Ways for assessment of the potential for development of the so called “smart cities”

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Abstract
The objective of the present article is to discuss and explore relevant indicators for assessing the possibilities for the realisation of the concept of “smart cities”. Therefore, as a characteristic of primary importance regarding the potential and the expected benefits from the realisation of the “smart cities” concept, we have highlighted the level of urbanization. Supplied and analysed is data about the urban population within the European Union, by country, as well as data about the regions around Bulgaria. As a second most significant indicator is singled out the access to financial resources, which are measured by GDP per capita of the population, as well as employment rates. Thirdly we have singled out a group of indicators which assess the level of technological advancement of a population.

Keywords: urbanisation, cities, indicators, electronic technologies.

1. Introduction

The ever increasing urbanisation in the developed industrial part of the world has presented certain challenges to the uniform development of territories, as well as a number of disadvantages for the big city dwellers. Most commonly known are the extended commute hours, air pollution, high maintenance fees, drinking water shortages, high density of building, limited parking spaces and etc. If we aim to optimise and incorporate technology in the organisation and management of routine processes, the effects of the above-mentioned disadvantages could be largely diminished. The right step in this direction is the implementation of the so called “Electronic city hall” which provides administrative services online that save time and energy in travelling to the respective public office, cuts costs and prevents corruption practices. The massive use of smart mobile devices in our daily lives led to the development of applications that facilitate travelling by public transport, choosing the best route to any location via car, taxi or public transport, as well as online banking, online trade and etc. Are there any limits in the use of technology and is it always beneficial, is a debatable matter. It is well-known that the use of smart devices and the virtual internet existence has led large numbers of people to cut down on face-to-face interactions with others and the phenomenon of self-isolation is becoming a social problem that in turn may lead to damaging demographic processes.

This article is looking at those forms of the uses of technology, typical for “smart cities”, which aim at making people’s lives less stressful, safer and more comfortable. The European Commission describes a smart city as “a place where traditional networks and services are made more efficient with the use of digital and telecommunication technologies for the benefit of its inhabitants and business.” Some of the expected benefits from the realisation of a “smart city” project could be: time-saving, money-saving and improving the quality of living of the city inhabitants.

A smart city is a place where traditional networks and services are made more efficient with the use of digital and telecommunication technologies for the benefit of its inhabitants and business.

The potential of a territory to realise the concept of "smart cities" should be measured through some quantative assessment, in order for this process to be subject of concerted organised efforts in the interest of the population, the public and private service providers, as well as environmental protection.

Object of study in the present publication is the concept of "smart cities".

Subject of study are the possibilities for a quantitative assessment of the potential for development of "smart cities".

Purpose of the study is to discuss and explore appropriate indicators for assessing the possibilities for the realisation of the concept of "smart cities".

According to us the most significant characteristic of a territory in terms of potential and expected benefits from the realisation of the concept of "smart cities" is the level of urbanisation. In the densely populated and overbuilt urban areas there is an increasing demand for digitalisation of the domestic, communal, transport and commercial services and utilities and hence the benefits of such a process are significant. It is worth noting that there is a certain condition in the use of the term "smart cities" as there are cities in Bulgaria that are smaller in population than some villages; therefore the term "city" should be perceived not so much as an administrative unit but as a densely populated area in which the advantages of the use of digital technologies could have the most tangible effects.
According to the United Nations (World urbanisation prospects 2018 [2] over half of the world's population is now inhabiting urban areas (55%), and this number is expected to rise to 68% by 2050.

Tables 1 and 2 below present the degree of urbanisation in Europe for the EU member states and in Bulgaria for the different regions.

Table 1. Relative share of the urban population (urban areas is a sum of cities, towns and suburbs) in EU member states in % by 2018

Country	Relative share in %	Country	Relative share in %
Malta	99.8	Hungary	67
Netherlands	89.4	France	66.9
Cyprus	82.2	Denmark	66.7
Belgium	81.5	Czechia	64
Sweden	80.2	Latvia	62.8
Germany	77	Austria	61.8
Italy	75.5	Croatia	61.5

Spain	74.1	Luxembourg	58.8
Portugal	73.9	Poland	58.8
Finland	71.4	Slovenia	54.4
Greece	70.5	Romania	54.3
Estonia	68.2	Lithuania	45.8
Bulgaria	68.1		

Source: Eurostat, Ireland, Slovakia, United Kingdom not available.

The Eurostat [3], data presented in Table 1, clearly demonstrates the differences in the degree of urbanisation between EU member states. Malta boasts with the highest percent of urban dwellers which comes up to almost 100%. It is followed by the Netherlands also with a considerable concentration of urban population (89.4%), next up come in Cyprus (82,2%), Belgium (81,5%) and Sweden (80.2%). The lowest share of urban dwellers is measured in Lithuania – only 45,8%.

As a rule, the capitals of a country have the potential to take leading positions in terms of development, as on one hand they are centres of economic activity, trade and competition, which leads to high efficiency in the production of of goods and services; on the other they offer a variety of educational, cultural, social and recreational activities which are in direct correlation with the quality of life of the residents.

