EAI Endorsed Transactions
on Smart Cities

Research Article EAI.EU

Open Data in Smart Region

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Abstract

Putting together up to date particular technical and organizing solutions brings us significant spin-off effecting. With support of information and communication technologies we are able to accelerate innovations, new services in region and its municipalities. We can improve life of citizens, improve regional transportation and deliver unprecedented value in many other areas. Industry 4.0 is not the goal but the means. Topics and issues in field of public transportation are discussed and some examples of open data processing are presented.

Keywords: Smart region, Industry 4.0, Transportation, Open data.

Received on 2 December 2017, accepted on 15 December 2017, published on 19 December 2017

doi: 10.4108/_____

1. Introduction

The Moravian-Silesian Region today is a varied palette of natural and cultural monuments that inspire life with sporting events and social events of national importance. The interconnection of industrial history with current trends in architecture, education and tourism makes the region and the cities of Ostrava a powerful magnet for tourists and visitors, as well as for entrepreneurs and investors.

The Moravian-Silesian Region is like a scaled model of the Czech Republic with mountains on the border and the river Odra, which pours life into the whole region and beautifully contrasts with the "Steel Hradčany", who are witnesses to the history of the region. The region has the same ambitions in terms of sustainable development and the trend of improving the quality of the environment and the lives of its inhabitants. It wants to be a model region that will inspire other regions of the Czech Republic to implement the concept of a smart region. The Moravian-Silesian Region has for a long time been focusing on improving the quality of life of its inhabitants. This effort is reflected in engaging in strategic concepts of sustainable development and concrete projects.

The Moravian-Silesian Region has simplified the definition of a SMART REGION: such region employs modern technology to save time and money of people who live there.

The reason for this simplification is the fact that the multitude of definitions makes it impossible to find the one that would be generally recognized and that would clearly express what a "smart city", "smart project" or "smart region" is. In most cases, the term "smart" refers to the application of new technologies, ICT in particular, to improve the quality of services and the quality of life in cities and regions.

The Smarter Region Strategy should also initiate the emergence of a new industry that will develop and produce products for smart solutions with a high added value. The Strategy should contribute to making the Moravian-Silesian Region a leader in the use of smart solutions in the Czech Republic and an exporter of these solutions from the region itself.

The Smarter Region Strategy will be a dynamic process. It will evolve continuously and respond to the development of new technologies and the transformation of social processes, lifestyle, and preferences of people.

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The Smarter Region Strategy of the Moravian-Silesian Region will also draw on the European Commission's working definition which is based on a mapping of smart concepts in European cities [1] and the Smart City Concept Methodology [2]:

- A Smart City is a city seeking to address public issues via ICT-based solutions on the basis of a multi-stakeholder, municipally based partnership.
- It is one of the concepts of applying sustainable development principles to the city management that relies on the use of modern technologies to improve the quality of life and make governance more effective. This concept is most widely applied in the energy and transport systems which can be managed more effectively by deploying appropriate information and communication technologies (ICT). Nevertheless, it can also be applied to other fields, like waste management or e-government.

The era we face as a society is not limited to revolutionary changes in the production and consumption of goods and services. It also relates fundamentally to how society and its institutions in this new context will understand and touch on important issues: what role will the individual, human being – as the proponent and subject of this phenomenon, play in this 21st century society? [4] See Fig. 1.

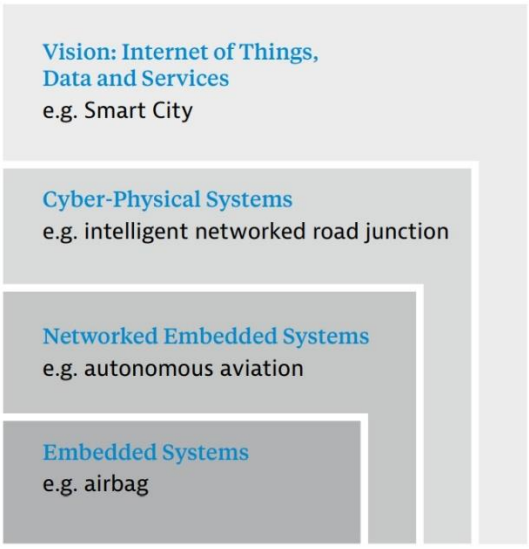

Figure 1. Evolution of embedded systems into the Internet of things, data and services [6]

2. Strategic management

The relationship between characteristics and components of smart region is complex topic. It is very similar to Smart Cities [7]. In practice, components and characteristics are often difficult to distinguish; components, in particular, are not systematically identified. The central thesis of this section is that they cannot easily be separated and that they should therefore be analyzed together. Components can be conceptualized as the building blocks of Smart City initiatives. They comprise the inputs, technologies and processes of specific initiatives, as well as the norms or standards deployed. It is summarized in Fig. 2. The outer ring shows the components, and the inner ring the characteristics. Rather than each component mapping onto specific characteristic, a range of technological, human and institutional factors underpins all characteristics.

