VILNIUS TECH
Vilnius Gediminas Technical University

Journal of Architecture and Urbanism
ISSN 2029-7955 / eISSN 2029-7947
2021 Volume 45 Issue 1: 1–8
https://doi.org/10.3846/jau.2021.12392

TO WHAT EXTENT WE DO UNDERSTAND SMART CITIES AND CHARACTERISTICS INFLUENCING CITY SMARTNESS

Skirmantė MOZŪRIŪNAITĖ [1,*], Jolanta SABAITYTĖ[2]

[1]*Department of Urban Design, Vilnius Gediminas Technical University, Vilnius, Lithuania*
[2]*Department of Business Technologies and Entrepreneurship, Vilnius Gediminas Technical University, Vilnius, Lithuania*

Received 10 April 2020; accepted 24 November 2020

Abstract. Todays large cities are continually evolving human ecosystem, delivering many services to citizens. The dramatic urbanisation processes and increasing numbers of the population in cities put many strains on city infrastructure and services. XXI century urbanisation issues require robust strategies and innovative planning for their future. Easily cities are characterised as smart or intelligent without regard to clear criteria or specification for a city. There are different opinions regarding smart cities, arguing that it may bring positive social and economic change, developed governance and human capital. However, these aspects are heavily achievable without eliminating the present discrepancy in planning. The purpose of the article is to clarify and identify the characteristics of smartness based on current scholar research. The qualitative study overview on integrative literature review and seven Baltic region cities case study explores possible characteristics, and various city dimension factors which can make a city smart.

Keywords: smart cities, smart city framework, smart city characteristics, smart city transformation, smart city development, economic factors.

Introduction

The researchers state that world's urban population increase twice by the year 2050, and 70% of the people will be living in cities (United Nations, 2011). It is great pressure and challenge for cities to manage the rapid population growth, services, infrastructure, climate change, etc. (McKinsey & Company, 2013). Thus, there is a need for a new design strategy to manage the development processes, policies and sustainability issues. Cities are trying different approaches and methods (policies, guidance, small region development, etc.) to overcome the fore coming climate change, social polarisation global urbanisation, economic instability and the increasing importance of a new technologies issues (Fernandez-Anez et al., 2018).

The past two decades, rapid technological progress and development became the mainstream of technical implementation in the city urban development across all field and levels. This technological development introduced new city models labelled as "smart cities", intelligent cities" and "creative cities". The "smart city" model became one of the most popular academic topics where, researchers started to explore a great variety of indicators and dimensions related to city performance (Letaifa, 2015). Smart city definition is not new; however, there is no one united definition. According to Giffinger et al. (2007) "a city well performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens". Smart city concept is based on the advanced digital technologies and their implementation in the city via different city dimensions. Then, we can state that the main goal of "smart cities" model is to develop advanced technological tools to solve the mentioned above city problems.

A literature review on smart cities reveals the variety of smart city definitions that emphasise the aspects driven by research focus such as cities function, etc. (Marek et al., 2017; Caragliu et al., 2011; Allwinkle & Cruickshank, 2011; Komninos, 2002, 2015; Lombardi et al., 2012; Shapiro, 2008; Fernandez-Anez et al., 2018). Smart cities as any other cities are highly complex systems which are difficult to analyse due to their dynamics and constant change. Thus, each of the research on smart cities

*Corresponding author. E-mail: *skirmante.mozuriunaite@vgtu.lt*

has many limitations and not enough of understanding on interdisciplinary and complexity of smart city indicators for the expected research outcome (Yigitcanlar et al., 2018). Majority of the literature review articles focuses on the technological approach to the smart cities and less to the institutional, environmental and people. There is no doubt that cities, their services, infrastructure, public life, the way people use the city being transformed due to the technological shift. Hollands (2008) states that smart cities are "…the implementation and deployment of information and communication technology infrastructures to support social and urban growth through improving the economy, citizens' involvement and governmental efficiency." However, solo (individual) elements such as ICTs, cannot meet the smart city overall standard. The smart city elements and indicators should be approached and managed with complex and integrated solutions to become smart. One of the main interest in start cities around globally is the balance between social development and rapid economic growth in increasing urbanisation. According to Vanolo (2014), to create a properly functioning pilot design system, we need to integrate and improve the use of energy, transportation, services and other sectors.

