Effective Management of Information Processes with CMS in Smart City. The Concept of Crowdsourcing

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Abstract. Globalization and civilization development are progressing in the world, according to statistics people have been migrating from rural areas to cities for many years. At the moment, this phenomenon is noticeable in every place and country, regardless of the state of affluence, level of development or other factors. Some developed countries such as Japan have urbanization at 97.6%. Along with the development of cities, problems also arise. One of the largest is the management of large municipal units. It should be noted that in addition to ordinary areas such as public transport and clean air, there are also extremely important as urban community management. Smart City concepts are created to coordinate activities in urban areas, but also outline development directions for the future. The author focuses on the analysis of information processes in Smart City and proper knowledge management thanks to electronic tools such as Resident Portal. Only fully coordinated and properly managed communication between residents, stakeholders and municipal authorities is able to strengthen and develop cities.

Keywords: Knowledge Management, Content Management Systems, Smart City, Crowdsourcing, Information processes.

1   Introduction

The idea of a Smart City is a relatively new concept implemented and used by central and local government authorities, business entities and urban residents themselves [1]. An intelligent city is one that uses information communication technologies (ICT) to increase the interactivity and efficiency of urban infrastructure and its components, as well as to raise the awareness of residents [2]. The area of urban and agglomeration development is currently a strategic element of globalization and civilization in the world. The trend of inhabiting urbanized 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 [3] (note the overall global population increase). More and more mega cities are emerging 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%). The inhabitants of Africa and Asia live mainly in rural areas, at present 40% and 48% of their population live in urban areas. A con-

tinuous increase in urban population is forecast in the next decades. Africa and Asia are urbanizing faster than other regions, and according to forecasts, by 2050 they will reach 56% and 64% of urban population, respectively. It is expected that India, China and Nigeria - together will account for 37% of the projected increase in the global urban population in 2014-2050. The estimated population increase [4] 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 has over 21 million inhabitants. It is estimated that by 2030, 41 megacities with over 10 million inhabitants will be created in the world. Forecasts indicate that Tokyo it 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 [5].

The development of urban agglomerations has many positive aspects for our civilization, but it is accompanied by many problems. The main of them focuses on proper city management. The author proposes to support knowledge management and knowledge acquisition by using crowdsourcing in the Smart City area. The diffusion of knowledge between decision-makers, shareholders and residents is extremely important because it can significantly help in the communication of all parties, decision-makers will reduce the information gap, and residents and stakeholders, i.e. in a direct understanding, the crowd will be aware of the Smart City environment and will be able to interact with decision makers.

The article is divided into four parts: the first defines information cycle management on the example of a city area, the second discusses the use of content management systems (CMS) as support for knowledge management processes. Then the author discussed the idea of Smart City. The last chapter focuses on obtaining information using crowdsourcing. The author asks the question where is the place of crowdsourcing in the flow and distribution of knowledge in the area of Smart City.

2 Management of information processes in Smart City

An intelligent city is a very complex creation, both in terms of infrastructure, communication and logistics as well as multidimensional in terms of information flow [6]. The information process can be called an economic process that performs at least one of the following functions: generating information, gathering information, storing information, processing information, providing information, sharing information, interpreting information or using information [7]. In relation to smart cities, these are all processes that operate on the information they have. The process may be, for example, information sent by delayed buses in the city to all target recipients, i.e. an electronic municipal information system located at city stops as well as the Internet. This information will be emitted and modified for end users - the application estimating the arrival of the nearest vehicle may modify the choice of a bus for another. So one information entails another, so the information cycle is created. Aggregated information may affect subsequent actions, e.g. a delay message will also be sent to the

traffic flow monitoring system in the city, which in turn may propose other communication solutions and tips on unloading traffic jams located on large streets. Only well-integrated tools and channels at all levels of information flow can properly distribute data transfer and support the current and future operation of the entire smart city [8].

