



**HAL**  
open science

# The Concept of Crowdsourcing in Knowledge Management in Smart Cities

Łukasz Przysucha

► **To cite this version:**

Łukasz Przysucha. The Concept of Crowdsourcing in Knowledge Management in Smart Cities. 7th IFIP International Workshop on Artificial Intelligence for Knowledge Management (AI4KM), Aug 2019, Macao, China. pp.17-26, 10.1007/978-3-030-85001-2\_2 . hal-03637467

**HAL Id: hal-03637467**

**<https://inria.hal.science/hal-03637467v1>**

Submitted on 11 Apr 2022

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License



This document is the original author manuscript of a paper submitted to an IFIP conference proceedings or other IFIP publication by Springer Nature. As such, there may be some differences in the official published version of the paper. Such differences, if any, are usually due to reformatting during preparation for publication or minor corrections made by the author(s) during final proofreading of the publication manuscript.

# The Concept of Crowdsourcing in Knowledge Management in Smart Cities

Łukasz Przysucha

Wroclaw University of Economics and Business, Komandorska 118/120 53-345 Wroclaw  
lukasz.przysucha@ue.wroc.pl

**Abstract.**<sup>1</sup> — Crowdsourcing is a new approach and concept increasingly used in companies and organizations. Thanks to the outsourcing of tasks entrusted to the wider community, principals can obtain more detailed results and satisfactory results of outsourced activities. This idea has been considered so far in business terms, hardly anyone referred it to processes such as cities. The author presents in the article the idea of Smart City, the area of knowledge management and the use of Crowdsourcing processes for the freeing of communication channels between decision makers and residents. Crowdsourcing has been recognized in the field of public aspects, turning to the wider society. The author indicates an important gap in communication between the city's decision-makers and the inhabitants. In many agglomerations, city authorities do not have knowledge about the needs of residents, whereas the information cycle is disturbed. The main goal of the article is to build a flowchart / model of information flow using crowdsourcing and to discuss its place in intra-city communication.

**Keywords:**<sup>2</sup> Crowdsourcing, Knowledge Management, Smart City.

## 1 Introduction

Our civilization is growing more and more. At the moment, people migrate from rural to urban areas around the world. Along with their movement, technology and available facilities and possibilities are developing. One should answer whether the current level of city management, communication between decision-makers and residents is adequate and whether it affects the development of the agglomeration. Do the metropolitan areas created have adequate grounds for further development and are able to avoid problems with functioning in the future? The author in the article analyzes the impact of crowdsourcing on improving communication in the city, and thus also the development of Smart City projects.

---

The article consists of 4 parts. The first one focuses on migration of people from rural to urban areas, impact on Smart City procedures and the need to take action in the area. The second part defines knowledge management processes in Smart City concepts, talking about the advantages and positive effects of the implementation of the knowledge management idea. The next one is dedicated to crowdsourcing and its impact on knowledge management in the area of Smart City. The last part contains a diagram showing the idea of crowdsourcing in the area of knowledge management in Smart City.

## **2 The development of the Smart City idea**

The idea of Smart City is a relatively new concept implemented and used by central and local authorities, economic entities and the city residents themselves. A smart city [1] is one that uses information and communication technologies (ICT) to increase the interactivity and efficiency of urban infrastructure and its components, as well as to raise the awareness of residents. Area of urban development and agglomeration is currently a strategic element of globalization and civilization in the world. The trend of settling urban areas on a global scale is more and more dynamic. In 1950, only 30% of the total population lived in cities, now it is almost 55%, while in 2050 it will be over 65% of the population [2] (attention should be paid to the global population increase). There are more and more mega cities with a population of over 10 million inhabitants. Currently, the most urbanized regions include North America (83% of residents living in cities in 2016), Latin America and the Caribbean (80%) and Europe (73%). Inhabitants of Africa and Asia live in most rural areas, at present 40% and 48% of their population live in urban areas. A continuous increase in the population of urban areas in the following decades is forecasted. Africa and Asia are urbanizing faster than other regions, and according to forecasts, by 2050, they will reach 56% and 64%, respectively, of urban living in the population. India, China and Nigeria are projected to jointly account for 37% of the forecast global urban population growth in 2014-2050. The estimated increase [3] of the population in urban areas in India is 404 million inhabitants, in China 292 million and Nigeria 212 million. Tokyo is currently the largest city in the world with an agglomeration of 38 million inhabitants, followed by Delhi with 25 million inhabitants and Shanghai with 23 million inhabitants. Mexico, Mumbai and São Paulo have a population of over 21 million. It is anticipated that by 2030, 41 megacities will be created around the world with over 10 million inhabitants. Forecasts indicate that Tokyo will remain the largest city in the world in 2030, with 37 million inhabitants, followed by Delhi, where the population is expected to grow rapidly to 36 million [4].

