of the largest cities, with county status, these competencies were supplemented by those of the counties, in particular by task of implementation of measures against unemployment, job centers, social care and family support units. These provisions endow city authorities with rather wide set of responsibilities. Nonetheless, it is the inappropriate financing and rigid legal demands as to the mode of their

implementation discussed above, which hamper to a large extent effective realisation of the cities' tasks.

The municipal responsibilities enlisted in the basic legal acts regulating local self-governments include both, routine tasks or services, which city authorities have to deliver on a daily basis and also those, which empower them to determine city's developmental trajectory. In fact, the Act on municipal self-government does not make a clear distinction between these two categories, listing all the tasks under one paragraph (Art. 7) [44]. However, this division is crucial for determination, which reforms may city leaders undertake in order to promote sustainable development, growth and competitiveness, so to create inclusive, resilient cities. Implementation of the routine tasks, such as provision of basic services, running schools and the job centers, depends largely on the framework regulations at the state level discussed in the previous section of this chapter under the broad title 'governance'. The other two elements of the puzzle are strategic planning as well as land and infrastructure management, which in the current legal framework lie within the competencies of municipalities although faulty planning provisions at the national level have played considerable role in impeding creation of the masterplans in Poland's cities. Both of them are key elements of a response to the modern crises related to urban sprawl, migrations, economic shocks, inequality, environmental hazards as well as facilitators of growth through creation of better public space, high-capacity efficient public transport, affordable housing, expanding economic opportunities and jobs creation. All of the latter factors are important contributors to the general life quality in the cities and as such may encourage residents to settle within the city borders or to the opposite.

Urban design (public space and transport network) is a key tool of intervention within strategic planning and at the same time one of the major weaknesses of the Polish cities. Masterplans cover on average only around 30% of cities territory. Once again the root of the problem lies in the national level regulations, namely, faulty definition of the public space [45] concept in the national Act on Spatial Planning and Development, combined with the obligation to pay indemnisations for land designated for public function in the city master plans [46]. Together with that, strict obligation to create plans only for areas of 'special importance' for the public (defined as 'public spaces') led in number of cases to visible lack of motivation of cities authorities for planning which is costly, time-consuming and potentially politically risky procedure. Grzegorz Buczek [47], former president of the Polish Urbanists' Society, suggests that in many cities their most attractive parts are not under the obligatory planning regime, which allows all stakeholders for involvement and that this situation may be intentional. This situation has also implications for the quality of local democratic standards. As Anna Minton [48] claims, since the spatial management remains one of the key competences of the local authorities, leaving out the planning procedures to discretionary decisions empowers economically strongest stakeholders and prevents transparent democratic procedures leading to decisions about the space.

Lack of the master plans is clearly detrimental to cities development and major negative externalities include increasing spatial chaos, degradation of natural

environment and rise of social and economic costs of urban areas' functioning, deficient transport systems and loss of attractiveness of such places as investment locations [49]. In turn, the social costs accruing from insufficient amount of public spaces and urban chaos include loss of time for commuting, raising costs of the transport network, deteriorating environmental conditions. All of these either lead to urban sprawl or are the consequences of this phenomena and thus are crucial from the point of view of city leaders aiming to address this challenge. The fact that the national regulations demand from the cities to create the master plans only in limited cases does not mean that city authorities may not subdue larger areas under the planning procedures. It is particularly important for the most attractive, often also the most contentious public spaces, as it would put decisions over their management under the public scrutiny. This is clearly not something all city leaders are prone to do, although public benefits from such decisions are quite evident.

There is no possibility to design realistic development goals without urban design and master planning strategies taking into consideration such elements as specific for the city urban context, public and private space mix, affordable housing, designated areas under revitalisation, inequality and poverty, density and integration, financing projects, capturing value and existent planning constraints. Creation of masterplans is therefore a must from the cities development perspective. Apart from eliminating the unequal treatment of various stakeholders (business, developers, citizens) they introduce predictability favouring creation of new economic opportunities, new settlements and business development. Spatial policies may alleviate the concentration of urban poverty and inequality and spatially targeted policies focused on most deprived urban areas increase cities' social cohesion contributing to public safety and making community a better place to live.

Public spaces define the character of a city but they need to be consciously designated and designed. The way it is done in modern cities significantly evolved during the last years. There is a universal trend in contemporary spatial city design to abandon XXth century monofunctional thinking about places, drawn from the modernist ideas about top-down city design. To the opposite, liveable city is a living city, which brings together various groups and encourages them to pursue variety of actions in a given area. The New York based organisation, Project for Public Spaces (PPS) conceptualised the idea of a good public space through its "Power of 10" concept. The assumption is that each good quality public place should have at least 10 different functions or 10 various reasons to be there. These might include a "place to sit, playgrounds to enjoy, art to touch, music to hear, food to eat, history to experience, and people to meet. Ideally, some of these activities will be unique to that particular place, reflecting the culture and history of the surrounding community" [50]. Local residents who use this space most regularly are rightly considered the best source of ideas for which uses will work best. Further, when cities contain at least 10 of these destinations or districts, their public perception begins to shift amongst both locals and tourists and urban centers can become better equipped for generating resilience and innovation. Observing the projects that have been implemented in this spirit all over the world, one may conclude that attractive public space may be a powerful magnet not only for

pass-byers but also potential residents. Urban renovation project bringing to life formerly abandoned areas in cities from Copenhagen to Vancouver have encouraged residents to move back into the city and are thus powerful instruments in combating negative population trends, such as occurring in Poland.

Apart from the planning and public space, management of mobility and logistics are other key aspects of city management. Their development should be based on the roadmaps for sustainable mobility guaranteeing creation of the cost-effective, high capacity urban transport and reduction of congestion. The latter consequence of inefficient transport system belongs to key determinants of the quality of life in the city due to the negative impact of time losses, energy waste or higher accident risks. Moreover, well-designed infrastructure network, in particular infrastructural links between high and low income districts are important element of policy to alleviate city's social problems. The transport system has to consider all functional areas of the city, the whole agglomeration, as otherwise there will be no possibility to decrease pressures out of the rapidly growing number of cars (for instance in Warsaw it increased two-fold during last 10 years). It thus require careful and long-term planning, based on the appropriate data set and the planning methods. There should be a high level of correlation between designation of housing areas and planning of the transport system but also provision of basic public services, such as schools and health institutions. Such holistic approach would diminish the demand on transport services and in the result diminish congestion and negative social and environmental externalities linked to gridlocked cities.

Environmental policy, in particular access to green spaces and air pollution is another vital aspect of the quality of life. Particularly harmful low emissions in the city centers need to be decreased not only as the cause of disease and premature deaths. Polish cities belong to the most polluted in Europe and the reports estimate that around 45 thousands people die due to the air pollution. Air pollution also brings additional costs inferred on the cities' health budgets, from which part of the healthcare costs is covered. The air pollution is lower in the compact cities with well-integrated transit systems. They are characterised by relative resource efficiency due to the transport energy efficiency resulting from reduced distances and higher share of green transport modes, energy-efficient buildings. This is therefore the direction towards which city planning should proceed.