This paper aims to develop a clearer understanding of a new smart city model, identifying and linking the key drivers to desired outcomes and then intertwining them in a multidimensional framework. The paper discusses the smartness characteristics and measures the smartness in the selected seven capital cities of the Scandinavia and Baltic region. Mors of the research cases cities smartness is measured individually without comparison in the region. This article analysis the Northern group countries capital cities as well as neighbour countries and analysis of what is causing the differences in cities smartness. The paper consists of three parts. The first part introduces the scientific literature review on smart cities determining their characteristics according to smart city ranking methodologies. The second part of the paper presents a short research overview of the seven Baltic region cities (Oslo, Stockholm, Helsinki, Tallin, Riga, Vilnius and Warsaw) based on the smartness indicators ranking. The third part conclusions and suggestions for smart city development.

1. The smartness of a city

The definition of the "smart cities" according to Glasmeier and Nebiolo (2016) is not a new concept, which was used in the nineteenth century to describe the processes of urbanisation, government control of society and industry. Nowadays, understanding of smart cities has changed; now it is a concept that involves government, natural resources, IT knowledge, etc., (Weisi & Ping, 2014). However, there is no consensus or agreement on the definition of smart cities due to its complexity and difficulty of classification (Ponting, 2013). The smart city concept is perceived as a positive and optimistic theory of future cities. Therefore, there is a lot of debate on the smart city standards and concept similarities to creative, intelligent or innovative cities (Hollands, 2008). It is needed to agree and define a clear smart city definition and characteristics (Allwinkle & Cruickshank, 2011).

Understanding and clarifying the concept of the smart cities it is necessary to identify the main elements of urban content of smart cities. The city structure and their functions differ significantly based on the size of the city scale and its functions. According to Liugailaitė-Radzvickienė and Jucevičius (2014), it is essential to highlight the qualitative parts of smart city, dimensions and infrastructure. Identifying elements within each level, it is essential to identify only the initial elements at every level. At the qualitative level, we could exclude the sustainability, dynamics, networking, knowledge, etc. Discussing the previously mentioned aspects for a smart city study framework, the dimension of the smart city suggested, according to Fuchs (Fisher & Lezion, 2009) would include, the economic, political, cultural, management, environment, society, and lifestyle. However, the infrastructure level differs significantly involving areas such as logistics, energy, services, real estate, ICT's and industry. It is important to note, that interaction of these mentioned smart city structure levels is the qualitative achievements of the society as well as the city towards smartness. The only difference between our research and other is the view of smart cities, the different approach to the types of data and the set framework to illustrate the empirical research of Norther Europe selected countries, not the megacities as in other research.

2. Methodology

There is a great range of scientific research on intelligent, smart and other cities. Researched observe, analyse and identify most common elements such as people, infrastructure, economics, management, etc. All these elements are part of a city structure, that is why all the city concepts are so alike and at the same time differ with their characteristics and elements. The paper presents a brief overview of the conceptual development of smart cities and empirical research. Majority of scientific articles identify several indicators of smart cities, such as mobility connectivity, community, technology and policy with strong links to outcomes of sustainability, accessibility, liveability and governance. Thus, it is seen that works of different researchers on the concept of a smart city is fragmented, covering only individual aspects of city activities.