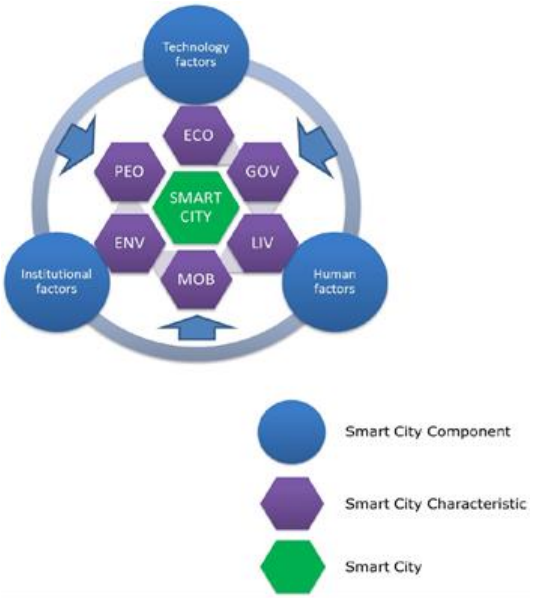

Figure 2. The relationship between components and characteristics of Smart Region/Cities [7]
(smart characteristics: ECO: economy, ENV: environment, GOV: government, PEO: people, MOB: mobility, LIV: living)

This allows us to understand the relationships between components and characteristics as both direct and indirect. In some cases, the characteristic fully describes the initiative by displaying what the initiative is about and the priorities of its participants and direct beneficiaries.

The strategic management of the Smarter Region [5] will be linked to six general areas.

Infrastructure

Infrastructure = Availability of an infrastructure for open data and information

Provision of a modern digital infrastructure offering secure yet open data and information to the inhabitants whenever they need access to it in quality that helps them make their decisions.

Inhabitans

Inhabitans = Concentration of smart solutions on the needs of the inhabitants in the first place

Public services provided primarily for the benefit of the inhabitants. The needs and problems of the inhabitants are at the focal point in the smart city strategies and take precedence

over organizational, institutional, or sectoral structures. The development of services is simplified in order to increase end-user convenience while reducing provider costs. Agendas related to life events, such as an address change, service payment, as well as subsidy or regulatory agendas, aim at maximal simplification of the process for the inhabitants, while saving both time and costs on both sides. This means to minimize the need, for example, to make arrangements for one event at multiple places and communicate with multiple authorities, or to provide irrelevant information and undergo undue procedures to obtain a subsidy. This concept also includes providing Internet services wherever possible in the simplest way for no or minimum fees.

Systems

Systems = Smart infrastructure, the Internet of Things, 3E, and security

Smart systems or the Internet of Things enabling service providers to use the widest possible range of data to manage and provide services on a daily basis (e.g. air quality measurement), or to make decisions on strategic investments (e.g. collecting and analyzing data about the use of mass public transport for community planning of its modifications both on the city and the regional level). It is essential to provide real-time protection of personal and business data and implement security features to prevent cyberattacks on smart technologies and cases of data misuse, in compliance with the EU data protection law, namely the General Data Protection Regulation (GDPR). This regulation shall apply from 25 May 2018, bringing the biggest revolution to date in the protection of personal data across the EU as well as astronomical fines for its violations. The management of public funds must follow the 3E principles, i.e. to ensure the attainment of the specific objectives set and the achievement of the intended results, to provide the best relationship between resources employed and results achieved, and to make resources available in due time, in appropriate quantity and quality and at the best price. [3]

Innovations

Innovations = Innovative approaches and experimentation

The openness of organizations and people to learn new things, learn from each other, experiment with new approaches, use new economic models, such as Pre-commercial Public Procurement (PCP) to provide for the development of a new solution that meets the demands of the contracting public authorities (regions and cities) but is not available at the given time, or Public Procurement of Innovation (PPI) to purchase innovative solutions that are not yet in the market or its availability is very limited (such solutions may be the results of the PCP model).

Opennes

Opennes = Transparency of outputs and results

Transparency in results and performance reporting, such as “city dashboards” (online web applications with real-time information and data on the regional / city events), enabling comparisons and motivating authorities, organizations, neighborhoods, or municipalities to achieve improvements in specific monitored areas (e.g. measuring the cycling rate).

Leadership

Leadership = Consistent vision, strategic management, partnership

Transparent and consistent leadership and strategic management in the field of smart solutions to provide benefits for the inhabitants of the region and the commitment to work on delivering necessary changes on a daily basis. This vision must be communicated in a clear and trusted manner and consulted with the inhabitants. An attractive environment must be created to encourage the entrepreneurial spirit of individuals and businesses and to attract new inhabitants to the region offering them as favorable living conditions as possible. It is necessary to initiate and support partnerships through networking of stakeholders which is a proven and effective way for the Smarter Region concept to mobilize them to carry out specific activities.

3. Long-term objectives of the smarter region strategy

The main objectives of the Smarter Region Strategy are to save time and money, and to reduce negative environmental impacts through the use of ICT technologies, innovative processes, and the support of a long-term systematic search for optimal solutions in partnership with relevant stakeholders in the Moravian-Silesian Region. List of main topics is in Table 1.

Table 1. Main long-term topics

Objectives	Solutions
Time savings	when commuting to work, schools, etc.
	when communicating and arranging issues with the authorities
	when searching for and using necessary information
	when managing and organizing public administration
	when marketing products and services to the end customers
	when visiting a doctor or a hospital
Money savings	when paying for energy and fuel consumption, heating and cooling
	when communicating and arranging issues with the authorities
	when managing and organizing public administration
	when searching for and using necessary information

Objectives	Solutions
	when running businesses and non-profit organizations
	when marketing products and services to the end customers
	when shopping
Healthy environment	due to reduced harmful emissions in the air
	due to air purification in heat recovery units
	due to better resource utilization and a more efficient circular economy
	due to a higher share of renewable energy use
	due to lower temperatures in the cities
	due to a more considerate and healthier lifestyle

4. Strategic priorities for the smarter region for 2017–2023

There are total of 5 priorities in smarter region activities (see Fig.3). Each covers several sub priorities, as there should be at least basic overview or detailed specification. Expected long-term benefits and measures for evaluation of achievements are mentioned in following chapters.