Well-thought housing policies as well as public properties management are key, on the one hand for creation of favourable settlement conditions and on the other, for provision of variety of functions and services contributing to their place-making strategies. Cities may well use their assets in order to promote their goals, such as making city centers attractive for visiting and living. Communal properties on disposal of municipalities may be used towards the common ends but this tool is often not properly utilized by Polish cities authorities. The communal properties should serve not only as a source of additional income (from renting or selling). The utility function should balance the financial and social interests. Such a result could be achieved for instance through profiled renting competitions, establishing street managers in charge of maximising the benefits in terms of income and variety of services, well-thought planning on the desired functions of the place and promotion

of location of the missing functions in the municipal properties. Lively streets, places to make shopping, also the basic ones, variety of services in the city centers create convenient and pleasant space but also discourage citizens and business to move out to the areas deprived from such benefits, namely the suburbs.

Although cities do have their developmental programmes, even if a formal basis for the purpose of EU funds acquisition only, in most cases there is a need for their improvement. The programmes should be complemented with the missing elements such as the timetable of masterplans' implementation but also they should be linked to the multi-annual financial programmes, which in number of cases live their lives completely independently from other strategic documents. City authorities should schedule the level of financing and its future sources for major investments to be realised. It is even more important in the light of the fact that extra budgetary financing of such investments for the Polish cities provided in the context of the EU co-funded regional programmes in a few years will start drying out.

If cities are to develop in a sustainable way and stop losing their citizens, their authorities need to define, which are the drivers of urban development and start designing appropriate tools for shaping them. It is important to collect data and based on it, gather in-depth knowledge about both, social and economic aspects of the city. With regard to the latter, the composites of the city economy should be analysed. The local authorities should also analyse how particular sectors, such as manufacturing, real estate, finance, education, function in their city environment. Similar exercise needs to be conducted in order to define the socio-demographic profile of the city, identify the areas of concentration of deprivation (this obligation is already imposed by the Act on Revitalisation followed by identification of spatial strategies) and plan measures, which can alleviate such poverty areas by optimising access to jobs, housing, education, health, public space, transport and community infrastructure.

Coherence between all sectoral strategies needs to be reassured. Horizontal ones, such as alleviation of poverty need to include elements from the sectoral ones (in case of poverty, urban space policies, mobility and infrastructure, housing policies, revitalisation policy etc.). In order for the strategies to play a larger role than only desk-drawer documents taken out into the daylight only in the election time, they should include clearly defined goals, milestones for their achievement and indicators of success assigned to particular city institutions as well as monitoring structures. The strategic documents should go through the consultation procedure and gain approval of the city inhabitants. Only than they would acquire the status of the sort of a binding social contract, which will promote their endurance and discourage major changes by the authorities taking over the rule in subsequent elections. In order to reassure that the actual operational decisions are coherent with the strategic documents, it is sufficient to introduce the rule that all major investment decisions, which are not in line with the goals set up in the strategy or the investment plan attached, require additional social consultations and only after receiving a green light in the result of such consultations they may be implemented.

As this section demonstrated, despite serious structural barriers to cities' autonomy in-built in state-level regulations, by no means one may assess that urban

authorities are powerless. They still may choose to prepare the masterplans or not to do so, create good public space or leave the job to the market forces, realise large infrastructural investments or choose step by step improvements to the local parks, streets and backyards, support families by providing quality childcare institutions or not to do so, back up affordable housing or leave the topic for the state and last but not least, facilitate creation of the unique city ambient by financial support for culture or instead, promote cheap entertainment as the main expression of culture. All of these are choices that city authorities may take and policies they may implement. The major problem, however, is the incidental character of some of them and weakness of the planning procedures detrimental to the city development for decades ahead.

As the city makers and scholars in unison claim [51], the success of contemporary cities depends to a large extent on fostering social capital, creation of the atmosphere of freedom and open dialogue between the public, private and civic as well as non-profit sectors, which is conducive to creativity and innovations. This is ever more important in Poland where the general negative demographic trends force cities to compete with each other in order to attract new citizens. Thomas Murphy, the former mayor of Pittsburgh, a city that did manage to successfully pass difficult transition from the XX c. heavy industry to XXI c. high technology, argues that attracting the talents is the key to a city success in situation of falling production sector as well as expanding professional, business service, health and education sectors, which provide higher share of the value added to city economy than ever before.

5 Conclusions

While there remain obvious systemic hurdles to a sustainable development and rational management of the Polish cities, the key to their promotion and making them better places to live is provided by the governance system and strategic planning based on vision and clearly defined goals. As shown in the second section of this chapter, the reforms of the national-level regulations concerning self-governments are necessary to improve the systemic context of city authorities operation. Better regulations providing appropriate incentive structures would rationalize local governments' financing structure and organisation. These framework conditions differ between countries and therefore, while some tenets of city management can be applied everywhere, only fragmentary results will be produced if these particular legal contexts are ignored. Nevertheless, long-lasting positive changes are contingent on a favourable regulatory framework but need to be, combined with the pursuit of a development vision drawing on the city's unique advantages, and with the turning of "spontaneous solutions already happening into the strategies". In this sense, it is a tailored-made exercise that needs to consider both specific national-level conditions and a city's individual environment.

Poland's self-governments cannot operate and fulfil their roles in an efficient way unless the basic structural problems are removed and effective, stable financing

sources for self-governments secured. Thus, local personal tax, organisational autonomy, better division of responsibilities between different self-government tiers, structural unity of self-government structures, and more effective supervision of their budgetary units are the most important elements of indispensable reform. Transparency and social participation need to be assured in order for the self-governments in general, and cities in particular, to act in a fully democratic way, secure social control over authorities' decisions and thus fulfil the principles of good governance. Some constraints, such as the centrally imposed ceiling on city parking fees, are truly harmful from the city development perspective, undermining transport programmes and contradicting the subsidiarity principle. Nevertheless, apart from the systemic problems, which hopefully will be addressed by the parliament in more or less far future, the key factor in a city's development is leadership with a vision. As Thomas Murphy pointed out, without a vision a city is doomed to drift rather than thrive.

References

1. For instance findings from city research of scholars such Ian Gehl or Charles Montgomery on the importance of efficient public transport networks, quality public space or natural environment became nearly universally-accepted benchmarks of the well governed city
2. GUS (2014) "Prognoza dla powiatów i miast na prawie powiatu oraz podregionów na lata 2014-2050", http://stat.gov.pl/obszary-tematyczne/ludnosc/prognoza-ludnosci/prognoza-dla-powiatow-i-miast-na-prawie-powiatu-oraz-podregionow-na-lata-2014-2050-opracowana-w-2014-r-,5,5.html
3. E.g. Haase A et al (2013), Labus A (2014), Pallagst KM, Schwarz T (2009), Rink D, Rumpel P (2012), Stohr K (2004)
4. Haase A et al (2013) Varieties of shrinkage in European cities. Eur Urban Reg Stud 0(0):1–17
5. P. Trębacz (2013) „Kurczenie się miasta na przykładzie Detroit", Teka Kom. Arch. Urb. Stud. Krajobr.—OL PAN, IX/3, 84–96
6. Freedman versus Florida debate on whether globalisation has levelled the playing field for commerce making location less important or whether the opposite has been happening, rapid movement of people to densely populated urban settlements makes locations matter more than ever before
7. Bieńkowska E (2013) "Zarządzanie rozwojem miast o zmniejszającej się liczbie mieszkańców (w kontekście perspektywy finansowej 2014—2020)." conference materials, Kancelaria Senatu, Warszawa 2013, p 14
8. OECD (2011) Urban Policy Country Reviews: Poland, OECD calculations based on data from the UN 2009 World Urbanization Prospects: the 2007 revision. p 41
9. Bieńkowska E (2013) "Zarządzanie rozwojem miast o zmniejszającej się liczbie mieszkańców (w kontekście perspektywy finansowej 2014—2020)." conference materials, Kancelaria Senatu, Warszawa, str. 14
10. Szukalski P (2014) "Depopulacja dużych miast w Polsce, Demografia i Gerontologia Społeczna—Biuletyn Informacyjny", Nr 7
11. Szukalski P (2014) Przyszłość miast wojewódzkich w świetle prognozy GUS z 2014 r. Demografia i Gerontologia Społeczna–Biuletyn Informacyjny, Nr, p 11
12. Lion's House based on GUS prognosis GUS, (Prognoza dla powiatów i miast na prawie powiatu oraz podregionów na lata 2014–2050) http://forsal.pl/artykuly/789579,polskie-miasta-beda-sie-kurczyc-urosna-tylko-warszawa-krakow-i-olsztyn.html
13. OECD (2011) Urban Policy Country Reviews: Poland. p 45