The development of urban agglomerations has many positive aspects for our civilization, but it is accompanied by many problems. The main one focuses on proper city management.

The concept of smart city, depending on the various definitions and scopes can include many aspects of life. According to this basic smart city can be called the area (city, region, agglomeration), which consists of four elements [5]. The first of these

are creative residents who are "enlightened" their activities and use their knowledge as well as develop it. Another pillar is effectively working organizations and institutions processing existing knowledge [6]. On the technical side must be ensured adequate technological infrastructure - broadband cable services in the network, digital space for data and remote tools for knowledge management. The final element is the ability to innovation. Komminos N. explains this as part of management and the ability to solve problems that appear for the first time since the innovation and management under uncertainty are key to assessing intelligence.

<b>Comparison</b>	
<i>Benefits</i>	<i>Threats</i>
Smart Cities help people to live, work and play with others while requiring fewer resources	Lack of electricity causes paralysis
It helps in controlling water, environment and conservation of animal populations	There are concerns about data privacy and security
It reduces traffic jams	Cities find it difficult to work across departments and boundaries
Facilitates access to the doctor	Addicted to the use of electronic equipment
Fast reaction time in case of danger	The ability to manipulate the target messages by the municipal authorities

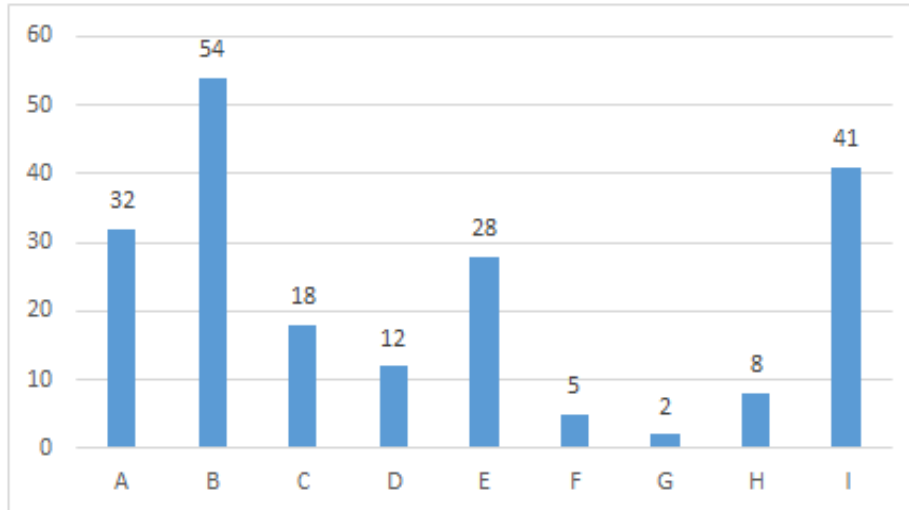
**Tab. 1.** Benefits and threats in the Smart City model.

In the process of creating Smart City, it is extremely important to create a structured resource of current (and updated) data that will be used by the administration and at the same time will be made available to residents to help them deal with official matters and, on the other, to get to know the city.

Under the influence of globalization, Smart City definitions change their dimensions in terms of time and space. They can be enclosed in three dimensions - global space covering a set of cities, on a lower level there is a local space corresponding to a city located in a given geographical area and another area of influence covering the field of interaction of the city with other cities

The author has conducted research among residents of the city of Wroclaw in Poland, in terms of what residents associate the concept of Smart City. The study was conducted among 200 city residents, taking into account the differentiation in sex, age

and work performed. The survey was conducted in December 2018 in paper form in Polish.



**Fig. 2.** Associations regarding Smart City.

Chart legend:

- A - Intelligent public transport
- B - New tele information systems
- C - Fast Internet
- D - Professional health service
- E - Clean air and renewable energy sources
- F - Social ties
- G - Exchange of knowledge
- H - Facilitation in shopping
- I - Easy contact with the city administration

It should be noted that a very large number of respondents replied that the concept of Smart City is associated with new technologies and easy, simplified communication with decision makers in the city. As many as 54% of those surveyed associate Smart City with new technologies. In additional dialogs, they marked mainly communication devices such as social networks, thought exchange places, applications and tools supporting Smart Society.