Transport

(i) To build an infrastructure and smart systems to support smart mobility.
(ii) To increase the use of mass transport and sustainable forms of transport (walking, cycling).
(iii) To increase the share of electro mobility and hydrogen vehicles in transport.

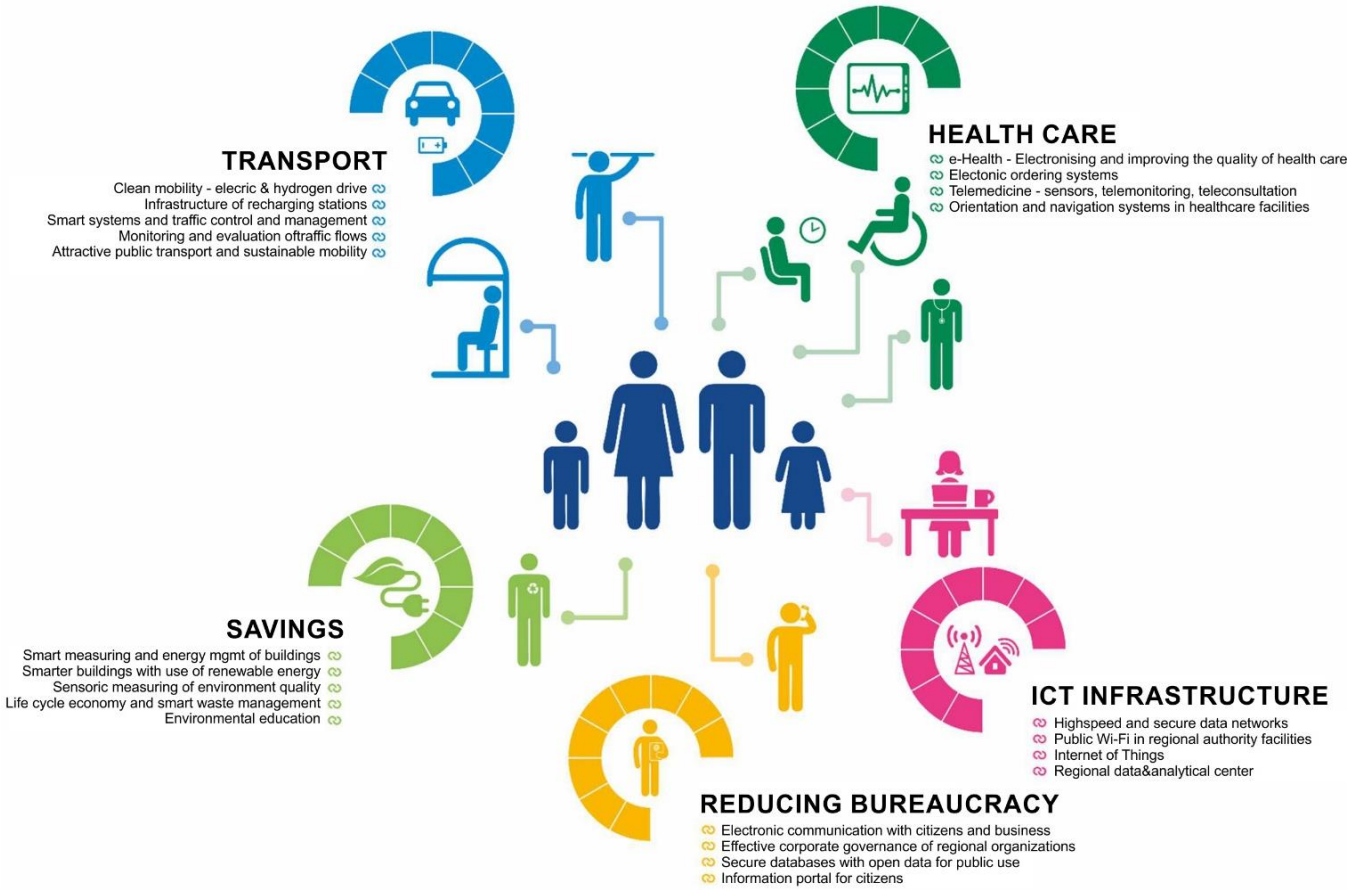

Figure 3. Strategic priorities and flagship projects for the Smarter Region for 2017–2023 [5]

ICT Infrastructure

(i) To build a backbone data infrastructure and a technology center capable of handling high capacity future demands for data, audio, graphics, and video.
(ii) To cover public buildings and mass transport vehicles with Wi-Fi.
(iii) To cover the region with networks for the Internet of Things (IoT networks).

Savings

(i) To reduce the costs for the supply of energy and maintenance of buildings and infrastructure in the region.

(ii) To increase the share of renewable energy sources in the energy mix.
(iii) To increase the efficiency of waste management and reduce energy consumption.

Healthcare

(i) To improve the quality and availability of healthcare services.
(ii) To foster responsible attitudes of the inhabitants towards health and improve the quality of social care.

Reducing Bureaucracy

(i) To remove bureaucratic obstacles while maintaining high quality of services provided by the Regional Authority and its associated organizations by means of electronic solutions.
(ii) To maintain high quality and level of corporate governance and services of the Moravian-Silesian Region.
(iii) To provide information and open data to the region's inhabitants.