14. Szukalski P (2014) Depopulacja dużych miast w Polsce. Demografia i Gerontologia Społeczna–Biuletyn Informacyjny, Nr, p 7
15. Sagan I (2014) Integrate to compete: Gdańsk-Gdynia metropolitan area. Urban Res Pract 7 (3):302–319
16. Regulski J (2013) Raport o ekonomicznych stratach i społecznych kosztach niekontrolowanej urbanizacji w Polsce. FRDL, Warsaw
17. Zarządzanie rozwojem miast o zmniejszającej się liczbie mieszkańców (w kontekście perspektywy finansowej 2014—2020)/" (2013), conference materials, Kancelaria Senatu, Warszawa, p 77
18. Zborowski A, Soja M, Łobodzińska A (2012) "Population trends in Polish cities—stagnation, depopulation or shrinkage?" Prace Geograficzne, 130. Instytut Geografii i Gospodarki Przestrzennej UJ, Kraków, pp 7–28
19. These have to be examined, however, closer as depopulation also changes the social structure. It may lead like in Boston and San Francisco case to citizens' loss but better economic conditions due to the fact that groups imposing heavy burden for social services (families with children) have been moving out while singles or childless couples, less demanding is terms of services, with ample income have moved in
20. Olbrycht J (2013) "Shrinking Cities—problem globalny, problem europejski." in Zarządzanie rozwojem miast o zmniejszającej się liczbie mieszkańców, conference materials, Kancelaria Senatu, Warszawa
21. OECD (2011) Urban Policy Review, Poland. p 25
22. Litman T (2016) Understanding smart growth savings evaluating economic savings and benefits of compact development, and how they are misrepresented by critics. Victoria Transport Policy Institute, May 18
23. Stohr K (2004) Shrinking city syndrome. New York Times, Feb 5
24. www.shrinkingcities.com; Cities regrowing smaller—fostering knowledge on regeneration strategies in shrinking cities across Europe (CIRES project) www.shrinkingcities.eu
25. Florida (ed) (2009) Who's Your city? basic books, place & happiness survey, 1 to 5 scale of importance where 5 is the highest
26. http://www.nytimes.com/2004/02/05/garden/shrinking-city-syndrome.html?_r=0
27. Krzysztofik R (2013) „Zagłada miast"—projekt Shrink Smart—The Governance of Shrinkage within an European Context na Uniwersytecie Śląskim in Zarządzanie rozwojem miast o zmniejszającej się liczbie mieszkańców (w kontekście perspektywy finansowej 2014—2020), conference materials, Kancelaria Senatu, Warszawa
28. Barry M (2016) Conference speech at the CEE summit urban vision & capital markets. Urban Land Institute, Warsaw, June 1st
29. ThinkTank (2013) Przyszłość Miast. Strategie i wyzwania innowacje społeczne i tchnologiczne, Warszawa
30. Constitution of the republic of poland. (1997) April 2nd
31. Act on the Municipal Self-Government, (1990) March 8th. Dz.U. 2016 poz. 446
32. Kulesza M (2009) How much decentralisation there is in centralisation and the curious habits of learned administrative lawyers. Samorząd Terytorialny no 12:7–12
33. Kulesza M (2009) How Much Decentralisation there is in centralisation and the curious habits of learned administrative lawyers, Samorząd Terytorialny no 12
34. Supervisory decision of Kujawsko-Pomorskie Voivod, 5.03.2008 r. (WNiK.IV.PK.0911–41/08), NZS 2008/4, p. 73; RIO Resolution, Opole, 26.07.2010 r. (16/35/10), OwSS 2010/4, p. 96; RIO Resolution, Zielona Góra, 2.07.2008 r. (107/08), OwSS 2008/4, p. 109; Złakowski, Ł. in Hauser, R. Niewiadomski, Z. (eds.), Ustawa o samorządzie gminnym. Komentarz z odniesieniami do ustaw o samorządzie powiatowym i samorządzie województwa, Warsaw 2011, p. 188
35. Act on the municipal self-government (1990) March 8th Art. 2.1, Dz.U. 2016 poz. 446
36. Forum Od-nowa (2013)."Samorząd 3.0." Wolters Kluwer, Warsaw, November

37. In Poland there are 18 percent and 32 tax thresholds. The lower tax rate is paid by 98 percent of citizens and amounts to around 37 billion PLN annually. Annual income from the taxpayers of the higher rate amounts to around 13 billion PLN annually
38. NSA resolution from 24 June 2013, no I FPS 1/13
39. Main organisation gathering the urban movements from various cities, the Urban Movements Congress was set up in 2011 in Poznań but some of the groups are much more mature. Ochocianie, the Neighbours from Warsaw District of Ochota were set up in 2007
40. Putnam RD, Leonardi R et al (1992) Making democracy work: civic traditions in modern italy., Princeton University Press, Princeton, New Jersey
41. Minton A (2012) Ground Control, Penguin Books, London; Jacobs, J (2014) "Śmierć i życie wielkich miast Ameryki", Fundacja Centrum Architektury, Warsaw
42. Glusman J (2009) When is EU conditionality effective? the terms of Poland's accession." PhD thesis, London School of Economics and Political Science, United Kingdom
43. Poland in administrative terms is divided into 2479 municipalities, 380 counties and 16 voivodships
44. The division of tasks is drawn between the 'own' tasks and those assigned by the government
45. Act from March 27th 2003 on Spatial Planning and Development, Dz.U. 2003 nr 80 poz. 717
46. Although it does not impact city areas with densely build-up city areas where no new function is introduced
47. Wiceprezes, Towarzystwo Urbanistów Polskich, http://www.urbanistyka.info/content/przestrze%C5%84-publiczna-jako%C5%9B%C4%87-%C5%BCycia-i-zamieszkiwania
48. Minton A (2012) Ground control. Penguin Books, London
49. Żuber P (2011) "Krajowa polityka przestrzenna, regionalna i miejska wobec zjawiska Urban Sprawl." Ministry of Regional Development, conference materials, Sopot
50. www.pps.org
51. Jan Gehl, Charles Montgomery, Thomas Murphy Richard Florida among the others

Exploring Public Attitudes Towards Urban Access Regulation Schemes—Case of Maribor

Darja Topolšek and Tina Cvahte Ojsteršek

Abstract When deciding on establishing schemes for limiting traffic in urban centers, authorities obtain studies based mainly on traffic models, limiting the input of residents and especially visitors. This study explores differences between attitudes on the introduction of schemes for urban access regulations from the perspective of the urban population and city visitors. A survey among residents and visitors of the city of Maribor, Slovenia will provide input data. Structural Equation Modelling will be performed to explore the attitude of residents and visitors towards schemes of restricting and managing traffic in city centers. The chapter will give a clarification of public opinion on implementing urban access regulation schemes, as well as a methodological example for further use. The findings show that there are significant differences among visitors and residents of the city center in regard of their opinion on acceptability of the implementation of various urban access regulation schemes. Their attitude also depends on their most commonly used modality for traveling into the city.