The table below presents interesting data about the share of urban population by districts in Bulgaria.

Table 2. Relative share of the urban population by districts in Bulgaria for the period 2012-2018.

District	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**Rate of growth For 2018 2012=100**
Blagoevgrad	59.34	59.50	59.61	59.46	59.64	59.83	60.02	1.15
Bourgas	74.85	74.88	74.91	76.11	76.21	76.30	76.42	2.09
Varna	83.73	83.80	83.76	83.48	83.61	83.77	83.95	0.26
Veliko Turnovo	69.67	69.87	69.95	69.95	70.12	70.43	70.65	1.41
Vidin	63.90	64.10	64.39	63.67	64.05	64.42	64.81	1.42
Vratsa	58.98	59.03	58.91	57.81	58.16	58.50	58.87	-0.19
Gabrovo	81.96	82.01	82.00	81.81	81.81	81.89	81.92	-0.06
Dobrich	69.04	69.12	69.06	68.78	68.96	69.07	69.18	0.21
Kardzhali	41.59	41.83	41.35	41.09	41.23	41.42	41.22	-0.89
Kyustendil	69.05	69.28	69.41	69.11	69.35	69.64	69.92	1.26
Lovech	62.42	62.50	62.61	62.52	62.64	62.77	62.94	0.83
Montana	64.15	64.29	64.28	63.43	63.68	64.00	64.34	0.29

Pazardzhik	62.32	62.40	62.49	62.38	62.53	62.69	62.79	0.76
Pernik	79.00	78.93	78.91	78.41	78.63	78.95	79.30	0.38
Pleven	66.60	66.68	66.77	66.36	66.52	66.74	66.98	0.57
Plovdiv	74.56	74.74	74.91	74.91	75.15	75.44	75.66	1.48
Razgrad	47.29	47.25	47.24	47.13	47.17	47.22	47.23	-0.14
Rousse	77.03	77.24	77.43	77.39	77.63	77.85	78.07	1.35
Silistra	45.08	44.91	44.85	44.42	44.32	44.24	44.28	-1.78
Sliven	66.13	66.08	66.07	65.69	65.76	65.86	65.91	-0.34
Smolyan	54.98	55.14	55.31	55.51	55.68	55.96	56.20	2.22
Sofia (stolitsa)	95.37	95.42	95.45	95.48	95.50	95.54	95.58	0.22
Sofia	61.16	61.26	61.29	60.93	61.05	61.20	61.46	0.48
Stara Zagora	71.72	71.84	71.98	71.72	71.95	72.11	72.43	0.98
Targovishte	54.13	54.17	54.07	53.65	53.84	54.01	54.14	0.00
Haskovo	72.37	72.49	72.48	72.03	72.20	72.43	72.53	0.22
Shumen	62.68	62.64	62.37	61.90	61.81	61.54	61.45	-1.97
Yambol	69.94	70.12	70.31	70.11	70.32	70.56	70.75	1.15

The above data is calculated by the author using as a source the National Statistical Institute [4]

It is evident in Table 2 that, not surprisingly, the capital Sofia comes on top with the highest degree of urbanisation (95.58 %), closely followed by Varna with 83.95 %. Although with a modest rate, the share of the urban population across the country has increased in 2018, compared to 2012. Highest rate of increase we observe in the ditrict of Smolyan (2.22%), followed by Bourgas by 2.09% and Plovdiv by 1.48%. We could draw the conclusion that the more urbanised a population, the stronger is the demand for the use of digital technologies in the optimisation of the traditional services, which favour the evolvement of the "smart cities".

Besides the presence of concentrated urban population in the cities and towns that would benefit from the advantages of the "smart cities", next in importance are the opportunities for the realisation of this idea, in particular the availability of human, financial, technical and technological resources for the implementation of the digital technologies in a widest possible scope of services. The availability of these resources is normally measured by GDP per capita [5] in the cities, which is directly linked to average income and purchase power of the population, as well as state and local taxes, customs duties, etc. We could also indirectly assess the economic condition and purchase power of the population through examining the rates of employment.

The data presented in Table 3 covers the predominantly urban regions where at least 80% of the population live in urban clusters and intermediate regions where between 50% and 80% of the population live in urban clusters.

Table 3. Some indicators for predominantly and intermediate urban regions for 2016[1]

Country	Employment (15-64 years) (Share of total %)	GDP at current market prices (million euro)	GDP per capita in euro
Belgium	91.41	40217308	38874
Bulgaria	88.28	4385853	7055
Czechia	78.63	14456929	17389
Denmark	72.64	21303082	52321
Germany	84.00	275320500	39773
Estonia	56.88	1514518	20909
Ireland	44.97	13319842	65976
Greece	70.43	13182500	17787
Spain	96.65	108428800	24189
France	-	176080800	36833
Croatia	65.60	3084613	12938
Italy	89.98	153561134	28106
Cyprus	100.00	1849020	21796
Latvia	78.78	2146374	13996
Lithuania	92.22	3691874	13993
Luxembourg	100.00	5330303	92500
Hungary	82.26	10032612	12594
Malta	100.00	1032684	22927
The Netherlands	-	70236600	41626
Austria	57.66	23532389	45582
Poland	64.39	31516830	12967
Portugal	69.51	13693325	19304
Romania	44.63	10743892	11761
Slovenia	42.22	2060300	24127
Slovakia	63.25	5751516	16952
Finland	100.00	14270595	43417
Sweden	91.30	42809756	47799
United Kingdom	96.44	232282355	36960