5. Priority 1 – TRANSPORT

Long-Term Benefits are expected as follows:

- Faster and more convenient public transport.
- Limiting the negative impact of individual car as well as public transport on the quality of the environment in cities and villages (especially with the aim of reducing air pollution caused by airborne dust and carbon dioxide, reducing noise caused by transport, and improving parking systems in cities and villages).
- Streamlining the coordination of regional transport and reducing infrastructure maintenance costs in the region.
- Flagship Projects
- Smart Parking – pilot projects of smart parking facilities and navigation systems for managing and organizing parking in selected cities.
- Support for building an infrastructure of charging stations for electric cars and electric bicycles – support for projects to extend the network of charging stations for electro mobility (cars, bicycles, urban maintenance vehicles) and stations for hydrogen-powered vehicles. Provision of corporate organizations of the Moravian-Silesian Region with electric buses, electric cars, electric bicycles, and hydrogen-powered vehicles.
- Intelligent traffic management systems – smart navigation and information systems, support for open data and traffic information, introduction of information boards and applications for faster and more convenient regional transport.
- Monitoring and evaluation of traffic flows (traffic research) – efficient collection and evaluation of data and information on transport demand and mass and individual transport volumes.
- Wi-Fi in public transport – introduction of Wi-Fi on regional buses and trains to make public transport and sustainable mobility more attractive.

5.1. Strategic Objective 1.1 – Free Flow of Traffic

To build an infrastructure and smart systems to support smart mobility. Examples of Measures to Meet SO 1.1:

- Intelligent traffic management – managing traffic and providing passengers with information on the traffic situation to increase the free flow and safety of the road traffic without the need to build complex infrastructure. Adaptive traffic management, providing real-time traffic information, developing parking information and navigation systems, customizing traffic light signalling. Support for cooperation and exchange of experience among the cities of the region with implementing intelligent traffic management systems.
- Mobile traffic applications – developing and offering products and services for mobile devices that show the real-time traffic situation based on location and preferences, allow communication with the Internet of Things and car applications, and allow entering notes, traffic alerts, or detours to the car on-board management systems.
- Autonomous and cooperative transport systems – development and preparation for the transition to autonomous forms of individual, freight, mass, and air transport, and for the application of cooperative systems (vehicles communicating with each other and with the infrastructure) with the aim of better traffic management and the elimination of traffic collapses.

5.2. Strategic Objective 1.2 – Sustainable Transport

To increase the use of mass transport and sustainable forms of transport (walking, cycling). Examples of Measures to Meet SO 1.2:

- Improving the attractiveness of public transport – promoting the use of public transport, improving its image. Improving the convenience of travelling by the means of public transport – access for disabled passengers, faster services, safer boarding platforms, Wi-Fi on buses, vouchers, discounts, competitions, better and easier orientation in public transport options (unified fares, contactless payment), X+1 systems (one passenger pays, the other travels for free), public transport cultural programs, better vehicle design, etc.

- Integrated travel planning systems – travel planning comparing time, costs, and emissions produced for each mode of transport for a given time of travel and route to encourage using modes of transport which are more environmentally friendly than individual car transport. Limiting the negative impact of individual car as well as public transport on the quality of the environment in cities and villages (especially with the aim of reducing air pollution caused by airborne dust and carbon dioxide, reducing noise caused by transport, and improving parking systems in cities and villages including shared parking lots).
- Integrated transport systems – transport services for a particular area that accommodate multiple types of public transport (urban, regional, rail) and multiple carrier lines with unified schedules and ticket cards. These systems integrate various modes of transport and connect them with cycling, walking, and car transport. Smart cards are used carrying various types of information, enabling contactless online payments, etc. See Fig.4 for implementation of contactless payment bank cards in public transport.

Figure 4. Terminal for contactless payment in public transport [https://www.dpo.cz/soubory/aktuality/prirucky/platebni-karty-1.pdf]

- Smart stops – linking the functions of transport to social use, including environmental friendliness and enjoyable waiting at stops. Examples of smart stop functions – charging mobile devices, Wi-Fi connection, generating power from alternative sources and physical exercise equipment, warming in winter, air purification, more comfortable (enjoyable) seats, attractive design and aesthetic appeal for the public space, information for both city inhabitants and visitors, emergency service calling 112. The role of the region can be primarily motivational, for example in the form of grants for municipal projects.
- Car sharing, Ride sharing, Bike sharing – creating conditions for sharing services that reduce the amount and use of individual car transport through shared cars or bicycles. An example of such service can be the provision of a fleet of electric cars and bicycles that will be available at a particular location, with the option of online reservation at flat rates or special tariffs.

5.3. Strategic Objective 1.3 – Electro mobility and Hydrogen Vehicles

To increase the share of electro mobility and hydrogen vehicles in transport. Examples of Measures to Meet SO 1.3:

- Support for building an infrastructure of charging stations for electro mobility – support for projects to extend the network of charging stations for electric cars and electric bicycles. Connecting the network of charging stations with the Internet of Things, sharing information on occupancy and additional services with users. Extending the network of charging stations for electro mobility (cars, bicycles, and urban maintenance vehicles) and stations for hydrogen-powered vehicles. Provision of corporate organizations of the Moravian-Silesian Region with electric cars. Promoting the use of electric bicycles as an alternative option to individual car transport.

6. Three basic smart criteria for smart projects

The following three basic SMART criteria will be the simplest fundamental measure of whether the proposed or implemented projects fit into the Smarter Region Strategy and can be therefore considered smart. This assessment is purely indicative and is not intended to replace any complex standardization system developed at the national level of the Czech Republic.