Keywords Urban access regulation schemes · Public opinion · Structural equation modeling

1 Introduction

When talking about urban mobility, it is necessary to focus on the guidelines of the European Commission in the framework of the Action Plan on Urban Mobility [1] that highlights the problem of growing population in cities, which generates up to 85% of GDP. Urban areas today face the challenge of making transport sustainable

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from an environmental viewpoint (CO_2, air pollution, noise) and from the viewpoint of competitiveness (congestion), while at the same time addressing social concerns. Since citizens are also those who bear the negative consequences of transport the most, they are also increasingly concerned about urban mobility. Nine out of 10 EU citizens believe that it is necessary to improve the traffic situation in their urban area [1].

Urban mobility is a key factor in long distance transport. Most transport, both passenger and freight, starts and ends in urban areas; urban routes are also the most congested. Urban areas should provide efficient interconnection points for the trans-European transport network as well as efficient last mile deliveries for freight and passenger transport. They are thus vital to the competitiveness and sustainability of the future European transport system.

The emphasis on small and medium-sized cities is vital to achieve substantial progress towards more sustainable urban development. In principle, their size allows flexibility in terms of urban expansion, adoption of "green" modes of travel and environmental protection [2]. Economic factors such as the recession and fuel prices also play an important role in determining decision rates for vehicle use and the purchase of a car [3].

City centers in older towns were designed at a time when there were no cars and are consequently hardly adaptable to today's mobility needs. The emergence of traffic congestion is a negative factor which increases environmental pollution, especially in urban areas where people work and live. Traffic congestion leads to unnecessary fuel consumption. Heavy traffic is a major problem in urban areas. Hyman and Mayhew [4] say that congestion is characteristic of modern cities, and although there are many ways this can be limited, only few successes can be seen so far. Overload of road systems and congestion in peak hours usually cause traffic jams [5]. Many cities still exceed the limit values of air quality (PM_{10}, NO_2), established by the European Union (EU) [3].

Political solutions already exist; they simply need to be implemented more broadly, based on analysis and acceptance of ideas of urban transport policy concepts or instruments from elsewhere. These are also subjected to several different influences, including political, professional, institutional, economic, and social. Research to date suggests that there is little evidence of the possibility of a "copy" of one policy from one city to another, and certainly not beyond national borders [2].

Effective organization of mobility in urban centers during congestion depends not only on individual vehicles, but also on parking spaces, roads, bridges, and other infrastructure used by cars. Although differentiated solutions for overcoming negative effects of congestion are being developed in different cities, such as improvement of public transport, reserved lanes, car sharing and bike sharing, only some have successfully come closer to a solution [6].

In terms of investments into the road network, the evidence so far suggests that it is necessary for urban development resources to focus on the maintenance of existing roads rather than building new ones. Without corrective measures, poor or inadequate roads pose an insurmountable obstacle to economic recovery and development of cities. One of the most important contemporary measures to reduce

negative effects of transport in urban areas are the so-called urban access limitation zones (also called for example zones of limited traffic, environmental zones etc.).

For limiting traffic in urban centers, there are several known schemes. The most common one is a Low Emission Zone. In order to reduce emissions, 200 Low emission zones were established in 12 different European countries. Access into these city centers is permitted only to vehicles that meet EU standards. Directive on ambient air quality and cleaner air for Europe [7] sets limit values for particulate matter PM_{10} and NO_2, which should have been met by all EU countries until 2005 and 2010, with the possibility of an extension until 2015. The final goal of many Low emission zones is to contribute to coherence to the EU limit values. If a vehicle does not meet the set standards, it is prohibited to enter the city center or must pay a fee to do so. European emission standards apply to passenger cars and vans (light commercial vehicles), two/three-wheel vehicles and heavy freight vehicles, and each vehicle type has different restrictions on emissions. The first Low emission zone in Europe was implemented in 1996 in Stockholm, Gothenburg, and Malmo in Sweden, and is known as an "ecological zone" (Miljözon). The first Low emission zone outside Sweden was established in 2002 in the Mont Blanc tunnel between France and Italy, and some countries (e.g. Germany, Netherlands, and Sweden) have a national Low emission zone framework [3].

Urban Road Charging schemes are an important limitation of traffic in urban areas as they offer the opportunity to achieve improvements in urban transport, but at the same time they are very difficult to implement. The primary objective of these measures is to promote the use of environmentally friendly vehicles [8]. Cities often need guidance on the factors to be considered in the planning and implementation of such a scheme [9]. These zones act as a restricted area: the entrance to the zone is limited, and afterwards, vehicles can move freely within the zone. A fee is charged for the entry and movement inside the zone, which aims to improve travel costs, to call upon people to choose an appropriate travel time and appropriate modality, to increase the average speed of vehicles, to change the modal split inside a city center, to convince users to change their trip modality from private car to public transport, to reduce pollution, to save energy, to increase traffic safety and to achieve sustainable development of urban transport [10]. There are seven key factors identified by the experts and discerned from data analysis and case studies, which show that the Urban Road Charging concept is a tool that brings many benefits [9]: reduction of the quantity of vehicles entering such a zone; significant reduction of traffic delays within the range of the zone; reduction of carbon dioxide emissions in the area of the zone; reduction of local emissions (NO_x, PM_{10}) in the zone; reduction of the number of road traffic accidents within the zone; significant revenue for reinvestment; the scheme in general does not have negative impacts, impacts on the urban economy are usually small, but positive. Before implementing Urban Road Charging schemes in a city, it is necessary to focus on informing the public achieving a shift of mindsets towards proposals to improve the cities [10]. Percoco [11] notes that in the case of Milan, many residents and regular visitors switched from motor vehicles which fall into emission classes Euro 0 to Euro 3 to

hybrid motor vehicles and motor vehicles running on liquefied gas after the introduction of the scheme. However, such a scheme also has several negative effects, which primarily affect the residents [12].

Major Access Schemes Regulation are the following important schemes, which effectively eliminate or significantly reduce the negative effects of urban motorized traffic. In this case, the area inside a city center can only be accessed by certain vehicles, which must have the necessary authorization or permits. Motor vehicles can only enter at certain times of the day (for example, from 6 am to 6 pm).

Studies have shown that another type of access restrictions, Physical regulations, which are restrictions of entry of vehicles into city centers based on weight or dimensions, contribute much to the improvement of living conditions and greater security in towns. This measure can be a double-edged sword, since the delivery conditions for companies using smaller freight vehicles remain unchanged, but for companies with larger vehicles, which have a gross weight of 12 tons or more, this measure means grave restrictions to their deliveries and operations [13]. To enter such a zone, it is necessary to consider specific conditions and restrictions. Milan, for example, banned all vehicles, which are longer than 7.5 m, with the exception of public passenger transport, which has to enter the area in special entrances, reserved exclusively for them [14]. Restrictions for freight vehicles commonly require that deliveries are performed using small and rigid vehicles that comply with any restrictions on heavy vehicles in city centers, enabling the city to reduce the number of vehicles that mostly restrict accessibility in urban centers [15].