The smart city open access research results publicly (www.smart-cities.eu, PLECC, www.smartcities.eu, www.smartregions.net, etc.) reveal that major aspect in research is ICT, highlighting that it is the major aspect of cities intelligence. Nam and Pardo (2011) agree, that smart cities are seeking of innovation in the technological fields, as well as in the organisational and political field, which is an instrument of smart governance and politics. In research, it is noticeable that authors face difficulty to describe the depth of ICT technology implementation level in reach. However, smart city critics note that it is a lack

of the ecological and environmental emphasis, between technologies and public asset resulting control of urban systems (Colding & Barthel, 2017).

The studies use a database, statistics (Eurostat, DIGCOP, etc.) and their indicators for determining the intelligence and digitalisation of various indicators. Then smart cities are ranked according to different urban indicators (The Smart Cities Wheel, Bilbao Smart City Study, Smart City Profiles, City Protocol etc.) (Ahvenniemi et al., 2017; Klopp & Petretta, 2017). Vienna University of Technology in 2007 delivered research on "European Smart Cities" evaluating and benchmarking smart or potentially smart city profiles of 77 medium and 81 large size cities in the European Union. Researchers have tested the validity of stereotypes that are associated with city smartness at a different scale. In Neirotti et al. (2014) published the article of smart cities classification based on urban initiatives. The article highlighted individual elements from hard such as environment, energy grids, mobility and soft domains such as culture, economy, education and e-government.

As the most suitable approach for carried research was considered European Smart Cities Ranking by Giffinger et al. (2007). This approach was chosen by the provided data and a list of indicators of smart city characteristics (see Table 1). In this paper, seven Baltic and Scandinavia region countries capital cities (Oslo, Stockholm, Helsinki, Tallin, Riga, Vilnius and Warsaw) are compared via the digital dimension. These cities were chosen based on the Northern countries region and the close relationship between the countries. Also, there is a lack of research comparing the Northern region and Baltic countries that are quickly bridging the gap in the technological update. Looking through a large number of indicators for ranking, it is hard to determine which should be included in the research due to the inconsistency and no standardisation and incomparable between the cities. This problem arises from the governmental level and research towards specific information needed. However, there are international data resources for data consistency in order to achieve the consistency and ability to compare cities via Global City Indicators, (UN Global Urban Observatory (GUO), World Bank, The World Health Organization (WHO)) and open data sources (Digital City Index, OpenStreetMaps, IT Development Index, Google, Municipality open data, OECD, EC).

The analysed cities are compared via Smart governance (participation), Smart mobility (transport and ICT), Smart environment (natural res.) indicators of smart city characteristics. The analysed data are determining the cities performance range in different cities based on different criteria and resources. The Smart governance indicator data is based on the citizen participation (% of the population that vote per city/country) (source: International Institute for Democracy and Electoral Assistance); degree of digitalisation of governance measured via Digital Infrastructure Rank (Digital City Index); urban planning measured by the number of airports per city and the percentage of green public areas in the city (OpenStreetMaps); education – number of universities in cities, schools, use of PC per 1000 inhabitants, and IT Development Index (IT Development Index, International Telecommunications Union, United Nations). Smart mobility data consists of smart parking data (Digital City Index, OpenStreetMaps, Official Sites of service providers, etc.), car-sharing services, traffic data and public transport (Mobility Carsharing and Flinkster, TomTom Traffic index, INRIX traffic scorecard, Google traffic, etc.). The data measuring Smart environment (natural res.) – sustainability is considered difficult to measure and to compare in terms of the quality and objectivity by measuring clean energy – a percentage of total renewable energy production (The World Bank), smart buildings – the amount invested in R&D (The World Bank, Global Innovation Index), waste disposal and environmental protection (The World Bank, United Nations). This data collected across the sources for indicators of smart city characteristic give a score. Then data were ranked and uniformed in a score of 10 (synthetic

Table 1. List of indicators of smart city characteristics (Giffinger et al., 2007, p. 12)