The condition for including a project in the strategy is meeting the SMART 1 criterion, taking into account the 3E principles – economy, efficiency, and effectiveness of public investment.

Involvement of broader partnerships or innovative and experimental elements in the project will be considered as a higher added value, i.e. promoting the search for and implementation of solutions that go beyond standard procurement processes and rigid systems that do not reflect the specific conditions of the region and the needs of end users in the long term.

SMART 1 – application of ICT and other technologies

The project involves a development or application of technology which, in addition to a financial benefit, brings also a socio-economic benefit, such as a positive impact on the quality of the environment while respecting the principles of safety and 3E.

SMART 2 – partnership principles

The project is managed and implemented in a partnership, not by a single organization only, in an open environment of information sharing and access to expertise, without the risk that the applied solution will be unavailable for further use.

SMART 3 – innovative and experimental elements

The project includes innovative or experimental elements testing the application of new technologies or solutions in the market.

7. Open data for analysis of transportation

Nowadays ICT enable gaining a variety of types of information. For projects supported and often co-financed from public sources, it is often agreed that the outputs and the related data sources will be open for general usage. In order for the open data to be effectively used for subsequent analyzes, the data sources must meet several basic requirements.

Metadata

Each attribute must necessarily have a description assigned. This description differs slightly from the commonly used "metadata" concept in transactional databases. The content of such description resembles the simplified form of analytical part of metadata in data warehouses. In particular, it is the information on how the data originated, what is the sampling period, what are the measuring units, the position of the sensor with sensor data (GPS coordinates). The most important part is a description of the exact meaning of the published data.

Lookup lists

If the individual records refer to the lookup lists, the relevant lookup lists must be completely available. Unless the meaning of the individual lookups is completely clear from the context, it must also be accompanied by a description.

Time stamps

Each record must contain a time stamp, because it allows the users to interconnect the individual datasets and also to create time series. We must take into consideration that the forecasting analytical procedures assume the time series to be complete, and that the sampling period is constant. For example, if we have daily records, we must adhere to the daily intervals and no single day should be missing.

Integrability of tables

For open data, large amounts of data are expected from different areas (public and passenger transport, environment, tourism, waste management, medical care, hydro-meteorological data). Analytical processing often utilizes combined data sets, such as combination of environmental and transport values, or tourism combined with the data on weather. It should be taken into account when loading data into the data platform. For example, if the data contents are related to different territorial units which are mutually incompatible, their subsequent integration for analytical purposes is impossible. As an example we may note the Eurostat data and the data from the Czech Statistical Office, which have a completely different territorial classification and therefore cannot be combined.

Unchanging collection methodology

Historical data must be available for forecasting purposes. If there is a change in the methodology of data collection, it often makes it impossible to analyze the time series as a single unit. We thus lose the possibility to observe changes in trends or irregularities, which may be very significant in content.

Data Granularity

Deciding on the appropriate data granularity is absolutely crucial. From the basic granularity, a range of applicable analytical techniques is developed. On the one hand, there is a demand for most detailed values with the shortest sampling period, i.e. transaction data. One transaction is understood as a sequence of operations that are no longer divisible from the point of view of content. E.g. one ride of one passenger, cash withdrawal from an ATM, one order of a plane ticket. On the other hand, we are limited by the technical and economic resources needed to manage such a large data volume. Attention is also drawn to the risks of misuse of transactional data in connection with the public security. Sensory data in tunnels, subways, etc. are particularly sensitive in this respect.

Intuitive, fast and easy to navigate

A user-friendly environment will have a direct impact on the utilization of open data. Selecting a suitable navigation system will not be easy, as data from different areas, with different granularity, related to different objects or territories, will be counted in the future. In some cases, it is possible to increase the clarity by mapping.

Predefined outputs and analyzes

Should the public data really serve the general public, it should contain a set of the most frequently used queries and outputs. It should be reflected that an ordinary citizen will not waste time searching for data, combining them and processing them. These can be simple questions like: find the nearest open emergency, show the trend of air pollution for the next day, find the optimal method of transport between the given points, and find the date of the next large-scale waste collection in the village. Nonetheless,

more sophisticated outputs or the possibility to use integrated analytical tools directly in the open data environment can be available.

For example, EEA - European Environment Agency manages the European publicly available database on the environment and health of the population. Clear navigation in the data sources, including metadata, is only one of the functionalities. In addition, users are provided with integrated data tools from OLAP analytics (Figure 5) to interactive charts. Therefore everyone can view data cubes, set up filters, change views, visualize and combine data quickly, comfortably and without any previous skills. Simple work instructions are also integrated. There are sets of pre-prepared interactive graphs (Figure 7), more complex analytical outputs (Figure 6), professional literature, and a description of the indicators used.

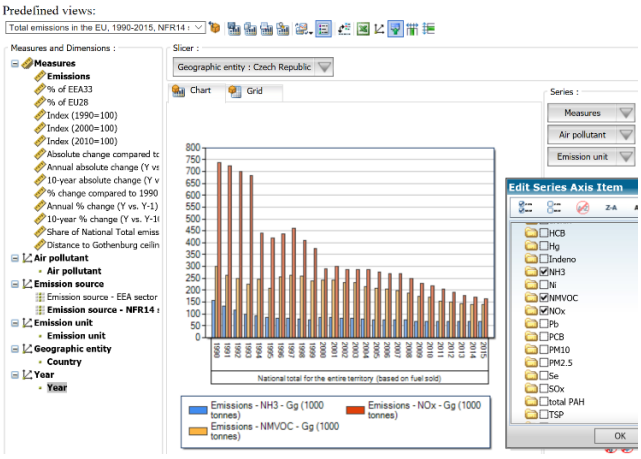

Figure 5. OLAP GUI – Total emissions in the EU [8]

Open Data in the Smart City context should:

- Increase citizens' awareness and assist them in their both daily and occasional activities;
- Provide data base for analytical activities.