For a city to achieve sustainable mobility, it is necessary to support initiatives that develop and strengthen synergies in the areas of: (1) mobility management measures that enable the awareness of the population about the benefits of environmentally friendly transport, (2) low-cost transport measures that maintain an adequate level of quality of public passenger transport, and (3) the tools and tactics of urban planning that devote part of road space to encouraging walking and cycling as a conscious mobility behavior [16]; and also to make proposals to promote the introduction of various schemes of limiting traffic in city centers.

Based on a review of previous research, it can be noted that different authorities (e.g. municipalities) should obtain studies on the advisability of establishing schemes for limiting traffic in urban centers based on diversified transport models. The decisions can then be made in an informed manner, and in rare cases, a referendum can also take place. In the case of the City of Edinburgh in Scotland, UK, the city's residents were asked whether they would encourage a limited access scheme to be implemented in the city or not in February 2005. This gave the public a direct opportunity to be involved in the decision making process, even though the city's authorities had spent many years planning the implementation of the scheme [17]. Public acceptance of various schemes of limiting traffic in city centers can be recognized as the most important and common barrier to actual implementation of such schemes (e.g. [18–20]), and this was also the case in Edinburgh, where the public decided against implementation of the access regulation scheme.

Public opinion therefore is very important. Mostly, opinion polls and research into public attitudes towards the introduction of urban access regulation schemes are carried out only from the point of view of the residents of a city or even at only a sub-region where the scheme will be implemented. The current research is limited; most notably from the perspective of the suitability of schemes and their selection for a specific area, and especially from the perspective of including residents and visitors into the decision making and implementation processes. For this reason, the study presented in this chapter aims to note differences between the perceived agreement with the introduction of one and each of the potential urban access regulation schemes from the perspective of the urban population and of visitors to the city.

2 Methodology

An exploration of public attitudes towards implementation of various urban access regulation schemes was performed based on gathering data using a survey among the residents and visitors of the case city, Maribor, Slovenia. Maribor is a Slovenian mid-sized city, dealing with high levels of air pollutants especially in the winter months, and seeing increased traffic flows and congestion in the city center mainly caused by a large number of daily migrations. Its city center is old and spatially limited. This makes Maribor a good example of a European city, facing all of today's transport related challenges while at the same time being limited with its spatial and urban characteristics.

2.1 The Research Framework

The following chapter presents the research framework, which summarizes the theoretical knowledge and links it to the given problem, identifies research variables, and clarifies relationships among the variables. Said framework includes a number of variables, namely 13 variables associated with four different urban access regulation schemes: variables LEZ_i, i = 1,…4, which represent characteristics, typical for Low Emission Zones; MARS_i variables, i = 1, 2, which represent the characteristics, typical for Major Access Regulations Schemes; variables URC_i, i = 1,…,5, which represent characteristics, typical for Urban Road Charging; and variables PR_i, I = 1, 2, which represent characteristics of the Physical Regulations scheme. These variables were evaluated by the survey respondents from the point of view of the advisability of establishing certain schemes, giving their subjective opinion, and this depending on whether they main transport modality is on foot, by bike, by public transport or by car; and separately

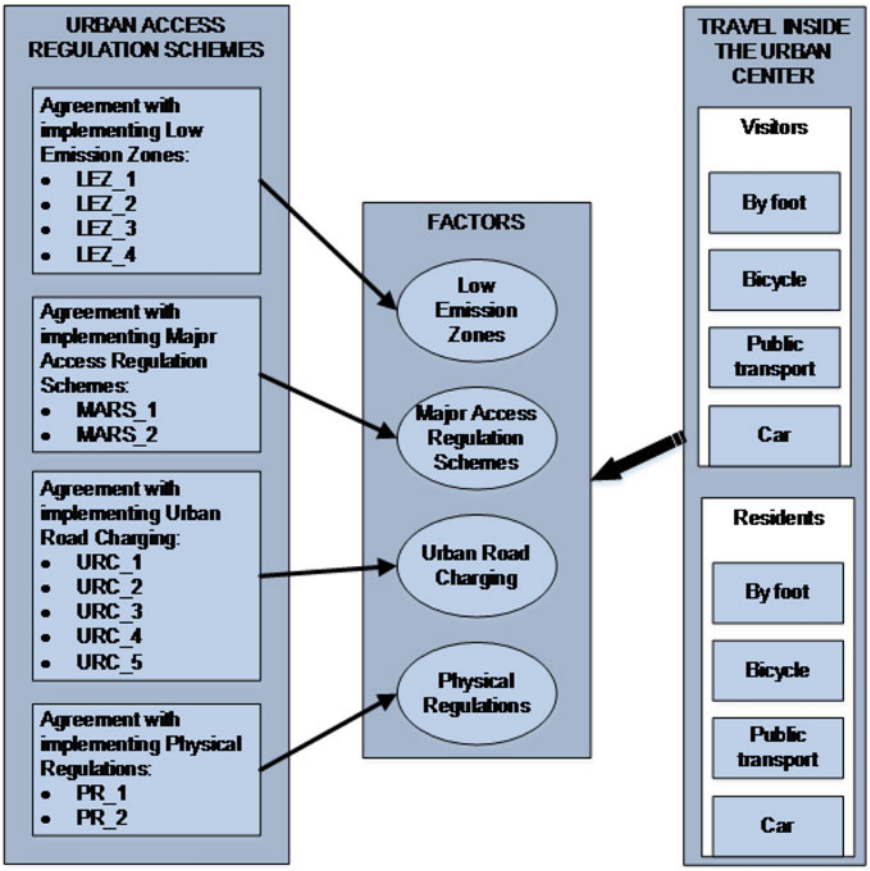

Fig. 1 Research framework

for residents and visitors. Figure 1 shows four expected factors, resulting from Exploratory Factor Analysis. It is assumed that these four factors will be related to survey respondents' answers, both in terms of whether the respondents are visitors or residents of the city, as well as from the perspective of their most common modality of transport around the city. The main area of research is exploring the differences between the acceptability and even desires for implementing different types of urban access regulation schemes depending on whether a person is a resident of the city or a visitor. To determine these differences, we will examine which scheme is most appropriate according to visitors and which scheme is preferred by the city's residents. The main research question therefore is: How are urban access regulation schemes seen and accepted by the public and are there any differences in views of a city's visitors and its residents? Since a research question was defined, we will not further define research hypotheses.