An equally popular association, as many as 41% of respondents answered that there is easy contact with the city administration. At this point, the residents commented on the possibility of influencing the processes in the city, co-deciding about projects and development of the city, awareness of creating their own image among the Smart Society and belonging to the community that develops and creates activities in the area.

### 3 Knowledge Management in the Smart City area

One of the best-known definitions for knowledge management is the one that defines them as the process of creating, sharing, modifying and using information and knowledge in a given area [7]. It is often heard that knowledge management is an element of organizations or companies. However, this is one of the areas where these processes and rules can be found. The implementation of knowledge management within cities has become very popular recently. Using the resident portals, i.e. electronic sites enabling them to connect to a given server, residents are able to retrieve knowledge and data that are transmitted in real time by institutions or exchange of information between them. Looking at the urban agglomeration, one should look in many ways for a company. The main goal, however, will be the well-being of the citizen and his security, comfort of living, speed of dealing with various matters, education, etc.

However, city management is very similar to the company management, because the authorities get a specific budget, they have specific goals and possibilities to achieve. In this case, also management processes will often be similar to those in organizations and business.

Below is a chart showing the expectations of the inhabitants of Wroclaw, Poland in the field of knowledge management in the Smart City area. As in the previous survey, 200 respondents were included.

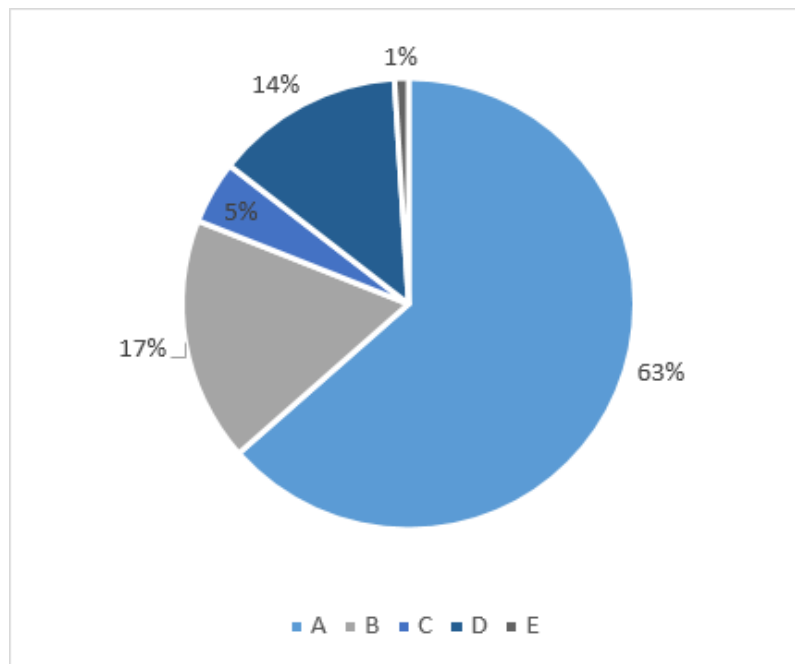
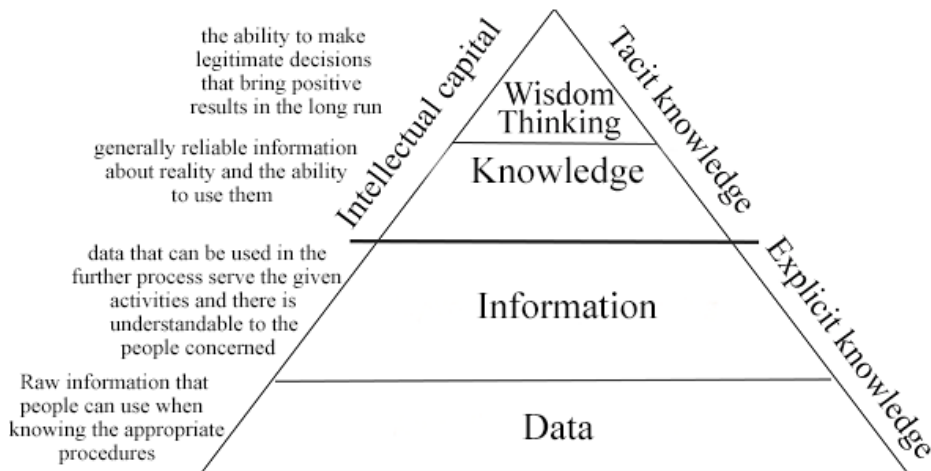


Fig. 2. Expectations of residents in the field of Knowledge Management in the urban area.