Smart economy (comprehensive)	Smart people (Social and human capital)	Smart governance (participation)	Smart mobility (transport and ICT)	Smart environment (natural res.)	Smart living (quality of life)
Innovative spirit Entrepreneurship Economic image and trademarks/city image Productivity The flexibility of the labour market/labour market International embeddedness/ International integration	Level of qualification/ education Lifelong learning Ethnic diversity Open-mindedness	Participation in public life/ political awareness Public and social services Transparent governance/ Efficient and transparent administration	Local accessibility/ local transport system (Inter)-national accessibility Availability of ICT-infrastructure/ ICT infrastructure Sustainability of the transport system	Environmental conditions Air quality (no pollution) Ecological awareness Sustainable resource management	Cultural facilities Health conditions Individual security Housing quality Education facilities Touristic attractiveness Economic welfare/ Social cohesion

indicator). Every indicator score based on the city varies from 1 to 10; the higher sore is, the better performance of the city is. However, the carried city ranking is subjective and show the approximate ranking of these smart cities in Northern Europe and the Baltic region and level of smartness despite the scale, population and level of cities.

3. Smart city characteristics

In the field of smart cities, there is no defined list of characteristics for a smart city ranking. Based on smart city analysis, Vanolo (2014) distinguish six smart city characters in other word urban smartness indicators. Such as smart economy, smart mobility, smart governance, smart environment, smart living and people (see Table 2). These smartness classification characteristics help to define smart cities from generic cities. These characteristics help easier to evaluate the cities smartness in general; however, there are a great variety of measurable indicators that should be considered by evaluating the degree of smartness in chosen cities, the same as their scale and rank level in the region.

Smart city characteristics vary depending on different research fields and level of research interdisciplinary, as well as a research focus. The research limitations on smart cities are based on the number of different measured indicators, that can provide a different outcome within every time while changing the number of indicators (IESE, 2016). Therefore, we might get a different result with different characteristics and city ranks. The characteristics listed in the paper and research are selected from a series of researches and articles. The main concern of the research is the lack of important characteristics that are not included in the statistics due to the lack of interdisciplinary approach and the depth and scope of the research based on the data and information accessibility. None of the statistic information or data resources has the present data on the city's social setting such as immigration, community development, sustainability, urban sprawl, the effectiveness of public inclusion and safety, etc.

The research carried by IESE (2016) has listed 9 Smart cities characteristics such as human capital, social cohesion, economic governance, environment, mobility, urban planning, international outreached and technology. According to the research, *human capital* is the ability of smart city governance to be capable of attracting and sustaining the creativity, education and research of the city. This characteristic is measured via several high education institutions, universities, cultural facilities, leisure and recreation. Characteristic of *social cohesion* is measured via social interaction dimension of cities that can come to a consensus with the social group or its members. The measurable come from the mortality numbers per city, crime and unemployment rates, and hospital (private and public) number in cities. *Economy* dimension includes the aspects of economic development in the area, as well as strategic and industrial plans, generation of innovation and entrepreneurial clusters. This dimension is measured via ease of starting a business, motivation for an entrepreneurship and GDP per capita. *Governance* mostly is used for the efficiency (quality, guidance, etc.) description of state intervention. It is measured via cities reserve (in millions of dollars), present corruption index, open data platform, e-governance development and democracy level. *The environment* characteristics mostly are measured via CO_2 emission index, pollution level, renewable water resources and solid waste per capita level. Main environmental concern is to improve environmental sustainability through anti-pollution plans, support for green buildings and alternative energy, efficient water management, etc. *Mobility and transportation* in the cities facing many challenges that have to ensure the movement through the cities and ensure access to public services. It is measured based on the traffic index, flight numbers, existing gas stations, etc. *Urban planning* is the characteristic that is hard to measure, as some of the processes in cities are self-organised. However, it is measured via a number of people per household, high-rise buildings, number of completed buildings per city and number of population with access to sanitation facilities. *International outreach*

Table 2. Smart city characteristics (Vanolo, 2014)