2.2 Definition of Questionnaire Variables

The description of the questionnaire variables is presented in the table (Table 1). As mentioned, this questionnaire was designed to evaluate the appropriateness of establishing different schemes of urban access regulations in terms of various modalities and in terms of the characteristics of the respondent (resident or a visitor). For measuring variables LEZ_i, MARS_i, URC_i and PR_i, a 5-point Likert scale was used (1 = completely disagree; 5 = completely agree). The respondent also identified themselves in the survey as a resident or as a visitor in the

Table 1 List of variables and their meanings

Item/ variable	Measure/items
Low emission zones items	
LEZ_1	Forbidden access to motor vehicle into the city center area that do not meet at least Euro 2 emission standards
LEZ_2	Access allowed for residents within the area with a special pass, regardless of the category of the vehicle according to European standards
LEZ_3	Access restrictions are in place throughout the year without cessation
LEZ_4	Restricted access does not apply to emergency vehicles
Major access regulation schemes	
MARS_1	The area can only be accessed by certain vehicles which must have the necessary authorization
MARS_2	Motor vehicles may only enter the area at certain times of the day (for example, from 6 am to 6 pm)
Urban road charging	
URC_1	A certain daily toll must be paid for entering the city center for all types of motor vehicles (possibility of reducing the overload of motor vehicles in the selected area)
URC_2	Residents within the area are allowed free access, while all visitors are obliged to pay a certain entry toll
URC_3	Unlimited and toll free access is allowed for intervention and urgent vehicles in cases of need
URC_4	Toll from Monday to Friday, from 6:00 to 18:00 pm
URC_5	Free access during holidays, weekends and between 6 pm and 6 am
Physical regulations	
PR_1	Restrictions for access of motor vehicles with regard to weight, height, width, length, axle load
PR_2	Forbidden access to the area for freight vehicles weighing more than 3.5 t
Most common modality of travel for the city resident or visitor	
–	By foot/bicycle/public transport/car
Resident or visitor	
–	Resident/visitor

city and chose their most common travel modality (on foot, bicycle, public transport, or car), which is used for movement in this city.

2.3 Survey and Demography

Data was collected through an online anonymous survey, conducted in the period of one month in autumn 2015. It included 12 questions, eight out of those were content related. The questions were directly related to the set variables. Most importantly, the survey asked the respondent on how they most often reach the city center (modality), how they assess the current state of the traffic and transport environment in the city, and which measures they would support to be implemented. The survey also included demographic questions, which covered respondent's gender, age, and level of education. The area of interest was the central part of the city of Maribor.

After completing the survey, 392 fully completed questionnaires were included in the study. The final sample consisted of 44.4% men and 55.6% women. 3.1% of respondents were younger than 18 years, in the age group from 18 to 30 years there were 71.9% of respondents, 20.4% were between 31 and 50 years, and 4.6% over 50 years.

45.9% of respondents completed secondary education, 51% undergraduate education and 3.1% completed postgraduate education.

The research limitations mostly come from its geographic scope, which was limited to Maribor, Slovenia. The sample is adequate in view of gender, but has shortcomings in view of participant age, since most participants were aged between 18 and 30, the age group between 30 and 50 is less represented, even though they represent the most active citizens who migrate to work daily and are most dependent on transportation. This limitation is due to the surveying mode, done via the internet.

2.4 Methodology Used to Develop the Model

Structural Equation Modeling (SEM) has been a growingly popular method lately, especially in the field of social sciences. It is a statistical tool, which allows researchers a comprehensive evaluation and modification of theoretical models. SEM combines the confirmatory factor analysis (CFA) and multiple regression analysis (simultaneous equations models) into a comprehensive modeling framework [21].

This statistical method involves four basic steps, which include exploratory analysis and confirmatory factor analysis. CFA results are connected to the measures of the SEM model, which describes the indicator variables' loadings on corresponding latent factors. Following this, both the measurement and structural

parts of the SEM model are derived, giving estimated interrelations and causal relations among the observed variables. At the end, model fit to real data is observed by calculating various model fit indices, which, if indicating poor performance, would point to the need to additionally modify the SEM model [22].

3 Survey Results

Giving of results will follow the recommendations given by Byrne [21, 23] and Hair et al. [24].

3.1 Exploratory Factor Analysis

This type of analysis is a multivariate statistical technique that allows explaining of variability among observed variables in terms of possible options to reduce the number of variables with the use of factors.

As already mentioned, 13 variables were subjected to EFA in this research, for which it was expected that these variables are loaded on 4 factors, namely Low Emission Zones Items, Major Access Regulation Schemes, Urban Road Charging, and Physical Regulations.

Before the implementation of EFA, in which it is necessary to select appropriate estimation methods, it is necessary to carry out a descriptive analysis and test of normality. Test for normality is most often carried out by calculating the skewness index (SI) and kurtosis index (KI) of the data. The values of these indices should be $|SI| < 3$ and $|KI| < 7$ [25, 26]. In the case of data from this research, the value of skewness index (−1.871, 0.504) and kurtosis index value (−1.316, 2.107) are within the limits of normality. Based on this test, we chose the Maximum likelihood (ML) method (with additional Promax rotation) for use with EFA, with its main advantage being the ability to calculate a large number of indexes for testing the model's goodness of fit.

Some other tests that ensure that the results of the EFA can be used for further analysis are the Kaiser-Meyer-Olkin test and the Bartlett's test of sphericity. Results for Kaiser-Meyer-Olkin test are 0.748, which is more than the recommended 0.5, as well as the results of Bartlett's test of sphericity ($\chi^2 = 1337.924$, df = 45, and $p < 0.001$) are satisfactory. Convergent validity, meaning there is convergence between the variables measuring the same phenomenon, is satisfactory because all values of factor loadings are greater than 0.4 [24]. Additionally, the Cronbach's Alpha reliability coefficient is among the most often used reliability measures, and is most often calculated for each factor. Hair et al. [24] define the generally agreed minimum lower level for Cronbach's alpha coefficient at a value of 0.70. The revealed results show that the common points of the observed variables were not large enough and there were significant cross loadings. Consequently, further

Table 2 Results of EFA

Pattern matrix	Factors			
	Urban road charging	Low emission zones	Physical regulations	Major access regulation schemes
Cronbach Alpha	0.790	0.760	0.746	0.720
% of Variance	36.221	16.587	12.957	9.105
Cumulative %	36.221	52.808	65.765	74.870
Items	Item loadings on factors			
URC_4	0.890			
URC_1	0.770			
URC_2	0.565			
LEZ_3		0.758		
LEZ_2		0.731		
LEZ_1		0.599		
PR_1			0.853	
PR_2			0.707	
MARS_1				0.882
MARS_2				0.591

analysis did not include these ill-fitting indicators. LEZ_4, URC_3 and URC_5 were excluded. After this, a second extraction of factors was performed and an additional rotation, which gave satisfying results with no significant cross loadings and sufficiently large communalities.

The results of the EFA matrix (loadings, Cronbach's Alphas (CAs), and the % of the total variance explained) are shown in the table (Table 2).

3.2 Confirmatory Factor Analysis

The main objective of the CFA is to investigate whether the data fits well to the hypothesized measurement model. This method enables us to test how well the observed variables represent a smaller number of constructs. CFA as such is also the first step in the creation of SEM. The CFA procedure checked if the given structure is consistent with the measurement theory. To do so, the maximum likelihood method was used for the estimation of all model parameters at first. While estimating the parameters, the difference between the data based covariance matrix and the model implied covariance matrix was minimized. CFA results are satisfactory, as all of the most commonly observed fit indices (see [24]) reached recommended levels. Also, convergent (composite reliability (CR) and average

variance extracted (AVE)), and discriminant validity are inside the appropriate levels, so we can conclude that there were no validity concerns.

3.3 Structural Equation Model

As already mentioned, SEM is a group of statistical models that attempt to explain the relationships between multiple variables. Preparation of the SEM model in this research follows the recommendations of Kline [26].