Chart legend:

- A - On-line portal for knowledge exchange within the city
- B - Events and meetings dedicated thematically for individual groups of residents
- C - Stationary places, allowing coming and acquiring general knowledge, interdisciplinary
- D - Knowledge base as a material value for the city and its future generations
- E - Exchange of knowledge with other unconventional media such as local newspapers and radio

The survey shows that residents expect mainly interactive knowledge sharing tools, accessible through ICT resources such as social media or the Internet. As many as 63% of the respondents indicated that they lacked a portal for local interaction between users. In the replies, it can also find comments that the portal should be available in real mode both via the Internet stationary as well as mobile. The next places are occupied by elements - widgets, applications and all kinds of possibilities to organize meetings between residents with similar interests, hobbies and professions. It should be noted that residents must be made aware of the importance of the Smart City concept and know what benefits it brings. In the field of Knowledge Management, two types of knowledge can be distinguished [8].



**Fig. 3.** Tacit and Explicit Knowledge.

Tacit knowledge and explicit knowledge. As in organizations and businesses, residents also aggregate and exchange knowledge. In connection with this, when analyzing information flows in agglomerations, one can come to the conclusion that there is also both tacit and explicit knowledge in urban areas. Tacit knowledge is existing



only in the mind of the man who owns it, created as a result of experience and not fully conscious ("I know that I can do it"), manifested only through skillful action. Explicit knowledge, however, is expressed in a character form and is written on the carriers of knowledge. In the case of cities, it is necessary to verify, collect and publish tacit knowledge for wider use. This knowledge base, which residents have, can be used to increase agglomeration development. It is also necessary to collect and manage the knowledge already discovered. Explicit knowledge should be segregated into the appropriate repositories, and the proper algorithms, instructions and operating diagrams may indicate the possibilities of using it.

Many scientists analyze the role of Knowledge Management in Smart City. For example, Negre, E., Rosenthal-Sabroux, C., & Gascó, M. propose [9] a novel and innovative Smart City concept based on people's information and knowledge, which aims to improve decision-making processes and add value to the business processes of a modern city. Other authors, Nam, T., and Pardo, T. A. identify [10] the components underlying the Smart City concept and key factors of the successful Smart City initiative.

#### **4 Crowdsourcing and its influence on Knowledge Management in Smart City processes**

The subject of crowdsourcing is quite a new, yet undiscovered, research area. Analyzing literature, we can only find a few books on the market that are devoted to crowdsourcing used commercially on the market. There is still a research gap in the use of crowdsourcing at the level of urban communities. Literature in the subject matter focuses mainly on scientific articles, the intensification of which can be attributed to the years 2018 and 2019. [11]

Crowdsourcing is a process [12] that uses the wisdom and potential of the community for the purpose of the individual or for the public good. It involves the outsourcing of a given task to the crowd, i.e. an unspecified number of random people. Crowdsourcing owes its rapid development to the Internet tool, i.e. the site that gathers millions of Internet users from all over the world, enabling all of them to participate in the tasks that were once reserved for a narrow group of specialists. Crowdsourcing are elements that can take different forms, depending on the conditions, their final purpose and use. It can be aimed at acquiring and generating new, creative ideas. Thanks to crowdsourcing, city authorities can create new solutions that will be conducive to the local community. Another use may be to give feedback on specific queries. This is the process of collecting user feedback on Smart City project data. Crowdsourcing can develop knowledge management processes in relation to Smart City projects. Acquiring knowledge from the crowd gives more opportunities, diversity of data and better exchange of information between residents and decision-makers. This, in turn, results in the awareness of the effectiveness of action, the sense of sharing knowledge and increasing motivation to engage in the process.

## 5 Model of distribution of Knowledge between residents and decision makers

Crowdsourcing in the area of Smart City means first and foremost the use of knowledge of residents by decision makers and the government. At this stage, one should ask the question what factors determine the involvement of stakeholders in acquiring knowledge. How can we influence their motivation and willingness to share information and knowledge? From the technical point of view, the question is also what tools are used to acquire knowledge from target stakeholders and to what extent can the acquired knowledge be used in Smart City projects? In cities there are information gaps at the communication level between decision-makers and residents. It is also important how we can supplement our information resources to reduce the information gap.