Characteristics	
Smart economy	An aspect which the authors link to a spirit of innovation, entrepreneurialism, the flexibility of the labour market, integration in the international market and the ability to transform
Smart mobility	Referred to local and supra-local accessibility, the viability of ICT's, modern, sustainable and safe transport
Smart governance	It is related to participation in decision-making processes, transparency of governance systems, availability of public services and quality of political strategies
Smart environment	Understood in terms of attractiveness of natural conditions, lack of pollution and sustainable management of resources
Smart living	Involving the quality of life, imagined and measured in terms of availability of cultural and educational services, tourist attractions, social cohesion, healthy environment, personal safety and housing
Smart people	They are linked to the level of qualification of human and social capital flexibility, creativity, tolerance, cosmopolitanism and participation in public life

describes the characteristics that provide the city brand and its international recognition through strategic tourism plans, the attracting of foreign investment and representation abroad and it is measured via the number of airports, number of passengers, hotels and sightmaps. Finally, the *technology* aspect also entitled as ICT, which is one of the major aspects helping to achieve cities smartness and it is measured via smartphone (mobile phone) usage, wireless hotspot capacity, innovation index and internet coverage.

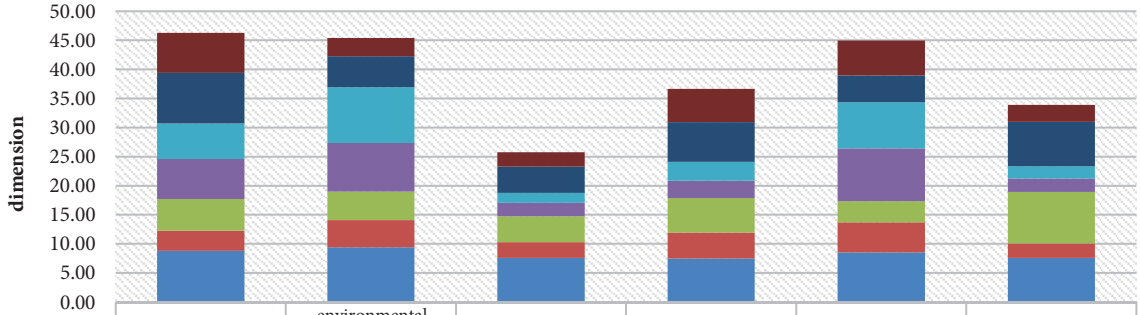
The main research constrain might be faced due to the lack of information regarding measured functions and facilities in cities. Most of the facilities might not exist or exist without any evidence in data. This phenomenon raises along with digital technology development, when the functions of not have their designated premises or buildings, but become digital. Thus, the information presented in the data or statistics might have a strong influence on the analysed and the present – a real situation in cities. Due to this issue and the amount of the data produced by the use of the technology in the cities, the analysed cities ranking include the data not only the statistic data but also the accessible open data sources. The data-driven analysis from the accessible open data sources proved the more accurate evaluation of the institutional governance, environmental evaluation and social perspectives.

4. Smartness and smart city indexes

Smart cities in scientific research and many studies rank cities according to varies characteristics, as mentioned in above (social, economic, mobility and environmental, etc.) in order to get the measurable criteria for the performance of the cities (McKinsey & Company, 2013). The analysed seven cities were chosen for this study not only to highlight the metropole cities in the region but to overview the Northern Europe smart urban growth and to find the aspects or characteristics in which leading cities are showing impressive acceleration towards being smart and getting peoples life comfortable through digitalisation.

When analysing cities for economic, mobility, sustainability, governance, ICT, and other factors the cities are being ranked determining their Smart City Index. The study overview (see Figure 1) on 7 Baltic region cities (Tallinn, Helsinki, Riga, Vilnius, Oslo, Warsaw and Stockholm) is based on the mentioned characteristics. The cities smartness overview indicates that Stockholm is the most equally developed city through all smart city characteristics. The weakest place and the smallest index of smartness through all characteristics is education; here we can see a sharp decrease in numbers. The digitalisation characteristics show a high development in ICT technologies in Vilnius, which, in comparison alone other characteristics, is leading in this field. This high rate of ICT achievement in Vilnius is caused by internet coverage across the city and the high-speed internet with hot spot use. Despite the leading positions in ICT technologies, Vilnius is one of the cities between the lowest rate of a living standard. This rate caused by the low GDP rate per capita, including the lowest average annual salary rate between compared countries and summarised average price for food, rent, etc.