Additionally, so-called single item constructs were added to the SEM model, which have been linked to the most commonly used modality for the respondent's travels in the selected area. As with the CFA, Maximum likelihood method was also selected here, and also the fit indices were calculated to test the model adequacy. Figure 2 shows the standardized structural equation model with the estimated path coefficients significant at the $p \leq 0.05$ level. Full paths show a positive connection and the dotted paths show negative connections. Such a SEM model shows the main construction of all major relationships among the factors that are present in this research, as well as single-items. Insignificant paths are not shown in the model on Fig. 2. Figure 2 is a composite image in order to facilitate an easier review of the results and presents double results for paths, namely for answers relating to those respondents who were city visitors and those who are city residents.

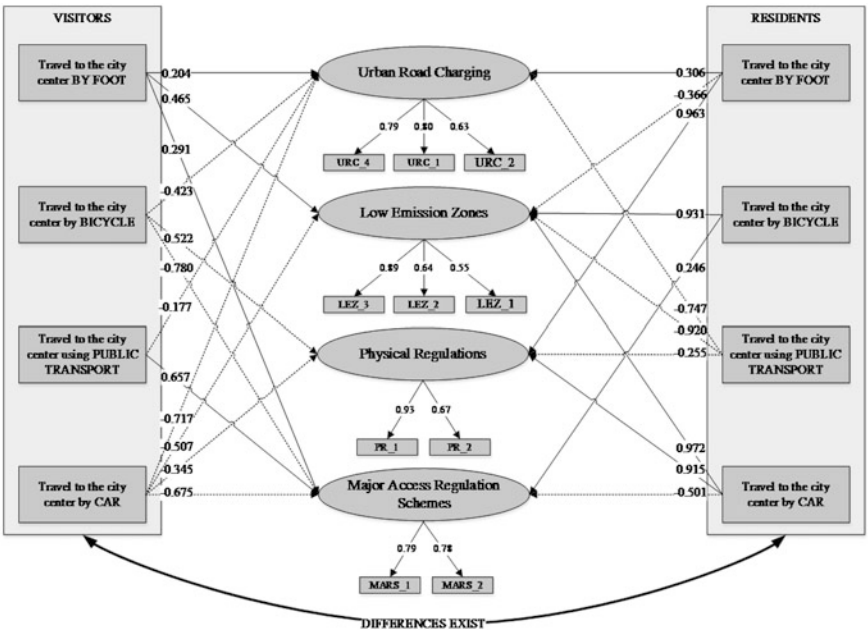

Fig. 2 Results of SEM model

3.4 Fit Indices

The question of whether the measured data was adequately fitted and gives quality information arises after the path model is built, since the knowledge of whether the hypothesized theoretical model gives an adequate fit for the gathered data. Most measures of fit indices use the chi-square test statistic for the hypothesized model. For the given model, the chi-square is 45.249, and the relative chi-square of the discrepancy has a value of 1.103, which is seen as a good result (<3 is good, <5 is permissible). Root mean square error of approximation is 0.026 (<0.07 is good) and p value (PCLOSE) is 0.837 (>0:50 is good). The Normed fit index is 0.941 (>0.90 is good, >0.95 is acceptable), and the Non-normed fit index (Tucker-Lewis Index) is 0.986 (>0.80 is good and >0.95 is acceptable). The Comparative fit index is 0.994 (>0.90 is good, >0.95 is acceptable), and Standardized root mean square residual amounts to 0.0435 (<0.09). Based on these results, we can conclude that they indicate an acceptable fit of the model.

3.5 Descriptive Statistics

One of the most common analyses that can be performed is a simple descriptive statistics analysis. Some of the more interesting highlights, especially from the viewpoint of practitioners, are presented here (the shown results do not encompass all of the survey questions).

In examining the most commonly used modality, a comparison between residents and visitors shows that they both largely rely on cars. The comparison is shown in the table. Each respondent was asked to assess on a scale from 1 (never) to 5 (almost always) how often they use a modality when traveling to the city center. The table shows average scores of their answers (Table 3).

It is evident that the most common modalities used are walking and car use with both residents and visitors. Residents also more often use bicycles and public transport.

Table 3 Modality use

	Resident			Visitor		
	Mean	St.dev.	Var.	Mean	St.dev.	Var.
Walking	3.62	1.19	1.41	3.62	1.31	1.71
Bicycle	2.09	1.24	1.53	1.41	0.94	0.88
Motorcycle	1.34	0.88	0.78	1.11	0.58	0.33
Public transport	1.85	1.23	1.52	1.56	1.02	1.04
Car	3.10	1.32	1.74	3.22	1.33	1.78
Small delivery vehicle	1.21	0.77	0.59	1.14	0.65	0.43
Large delivery vehicle	1.03	0.37	0.14	1.00	0.00	0.00

Table 4 Opinion on effects of traffic

	Resident			Visitor		
	Mean	St. dev.	Var.	Mean	St. dev.	Var.
Emissions	2.89	1.31	1.71	3.14	1.08	1.17
Noise	3.06	1.30	1.69	3.33	1.21	1.47
Deliveries	2.85	1.17	1.36	3.41	1.11	1.24
Crowded streets	3.87	0.94	0.88	3.81	1.01	1.02

Table 5 Support for different types of access restrictions

	Resident			Visitor		
	Mean	St. dev.	Var.	Mean	St. dev.	Var.
Motor vehicles have to meet a certain emissions standard to be allowed into the center	3.39	1.08	1.17	3.19	1.25	1.56
Motor vehicles can access the center only in given time frames or with a special permit	2.99	1.18	1.38	2.99	1.30	1.69
Motor vehicles have to pay a fee to enter the center	2.47	1.29	1.66	2.05	1.19	1.42
Access is only allowed to motor vehicles complying with physical restrictions	3.02	1.23	1.51	3.18	1.33	1.78

Another goal was to find what consequences of heavy traffic the respondents find most disturbing, based on which practitioners can define what aspects of traffic regulation need priority mitigation (Table 4).

It is clear that visitors are more critical of the negative effects of traffic than residents are. Both rank crowded streets as the most disturbing effect of traffic, which points to the idea that there are too many vehicles in the city.

When asked about their opinion on whether implementing better, more convenient and punctual public transport would convince them to use it more often and would reduce the number of cars in the city, residents had a lower opinion than visitors (mean of 3.2 (s = 1.35) vs 3.76 (s = 1.13)).

Among other, respondents were also asked what types of access regulations they would support. Again, they rated their responses on a scale from 1 (strongly against) to 5 (strongly support). The results are shown (Table 5).

The results show that in general, residents are more supportive to various access regulation schemes than visitors are. Visitors would however be slightly more prone to implementing access regulations based on physical restrictions.

3.6 Explanation of SEM Results

The research results arising from opinions of visitors and residents of the selected area show the expected difference between the two groups. From the point of view of people who most often move on foot, the visitors to the city center see the Low Emission Zone as their preferred scheme of urban access regulations. This is not true for the group of residents using the same modality, as they believe that the most appropriate scheme for their city would be Physical Regulations. If we continue analyzing depending on the modality for those most often using bicycles, we find that visitors do not want any of the schemes, since those who frequently move within the city do not support the implementation of any urban access regulations scheme. In contrast, residents using bicycles are most likely to support the introduction of Low Emission Zones. Users of public transport are generally not interested in the introduction of any of the proposed schemes, since only visitors using this modality support Major Access Regulation Schemes. The group of most interest in view of the current car-driven cities is of course the respondents who prefer travel by car, and this group in commonly also the most affected one in any urban access regulation scheme. The interesting point here is the obvious difference between support of traffic restrictions from the visitors and residents. Visitors do not support the implementation of any scheme, which is shown by all negative connections between items. Residents mostly support Low Emission Zones and Physical Regulations, these two are among the strongest links in the overall analysis.