The main questions for residents (people who have knowledge that can be used in the crowdsourcing process), but also city decision makers are:

- A. *Under what terms and when you would like to share your resources?*
- B. *What internal and external factors influence your motivation to share knowledge?*
- C. *Are Social Media and Resident Portal appropriate information channels?*
- D. *What do you think about building a local social image? Are you willing to participate publicly in the future in the debate about your region and represent others?*
- E. *What do you think about building a local social image? Are you willing to participate publicly in the future in the debate about your region and represent others?*
- F. *Do you want to co-decide about urban processes?*

Crowdsourcing as a process can have many advantages resulting from its implementation in given places. These can be corporations, organizations, as well as urban agglomerations and other clusters of people who can support the processes of acquiring and transferring knowledge.

The main advantages of crowdsourcing in relation to the urban community may include [13]:

- A. *Saving time and money.*

The crowd generates ideas much faster and the preparation of the website is definitely cheaper than paying for the work of a narrow, specialized team.

*B. The variety of submitted projects and their originality.*

Many perspectives and points of view. As with the development of GNU GPL applications available to thousands of users, many programmers have many points of view, which means that the systems are very diverse and have thousands of additions, templates and widgets. In the case of acquiring knowledge from the crowd using crowdsourcing, this process looks similar.

*C. Obtaining information on the needs and expectations of residents.*

The process of exchanging messages and needs between residents and decision-makers in a given location is extremely important because it develops Smart Society, the residents feel understood and have a real influence on deciding on important issues in the area of the immediate environment. The rulers are not detached from reality and their opinion is compatible with the rest of the people living in the agglomeration.