Transport and mobility characteristics measure the smartness of cities via smart parking, car-sharing services, traffic and public transport use (see Table 3). It is Helsinki city has the highest rates in the smart parking and car-sharing services including numbers of e-charging spots, with efficient public transport that minimises the congestion level and a number of parking spaces in the central part of the city, which turns to be one of the most expensive between compared cities. On the contrary, the transport and mobility between the rated countries are poorly developed in the Tallinn and Warsaw. The best-developed transport infrastructure, according to the data, is in Stockholm, which



	traffic	environmental protection	education	busines ecosystem	internet speed	living standard
Tallinn	6.88	3.16	2.47	5.76	6.02	2.90
Helsinki	8.70	5.33	4.55	6.80	4.63	7.63
Riga	6.11	9.57	1.69	3.25	7.92	2.13
Vilnius	6.88	8.36	2.30	2.99	9.05	2.30
Oslo	5.41	4.89	4.46	5.93	3.68	8.88
Warsaw	3.51	4.72	2.73	4.46	5.15	2.47
Stockholm	8.79	9.39	7.58	7.49	8.53	7.58

Figure 1. 7 Baltic region cities smartness overview

corresponds together with a high number in the governance, urban planning. As well as the worst traffic rates are in Warsaw as well as in urban planning, which reflects the countries retardation in the shared, smart and e-charging services. The best-developed transportation scheme with the highest traffic indicators is knowledge-based, with smart parking solutions, traffic sensors and car-sharing schemes and applications. The sustainability aspect is highly important in smart cities, as well as hard to measure with a major focus on clean energy, waste disposal and environmental protection. The leader city in clean energy is Riga; it shows the extremely low rate of CO_2 emission. This rate might be related the public transport efficiency based on the high-rank number as well as renewable energy percentage from the renewable resources and the recycling. On the contrary, we can see the extremely low score in Warsaw, which relates to the countries use of the brown coal, which does not contribute to the reduction of the CO_2 emission and use of the renewable clean energy. The leader of the sustainable smart buildings introducing the innovations in the Baltic region is Helsinki. This rate shows high numbers of the total investment and GDP investment in R&D, including the proportion of GDP per unit of energy (kWh).

The most efficient and developed system in waste disposal goes to Stockholm. This rate shows a great contribution to SDG goals and efficient governmental implementation of the recycling and reproduction system in the county. This rate directly correlates to the renewable energy from the recycling. The lowest positions of sustainability issues go to Riga despite environmental protection. In addition to smartness characteristics, governance containing a high level of educated citizens with easy online access to governmental services indicates a high level of citizen participation as in Stockholm city. Across the governance characteristics, Stockholm is scoring the highest ranks in social responsibility and percentage of the population that vote along with the digitalisation of the accessible infrastructure and governance. In the ranking of urban planning, Helsinki is at the top rank with the highest score in green public areas versus total city area and number of airports per city. On the contrary, the lowest-ranked city in the citizens participation, e-governance and urban planning in Warsaw. This rank is caused by the location of the cities in the natural environment and as well as the densities and spread of the cities. Also, these rank numbers might be connected to the country policy regarding smart cities development, present political situation, governance and more complexed issues in Warsaw.