The author decided to divide the concept of Smart City into 10 spheres that are integral with each other and are responsible for other areas of everyday life of citizens in the city [9]. These are: smart business, smart human capital, smart management, smart environment, smart transportation, smart IT, smart everyday life & communication, smart care and smart future. Each of these modules contains thousands of information processes that interact with each other, and there are mega-processes between the modules. The following are examples of information processes that can occur in the Smart City concept by modular assignment.

Knowledge in Smart City goes through a cycle that lasts indefinitely. The first stage focuses on acquiring knowledge from the environment. Knowledge is obtained from specific locations and transferred. Decision makers can acquire knowledge from residents, or another exchange of knowledge takes place, e.g. between residents, interveners, etc. The next step is to generate knowledge [10]. Tools supporting knowledge management and learning are useful. A great support also for generating knowledge can be the resident portal operating in a given agglomeration [11], which will support all processes remotely in the electronic aspect [12]. Nowadays, this knowledge is extensive in systems and there is no place for evaluation, only collection and repair [13]. Policy makers must remember about secure access to confidential information [14]. The next step is to evaluate knowledge, sort it, prioritize and eliminate unnecessary content. Dedicated aggregation of staff rates by importance, followed by the dissemination of knowledge. The last two stages are responsible for verifying the correctness of the acquired and processed information and making it available in the event of successful validation results [15]. Below is a diagram illustrating knowledge management cycle processes.
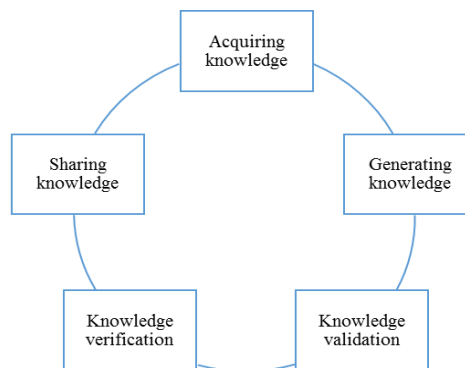

Fig. 1. Knowledge Management process. Source: own elaboration.

Information in the Intelligent City is provided in accordance with the standards and procedures set out within a given metropolitan area and imposed IT rules [16]. The

content can be divided into text, graphics, charts, videos, animations, and interface of system [17]. Depending on the type of content, there are many ways to aggregate data [18]. Particular attention should be paid to the amount of data stored [19] as it will be necessary to adjust the technical infrastructure and software to data sizes [20]. The scheme of information lifecycle is set out below.
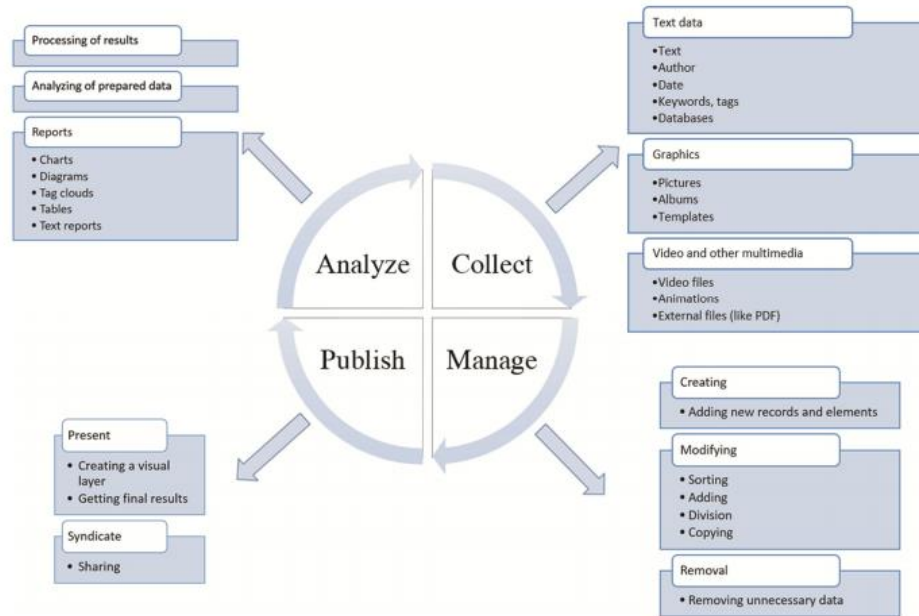

Fig. 2. Content lifecycle. Source: own elaboration.