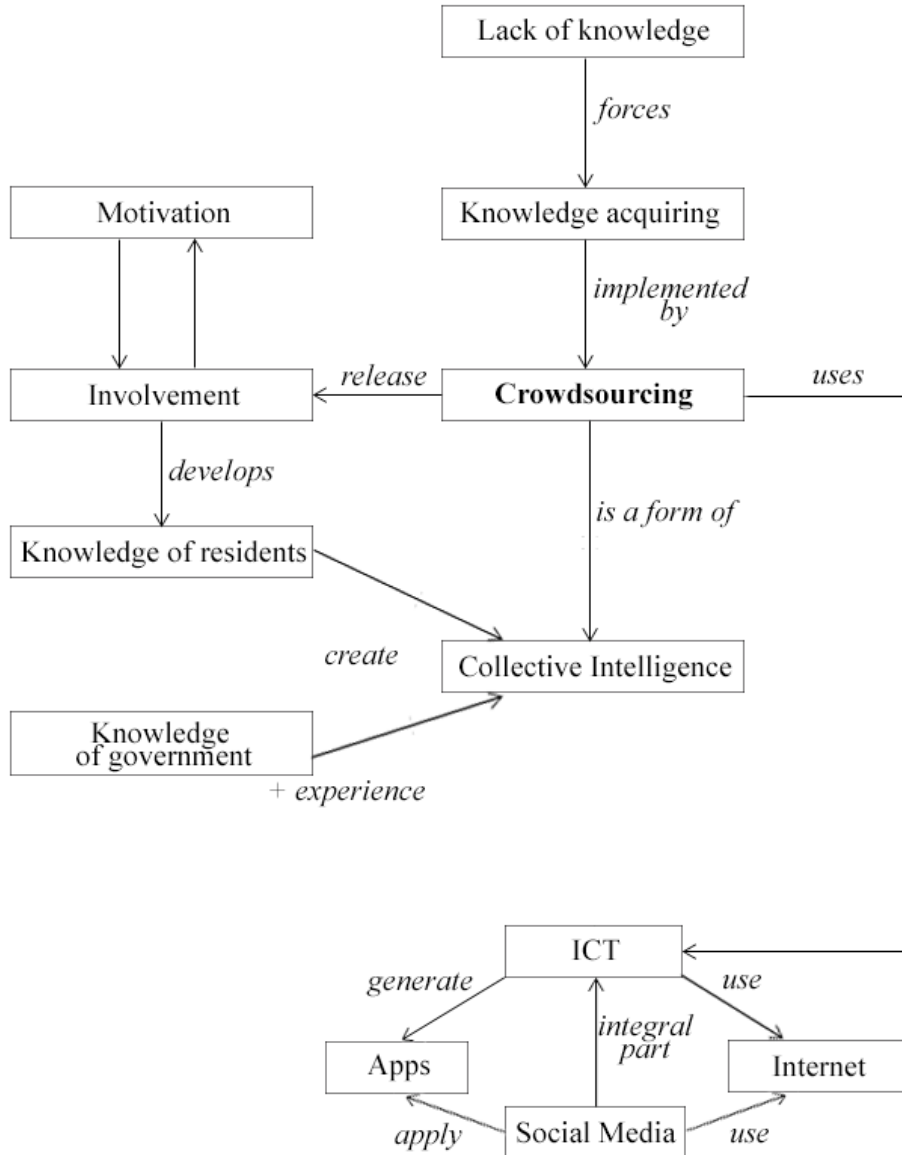
*D. Creating a committed community.*

An engaged community can greatly influence positive changes in the city. Thanks to the awareness and commitment of people, the government can develop all areas of Smart City. Residents and the government (with extensive experience) can create Collective Intelligence.

*E. Marketing and promotional benefits.*

Using crowdsourcing can also be a positive urban element, which will be made available to other municipal units. This can be treated as a marketing element of the urban strategy.

Below, the author presents a general knowledge distribution scheme in the area of Smart City, including Task Crowdsourcing.



**Fig. 4.** General knowledge distribution scheme in the area of Smart City.

It should be understood that Crowdsourcing is a response to the lack of knowledge demand. It forces the process of knowledge acquisition, which is carried out by the crowdsourcing process. Crowdsourcing triggers engagement in target users (in the case of Smart City residents). It is directly related to the motivation that makes the willingness to share knowledge between residents and the government. This process is dual and returnable. Commitment, in turn, develops the knowledge of the residents.

This in turn with the knowledge of the rulers (who have the appropriate experience) creates collective intelligence. Crowdsourcing is a form of collective intelligence. It can be done through modern ICT tools. These tools generate applications, constitute social media via the Internet.

## 6 Conclusion

Crowdsourcing as a process occurs in many places. So far, most of the definitions were based on organizations and companies. In the last 2-3 years, he began to appear in relation to Smart City. Using Crowdsourcing to acquire knowledge from residents can help exchange knowledge between residents, decision makers and the government. However, one should ask yourself what factors can affect the involvement of residents in the willingness to share their knowledge and participation in this project, how to develop their motivation and what factors, including technology, can be used to optimize and implement this process in all dimensions.

Thanks to crowdsourcing in the area of Smart City, the municipal government can save time and money when making decisions, there is a much greater variety of ideas, knowledge from the crowd results in standardization of expectations and directions, and develops originality of submitted projects. Decision-makers get information on the needs and expectations of residents. The community becomes more involved and motivated. There is a diffusion of knowledge and a full information cycle inside the city. Knowledge is sourcing, processed, modified and shared. An important element is bilateral exchange, interaction between decision-makers and residents.

## References

1. Smart Cities Study: International Study on the Situation of ICT, Innovation and Knowledge in Cities.
2. Urban World: Cities and the Rise of the Consuming Class, McKinsey Global Institute
3. United Nations Development Programme
4. World Urbanization Prospects 2018
5. Komninos N., Intelligent Cities and Globalization of Innovation Networks (2008)
6. Understanding Smart Cities: An Integrative Framework
7. J. Girard, JA Girard, "Defining knowledge management: Toward an applied compendium" in Online Journal of Applied Knowledge Management, vol 3, 2015
8. K. Dalkir, "Knowledge Management in Theory and Practice", McGill University, 2005
9. Negre, E., Rosenthal-Sabroux, C., & Gascó, M., "A knowledge-based conceptual vision of the smart city." in System Sciences HICSS, 2015
10. Nam, T., Pardo, T. A., "Conceptualizing smart city with dimensions of technology, people, and institutions." in Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times, 2011
11. Abu-Tayeh G., Neumann O., Stuermer M.: Exploring the Motives of Citizen Reporting Engagement: Self-Concern and Other-Orientation, 2018

12. Brabham, D. C. Crowdsourcing as a model for problem solving an introduction and cases. "Convergence: the international journal of research into new media technologies", 2008
13. Aitamurto T., Leiponen A., Tee R., The Promise of Idea Crowdsourcing – Benefits, Contexts, Limitations, Nokia White Paper, 1 (30), 2011