Smart city analysis and ranks are based on open data, which is changing the face of cities and the world as we knew it. The ability of data use allows us to look at the cities and measure their characteristic in various ways. Also, it allows us to test and create better solutions to existing problems. Figure 2 overviews the smartness rank based on the open data, which allows as to see the actual data and insights of the presented data. From the 7 Baltic region cities smartness ranking it is seen, that cities face some problems related with a living standard even though if the cities are highly ranked in the business ecosystem (Tallinn, Warsaw, Riga, Vilnius). Such interesting situations in research clearly shows the difference in the cities GDP per capita level, the difference in the average annual salary rate and expenses in Scandinavian and Baltic countries capitals, including Warsaw. Figure 2 rank scope clearly illustrates three groups of cities with three grades of data score. The first group include Oslo, Helsinki and Stockholm, the second group – Riga, Vilnius and Tallinn and Warsaw. The cities fall in groups based on the and living standard, becoming smarter and overall score and economic development. However, the business ecosystem score differs and eliminates the clear segregation of the cities. The business ecosystem score represents the achievements in the innovation and national global innovation score, including the number of newly registered startups

Table 3. Research on 7 Baltic region cities Smart city characteristics

City	Transport and mobility				Sustainability				Governance			
	Smart parking	Car sharing services	Traffic	Public transport	Clean energy	Smart buildings	Waste disposal	Environmental protection	Citizen participation	Digitalisation of governance	Urban planning	Education
Stockholm	6.88	6.18	8.79	1.95	8.44	6.88	8.94	9.39	8.57	9.74	8.24	7.58
Warsaw	5.07	1.43	3.51	5.67	2.21	2.82	4.35	4.72	2.34	1.52	5.06	2.73
Oslo	6.01	5.59	5.41	6.28	9.91	5.93	7.53	4.89	7.86	6.37	8.24	4.46
Vilnius	4.03	5.33	6.88	6.28	5.76	3.77	3.38	8.36	2.43	8.27	9.12	2.30
Riga	4.55	3.25	6.11	7.49	9.13	2.21	2.06	9.57	3.85	9.05	6.82	1.69
Helsinki	8.53	5.85	8.70	7.40	7.23	7.41	6.82	5.33	5.28	9.48	10.00	4.55
Tallinn	3.16	3.60	6.88	4.20	2.56	2.30	7.09	3.16	4.56	9.39	7.62	2.47

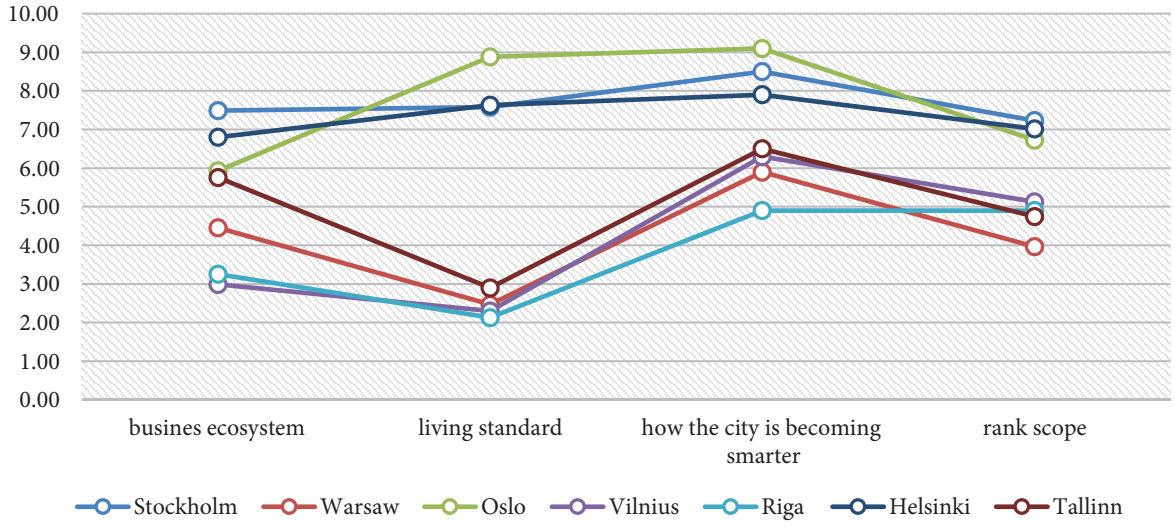


Figure 2. 7 Baltic region cities smartness rank

per city. This score clearly shows that cities group differently based on their score; the first group include Oslo, Stockholm, Helsinki and Tallin, the second group include Warsaw with slightly better performance, Riga and Vilnius behind. It clearly illustrates the situation with the business intelligence and governmental support for business and business environment in different countries.