As far as services for the general public are concerned, passenger transport appears to be a suitable initial application. At present, it is a burning problem for most large cities. Participating organizations strive to publish up-to-date information on traffic intensity on critical roads, inform about planned and acute road repairs, congestions and traffic accidents, suggest preferable highway exits and detours, help plan routes, inform about paid parking areas, parking slots and free capacities of car parks, enable citizens to book and pay a parking space online. Most applications offer the closest object search according to the current GPS position of the user, or by selecting the area of interest in the map.

Examples of successful portal in the Czech Republic:

- The Road and Motorways Directorate of the Czech Republic publishes (at http://scitani2016.rsd.cz) interactive maps with focus up to the composition of the traffic flow, the amount of pollutants emitted, the intensity of traffic, etc. (in an annual aggregation).
- The RODOS project (Rozvoj dopravních systémů – Development of Transport Systems) publishes (at https://rodos.vsb.cz) current traffic situation on motorways and expressways in the form of simple graphics. The information is updated every half-minute, supplemented by meteorological data, bypass suggestions, statistical indicators, etc.
- TSK Prague operates a Prague parking portal (at http://www.parkujvklidu.cz) where citizens can find not only interactive maps with parking zones, vending machines and parking, but also virtual parking.

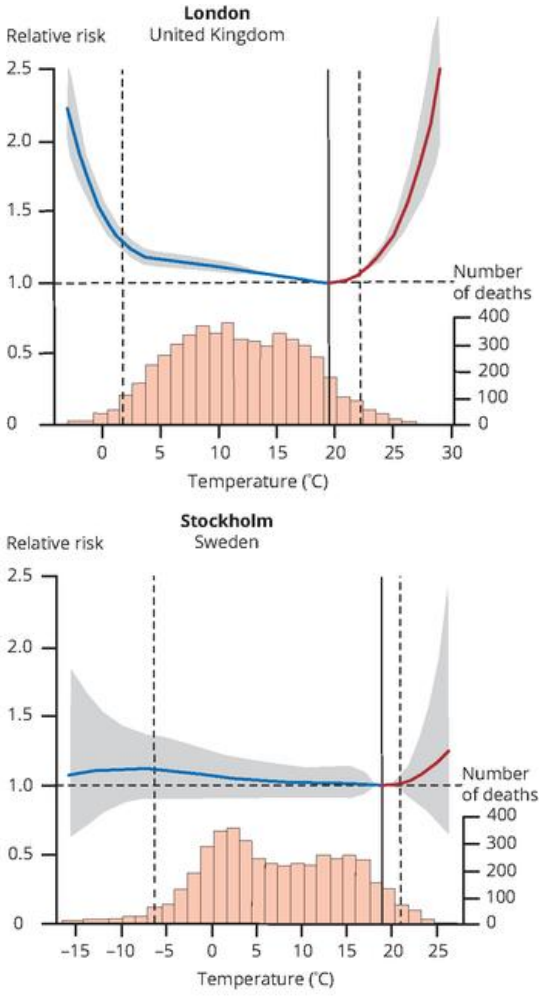

Figure 6. Exposure-response associations between temperature and mortality in two European cities, together with related temperatures distributions.
The shaded grey area delineates the 95 % empirical confidence interval. Solid grey vertical lines are minimum mortality temperatures and dashed grey vertical lines delineate the 2.5th and 97.5th percentile temperatures.
[https://www.eea.europa.eu/data-and-maps/figures/associations-between-temperature-and-mortality]

Individual portals and applications are user-friendly, intuitive, functional and up-to-date. Unfortunately, they always focus only on a selected section of the whole issue of public / passenger transport, and wider public often lacks awareness of their existence. A data platform that will have access to the relevant data sources will have a unique opportunity to integrate the individual sections into a common unit.

An appropriate addition seems to be increased effort to motivate population for wider use of public transport and alternative modes of transport. A good start is creating an introductory interactive map comprised of several layers – passenger transport and parking, public transport, cycling and pedestrian traffic.

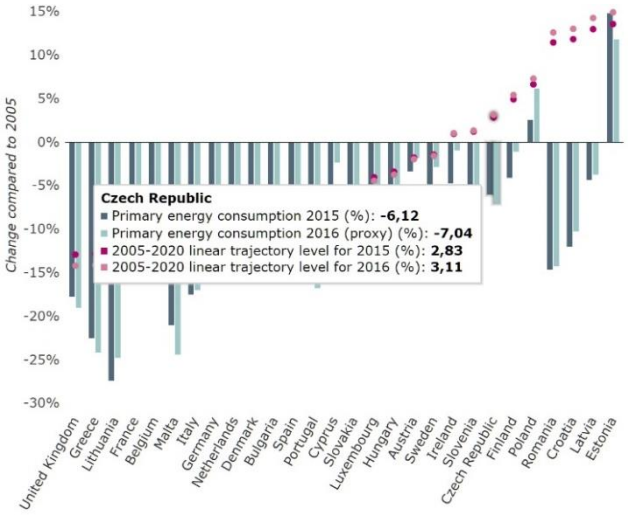

Figure 7. Primary energy consumption and linear trajectories to 2020 targets, 2015 and 2016 [https://www.eea.europa.eu/data-and-maps/daviz/primary-energy-consumption-and-linear#tab-based-on-data]

The Cycling+Pedestrian layer may provide information on pedestrian and cycling zones, bicycle stands and rentals, on-line booking of bicycles, location of parks and green areas, outputs from online cameras as well as meteorological outputs with forecasts for an upcoming time period. Park+Ride parking should obviously be included too.