The link between the expectations of visitors and residents, depending on the most common use of different modalities, was determined according to the results of individual connections shown in Fig. 2. From the results and the figure, it can be established that there is no correlation between the perception of the appropriateness of a particular scheme in relation to a person being a resident or visitor, in the case that this relationship is viewed from the perspective of the individual modalities.

Basic statistical analysis among visitors and residents, independent of the most commonly used modality, has shown that visitors find Low Emission Zones to be the most suitable scheme, which also applies to residents. On the other hand, visitors and residents (regardless of most commonly used modality) deem Urban Road Charging and Major Access Regulations schemes the least appropriate. Of course, this is a general analysis, but this is nonetheless an important result. In any case, city planners are those that need to take into account the most commonly used modalities and preferences of visitors and residents when making decisions regarding the implementation of urban access regulations.

Additionally, multi group comparison was performed, meaning that the dataset was divided into two groups according to gender and age of respondents, and then the model was tested for each group separately. When examining differences among males and females the model results show that there are certain differences in the model according to gender, which reflect in the connection between walking into the city and acceptance of Urban road charging, and in the connection between driving to the city center and implementing physical regulations. In view of respondent age, the model is not any different among groups.

4 Conclusion

Urban development includes two key elements, namely land use patterns and transportation systems, and as such, these are at the heart of urban policy planning [27]. The processes of planning and decision-making need to be properly implemented and maintained, and an important emphasis has to be made on the opinion of different stakeholders [28], as the different groups of visitors and residents can be decisive in the adoption of appropriate measures.

The survey results show an expected difference between the expectations of visitors and residents of the surveyed urban area of Maribor, Slovenia. A Low Emission Zone is generally the most acceptable between the surveyed schemes, while Urban Road Charging and Major Access Regulation schemes are among the least popular when looking at the overall opinion, i.e. independently of the most commonly used modality. Dieplinger and Fürst [29] have determined the extent to which the implementation of different urban toll measurements was accepted in various European cities. Despite the fact that urban tolls are an effective approach to the restriction of motor vehicle use in urban centers, this measure has a poor overall acceptability from users. However, the study shows that the acceptability is increased by more effective strategies and taking into account the views of different groups of users [29]. Their findings are also conclusive to findings of our research, which points to poor acceptability of urban tolls, but a better acceptability of schemes that limit access according to environmental characteristics of vehicles.

In regard of practitioners and managerial insight, the research, even with its limitations, points to the need to properly plan, implement and thoroughly communicate any efforts towards restricting access in a city. Since not all stakeholders approve of such measures or would be prepared to support them, the focus on presenting their benefits from the viewpoint of each stakeholder group must be one of the priorities in any planning process.

References

1. European Commission (2009) Action plan on urban mobility. Brussels: commission of the European communities
2. Pojani D, Stead D (2015) Sustainable urban transport in the developing world beyond megacities. Sustain—Open Access J 7: 7784–7805
3. Harrison R, Holman C, Querol X (2015) Review of the efficacy of low emission zones to improve urban air quality in European cities. Atmos Environ 111:161–169
4. Hyman G, Mayhew L (2002) Optimizing the benefits of urban road user charging. Transp Policy 9:189–207
5. Kawka G, Miklasz M, Nowosielski A (2013) Automated supervision systems for limited traffic zones. Polish Assoc Transport Telematics 6:39–43
6. Grillo F, Laperrouze J (2013) Measuring the cost of congestion on urban area and the flexible congestion rights. J Manag Sustain 3:40–55
7. European Commission (2008) Cleaner air for Europe. Brussels: commission of the European communities

8. Tretvik T, Elvsaas Nordtomme M, Ystmark Bjerkan K, Kummeneje AM (2014) Can low emission zones be managed more dynamically and effectively? Res Transport Bus Manage 12:3–10
9. Blackledge D, Fioretto M, Koh A, May AD (2010) Overcoming the barriers to implementing urban road user charging schemes. Eur Transport Res Rev 2:53–68
10. Ye S (2012) Research on urban road traffic congestion charging based on sustainable development. Phys Procedia 24:1567–1572
11. Percoco M (2014) The effect of road pricing on traffic composition: evidence from a natural experiment in Milan, Italy. Transp Policy 31:55–60
12. Bonsall PW, Milne DS (2003) Urban road user charging and workplace parking levies. In: Integrated futures and transport choices, transport and society, pp 259–286
13. Anderson S, Allen J, Browne M (2005) Urban logistics—how can it meet policy makers sustainability objectives? J Transport Geogr 13(7):1–81
14. Rotaris L, Danielis R, Marucci E, Massiani J (2010) The urban road pricing scheme to curb pollution in Milan, Italy: description, impacts and preliminary cost–benefit analysis assessment. Transport Res Part A 44:359–375
15. Quak H, de Koster R (2009) Delivering goods in urban areas: how to deal with urban policy restrictions and the environment. Transport Sci 43(2):211–227
16. Papagiannakis A, Vitopoulou A (2015) An urban strategy in time of crisis: mobility management and low-cost public space design. SPATIUM Int Rev 33:1–7
17. Gaunt M, Rye T, Allen S (2007) Public acceptability of road user charging: the case of edinburgh and the 2005 referendum. Transport Rev 27:85–102
18. Jones PM (1998) Urban road pricing: public acceptability and barriers to implementation. In: Button KJ, Verhoef ET (eds) Road pricing traffic congestion and the environment, traffic congestion and the environment, issues of efficiency and social feasibility, pp 263–284
19. Schade J (2003) European research results on transport pricing acceptability. In: Schade J, Schlag B (eds) Acceptability of transport pricing strategies. Elsevier, Oxford, pp 109–124
20. Jaensirisak S, Wardman M, May AD (2005) Explaining variations in public acceptability of road pricing schemes. J Transport Econ Policy 39:127–154
21. Byrne BM (2009) Structural equation modeling with AMOS: basic concepts, applications, and programming, 2nd edn. Routledge, London
22. Dragan D, Topolšek D (2014) Introduction to structural equation modeling: review, methodology and practical applications. In: 11th international conference on logistics and sustainable transport, Celje, Slovenia, pp 19–21
23. Byrne BM (2012) Handbook of structural equation modeling. The Guilford Press, New York
24. Hair JF, Black WC, Babin BJ, Anderson RE (2010) Multivariate data analysis, 7th edn. Prentice Hall, New Jersey
25. Zhai X, Liu A, Fellows R (2013) Human resource practices in Chinese construction organizations: development of a measurement scale. Int J Archit, Eng Constr 2(3):170–183
26. Kline RB (2005) Principles and practice of structural equation modeling. The Guilford Press, New York
27. Pozoukidou G (2014) Land use transport interaction models: application perspectives for the city of Thessaloniki. SPATIUM Int Rev 32:7–14
28. Hristić DN, Stefanović N (2013) The role of public insight in urban planning process: increasing efficiency and effectiveness. SPATIUM Int Rev 30:33–39
29. Dieplinger M, Fürst E (2014) The acceptability of road pricing: evidence from two studies in Vienna and four other European cities. Transp Policy 36:10–18