Source: The data is calculated by the author based on information from Eurostat [6]

From the above data on the employment rate amongst people in working age (15-64) we are learning that there are several countries in which 100% of the urban population is employed – namely Cyprus, Malta, Luxemburg and the Netherlands. The lowest is the share of employed people within this demographics in Ireland (44.97%), Romania 44.63

[1] Due to a lack of comprehensive data for 2017 and 2018 Table 3 reviews the indicators for 2016.

and Slovenia 42.22%. Reviweing the GDP indicators per capita of the population in all of the EU member states, we cannot help but notice that in 2016 Bulgaria marks the lowest figures – 7054.785 euros. At the top of the rankings is Luxembourg with 92500 euros.
Next in importance, besides the financial resources, for the realisation of the concept of "smart cities" we need "smart people" who are capable of working the digital technologies.

Hence in this case we can use as indicators:

- Access to education for the urban population.

The large number of educational institutions concentrated in the bigger towns and cities offer to the population of different demographics sufficient choice and opportunities which naturally are not available in the countryside. Educational centers have the potential to inspire, motivate and challenge people to achieve more and are of key importance for producing the necessary human capital for stimulating the development of the "smart cities".

Figure 1 presents the share of the students in higher education institutions in some of the bigger towns and cities in Bulgaria. It is clear from the figure that the biggest share of the highly educated population is concentrated in the capital Sofia.

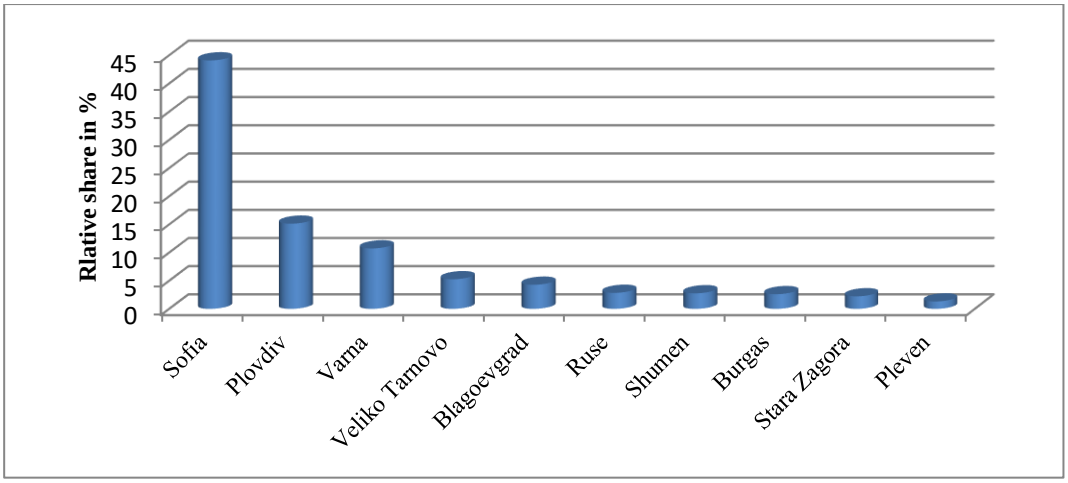

Fig. 1. Distribution of the university students (ISCED level 5-8 short-cycle tertiary education, bachelor's or equivalent level, master's or equivalent level, doctoral or equivalent level), in some of the bigger towns and cities in Bulgaria
Source: Eurostat [7] *https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do*

- Relative share of the people employed in the digital technologies sector;
- The degree of development of the legislative base related to the digital technologies;
- The modelling of the social attitudes in favour of the digital technologies (online trade, online banking, online voting, online tax payment, the use of navigation and security systems, based on digital technologies)

It should also be emphasised that the digital technologies in the smart cities" should not lead to social alienation, but to more free time for face-to-face social interaction, although urban environments are not always capable of providing that.

In conclusion it is worth reiterating that the "smart cities" are already here and they will be growing in number and getting smarter. That is until people start hearing the call of nature again and remember its intransient qualities that would make them choose a helthier lifestyle closer to nature, in proximity to cities, where they can be near the land, the flora and the fauna and enjoy the rewards of physical labour that produces tangible fruits, objects and comforts according to people's personal preferences and taste. The use of modern technologies does not necessarily exclude closeness to nature. They could co-exist. The development of transport could facilitate this process and so people could have the charming opportunity to make a choice for a place to live between the rational dynamics of the "smart cities" and the natural beauty, harmony and peace of life close to nature.

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