The P+R parking should encourage drivers for frequent usage not only with easy navigation and virtual parking slots. The offer should include real time departures of the nearest public transport links, including information on the impact of car traffic on the environment and possibly health.The following figure (Figure 8) shows a proposal for information on a selected parking lot. The bar graph is based on the historical occupancy values of the car park, varying depending on the day of the week or possibly taking into account the difference between working day/weekend. Drivers can easily recognize that from 14-17 o'clock the parking lot is fully occupied, how many parking spaces are available (123 of 450), and how many tons of pollutants the car park has already saved over the week thanks to the people going by tram or walking instead of going by car. Values are calculated based on the entrance barriers readers. The calculation formula was proposed by the European Environment Agency according to TERM 027 indicator and TRACCS 2013 database [9]. The formula is based on the average occupancy of 1.2 passengers per car, which may slightly differ; the data can be found for individual sections at (http://scitani2016.rsd.cz). The amounts of pollutants saved are really impressive, as in a single week it can be even several tons of greenhouse gas, if we count with the average saved driving distance of 5 km.

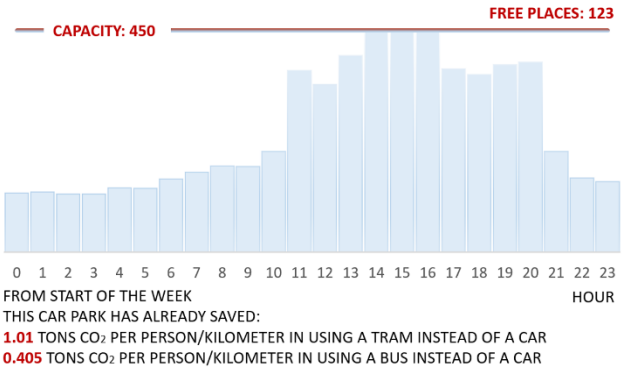

Figure 8. Parking popularity on Monday with additional informaton

As far as the utilization of the data platform for analytical purposes is concerned, optimizing public transport is a suitable area of expertise. In order to modify the structure of the network of individual public transport lines and the frequency of connections, we need to trace the transport habits of the population. One of the possible methods is to analyse transaction data of public transport. The entry condition is, naturally, the technical capability to record boarding / exit stops of the passengers in vehicles. Using analytical procedures, we can identify the utilization rates of individual lines and links, as well as the stops where passengers most often board and disembark the vehicles. With certain reservations we thus gain an overview of where to and from the inhabitants are transported by public transport.

It is desirable to motivate passengers to use the contactless chip cards as much as possible. Data usability will be multiplied. This will allow analysis of the passenger features (child, student, adult 15+, pensioner) (see Fig. 5) and the fare type (type of long-term ticket, individual fare). We will get the background data for optimizing fare and fare rates, we can track how many times a week the individual groups use public transport, which payment method they prefer on which routes. Another useful aspect of chip cards is the ability to identify the transfer

passengers and to get a complete overview of where (from), when, how often, and on which lines they travel.

Detailed processing of transaction data enables the maximal utilization of the information contents of the data base. See example at Figure 9. Facts that have so far escaped our attention are often revealed. It is because in the aggregate data values of anomalies and small patterns of behaviour often simply disappear. Looking at transaction or sensory data directly, even if there is a significant anomaly, we will probably not pay appropriate attention to it. Only when we notice that the anomalies are periodically repeated or show some mutual relation, we try to find out their cause. Transaction data have to be processed with all the details available, in different relations and variants. Otherwise, the discovery of hidden information is more a matter of coincidence than the analytical activity. We cannot do without powerful technology, high-quality software and relevant analytical knowledge.

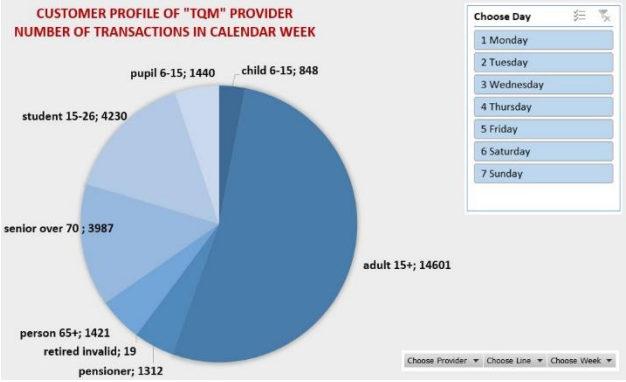

Figure 9. Customer profile of public transport provider - number of transactions in one week

8. Compliance with major policies and strategies

The Smarter Region Strategy differs from other development and sectoral policies and strategies with an impact on the Moravian-Silesian Region by the use of ICT technologies and innovations along the lines of other smart policies and strategies. Compliance with the objectives and general aims of these policies has been ensured during the drafting of this strategy and will be followed in the future as well.