The selected Oslo, Stockholm, Helsinki, Tallin, Riga, Vilnius and Warsaw cities belong to the Northern Group countries. Despite cities diversity in terms of historical, political and environmental context, sizes and resources with the help of data it is possible to see how do the cities align based on different aspects; then it is a possible model and tackles the most important issues. The open data is a powerful tool that could help to use technologies in order to search for better solutions in order to reduce traffic congestion, CO_2 emission, pollution, and increase cities smartness. According to Zygiaris (2012), there is a need for a comprehensive framework that could conceptualise different components of a smart city. The comprehensive framework, along with specified characteristics and outcomes, all together would create a smart city framework, where each of them represents a distinctive dimension of the smart cities approach (Yigitcanlar et al., 2018).

5. Discussion

The smart city definition is a to some extent a new concept involving new technologies and a vast amount of data that can be measured thanks to the new modern technologies. Although within this research, the presented selected cities smartness reflects only the set framework outcomes, that clearly shows the three groups of cities based on their smartness performance. However, the lack of agreement what data should be measured representing the smartness of the cities, and without a finalised concept of the smart cities, it makes difficult to measure the smartness of the cities objectively. There is a lack of parameters that should be identified from the environmental and planning field, that play an important role in smart cities. However, it is seen that the smart city framework include data that is easily measured by ICT technologies (hard data) or statistic data. It is essential to take in to account all data (hard and soft) in order to get the most objective findings. The complete data can provide a total evaluation of smart cities, which will enable other countries to learn from the best practices and to improve their smartness. With technological development and simulation tools, it is possible to try different scenarios and to see how to improve the specific parameters smartness, that would lead countries to more sustainable and optimal use of natural and internal resources cities.

Conclusion

The overview of scientific research shows that studies in the majority are mostly based on the technological, economic and digital knowledge aspects, which are emphasised as the main elements. This is noticeable in articles of the technological field. However, the highlight of ICT technologies results in the limited approach, and at the same time creates a larger separation between cities and regions. It is seen from the carries research that ICT technologies, when implemented in various cities element, help cities to reach a better scoring. This leads to a conclusion that cities with less integrated ICT technologies in economic, social, infrastructure and other fields will not succeed. Then, a result, the works of different researchers toward smart cities become fragmented and limited with single aspects. Therefore, we can state that economic social and technological objectives are clear. However, it is a lack of environmental, planning goals and interdisciplinary research, giving a broader overview of all fields of smart cities and various aspects.

Most of the European and other continent developed cities feel the pressure on transformation into smart cities, even though a gap exists on how these cities' services and functions shift toward smart services. Developed cities network infrastructure and advanced technologies are used to increase economic and political efficiency of, as well as social and economic development. However, other smartness assets seem to be non-priority. Therefore, there are some doubts regarding the goals of a smart city. Thus, clarification and agreement on the smart city definition and characteristics should be made in order to have clear guidelines for design, evaluation and implement strategies for building smart cities.

The following future research on smart cities should be focused on a common concept and definition of smart cities with a standardised set of parameters based on soft and hard data. It is important to take into account not only easily accessible open data, but also the real data, that represents the present cities condition in sustainability, environmental protection and urban planning. This will allow seeing the real present situation of smart cities. With the help of AI and simulation tools, it is possible to create a smart city sustainable development tool with monitoring, that would lead and help cities to achieve smartness.

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