The Smarter Region Strategy will not develop its own complex metrics and set of indicators. The strategy will be implemented by means of projects that meet the smart criteria in constant interaction with existing development, sectoral, and thematic strategies and sub-strategies, plans and action plans.

The strategic framework of the Smarter Region Strategy is primarily based on the following strategic policies and documents:

Europe 2020 Strategy, Partnership Agreement for the 2014–2020 Programming Period

Digital Agenda for Europe:

The goal of the Europe 2020 Strategy is to create a digital single market based on fast and ultra-fast Internet and interoperability of applications:

- by 2013: basic broadband coverage for all;
- by 2020: Next Generation Networks (NGN), 30 Mbps or more for all;
- by 2020: 50 % of households having 100 Mbps subscriptions or higher.

Innovation Union

- Focusing research, development, and innovation policy on the major challenges of the world today, i.e. climate change, energy industry, resource efficiency, healthcare, and demographic changes.
- Supporting each element of the innovation process, from basic research to product marketing.

Strategic Framework Czech Republic 2030 (Government of the Czech Republic, 2016)

Section 412 – (Sub)urbanization and spatial mobility:

"In their urban development, cities must seek the ways in which technological innovations can be combined, in particular finding the so-called integrated solutions (combining transport, energy, architecture, communication, or green technologies). However, the overall streamlining of urban systems, sought for example by the Smart Cities concept, must not be at the expense of preserving the identity of the city, created by monuments as well as other buildings, the public space, culture, and everyday life. Planning at the local level must therefore also promote social cohesion and create living communities and viable cities. This goal should be aimed at with the Smart Cities concept prioritizing not only technological changes, but social and organizational innovations which are often of higher importance."

Smart City Concept Methodology (The Ministry of Regional Development of the Czech Republic)

The methodology includes, for example, the following definition of smart cities:

"A city that holistically manages and follows its long-term development strategy which is based on qualitative and numerical indicators and serves to cultivate the political, social, and spatial environment of the city to enhance the quality of life and its attractiveness, and to reduce negative environmental impacts. By deploying appropriate ICT technologies, it enables its citizens to engage in the city development and to materialize their ideas and suggestions through community programs or sharing economy in order to improve their communication with the city and revitalize the public space. The city encourages this process of transition to the culture of conscious behaviour by deploying suitable organizational and technological tools of the 21st century in a wide-spread,

integrated, and open way to ensure the interoperability of different systems and technologies and their synergies. The quality of life in the Smart Cities concept means the digital, open, and cooperative environment of the city that is healthy, clean, safe, and economically interesting for the citizens."

Strategic Framework of the Economic Restructuring of the Ústí, Moravian-Silesian, and Karlovy Vary Regions

In Strategic Objective G.2, this strategy sets the goal of "Streamlining the management and performance of public administration for businesses and inhabitants, building the necessary ICT infrastructure for this purpose and implementing additional investment projects using modern technologies for applications and services."

The required changes focus on the applications of the Smart Cities concept both in software and hardware. One of the changes should be the introduction of ICT services and applications which address the most pressing needs of people and businesses in communicating and arranging issues with public administration authorities and implementing electronic solutions for the city agenda. These include, for example, open data and database sharing, faster communication with people and businesses by electronic tools, using electronic forms, empowering participatory management, and strengthening hardware capabilities for software solutions.

Development Strategy of the Moravian-Silesian Region for 2009–2020 (updated in 2012)

The strategy states its mission: "We create our future in our heads and hearts!"

"We perceive our region as a living organism, of which we all are active parts. Our personal qualities rest in flexible minds and muscles trained by years of work on the transformation of the backbone economic, transport, and technical infrastructure. We search for smart solutions for the future and we will use our inner strength and motivation to implement them."

Other documents:

- Regional Action Plan for the ESIF 2014–2020 Programming Period
- Regional Innovation Strategy of the Moravian-Silesian Region 2014–2020 (RIS3 update to follow the Smart Specialization Strategy – Regional Annex, May 2016)
- Joint Declaration on the Collaboration in Drafting the Smart City and Smart Region Policies with the Priority to Improve the Overall Quality of Life and the Environment in Ostrava and the Moravian-Silesian Region
- Strategic Development Plan of the Statutory City of Ostrava 2017–2023
- The Smart City concept "Třinec i ty" of the city of Třinec

9. Conclusion

The industrial heritage is an opportunity and a test for the future development of the region. Achievements in traditional industries in the past do not automatically mean success in the present or future. Rather, it seems that the future prosperity of the region will have to be built on new sectors, which are based on the traditional industries of the region. The automotive industry is to be complemented by new, dynamically developing sectors such as information and communication technologies, renewable energy sources, robotics and others that will provide job opportunities for the next generation as well as the competitiveness of existing businesses and sectors. Reducing the product lifecycle, constant pressure on price and innovation are forcing companies to join the Industry 4.0 initiative, which is one of the answers to the question of today's business going tomorrow.

A similar challenge as businesses is also facing regions. They engage each other in attracting people and maintaining the optimal structure of the population. Lack of workers in the industry can partially address companies by introducing digital technologies and robotics. However, the outflow of the region's inhabitants cannot be solved as easily. However, even in this case, the deployment of modern technologies can help. The Moravian-Silesian Region has long been facing the population outflow. Young, economically active people stay in college towns and cities after school. At best, in Prague or Brno, the worse they scatter around the world. The concept of a smart city and region is one of the ways to slow this negative trend and make life more attractive in so-called smarter cities and regions.

Acknowledgements

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