3   Knowledge Management systems

Knowledge management is the entire process that enables the creation, dissemination and use of knowledge [21] to achieve the specific goals of an organization [22]. The concept of knowledge management is perceived by modern enterprises, organizations and business entities as one of the elements of building competitive advantage [23]. The methods and strategies of gaining competitive advantage used so far, such as the introduction of new products and continuous improvement of processes, are becoming less and less effective, because products and processes can be easily copied and adapted to the needs of competitive enterprises [24]. Traditional methods require much more effort on the part of employees and costly investments, with a shorter period of using the benefits obtained with their help. Modern realities, i.e. growing competition, rapidly growing customer requirements [25], etc. require the company to provide the highest quality product and an efficient production process.

The author suggests thinking in some respects about the city as a company. A place where economics also works and conditions similar to those in organizations exist.

The concept of implementing a knowledge management system in the city can have many positive aspects that will affect the everyday life of residents, as well as in the long term development of urban agglomeration. The following is an analysis of the benefits of implementing knowledge management processes in Smart City from different perspectives suggested by the author.

A. Business perspective.

The correct flow of information and knowledge, as well as the resulting patterns of appropriate actions can help the creativity of residents, which will result in the creation of new start-up companies, as well as long-term support for local business and the creation of new jobs. Creating unique solutions on a national and global scale can bring companies from other countries to the city, thanks to which patents can also lead to increased profits from city taxes. Additional circumstances conducive to the exchange of knowledge, such as business conferences and meetings of entrepreneurs, can help in the exchange of knowledge between specialists in a given field and residents. The city should allocate funds for such projects.

B. Educational perspective.

The exchange of knowledge between universities in the city and outside is a key element of their activity. The creation of an information center that collects and disseminates knowledge acquired in metropolises can be a benefit for educational units operating in the Smart City area. [26] Creating models for the exchange of information between scientists, as well as preparing the right conditions for research can be the key to the success of universities and research centers.

C. Resident perspective.

On the part of the citizen, the exchange of knowledge is important because it allows for self-development, increase of competence and the possibility of raising personal and professional qualifications. This translates into the possibility of better work, and thus potentially increasing the quality of life, as well as supporting urban processes as a partner - residents are able to understand their belonging to the community and engage in urban activities that contribute to the development of the whole society.

D. Government perspective.

People managing a metropolitan area acquire new qualifications, develop themselves, learn about different perspectives of residents, which allows them to better meet the requirements and support decision-making processes. It is important that the exchange of knowledge take place at all levels in the city and in areas, so that the knowledge resources have interdisciplinary status.

Existing knowledge can be both tacit and explicit. Tacit knowledge [27] exists only in the mind of the person who possesses it, created as a result of experience and not fully aware ("I know I can do it"), manifested only through skillful action. Tacit knowledge is most often transmitted during joint work, workshops, through conversation, storytelling and shared experiences. It is knowledge acquired subconsciously and

equally subconsciously used, it is more difficult to express and it is more difficult to write in the form of electronic records. This knowledge can be exchanged in the city by organizing workshops, creating common places to exchange ideas, bringing people together in groups according to professions, industries and hobbies. Explicit knowledge [28] is expressed in character and stored on knowledge carriers. This knowledge can be accumulated in knowledge repositories [29]. For example, cities can have servers connected to a system that has an interface for transferring data and creating workflows, so that data on the other side can be read and properly used in the form of knowledge.

Below, the author provides levels of data, information, knowledge and wisdom, dividing them into tacit and explicit and defining each of them. It is worth noting that the division can be used to create a resident portal, available online, supporting knowledge management processes. On this basis, relevant resources can be assigned and qualified to the persons concerned.
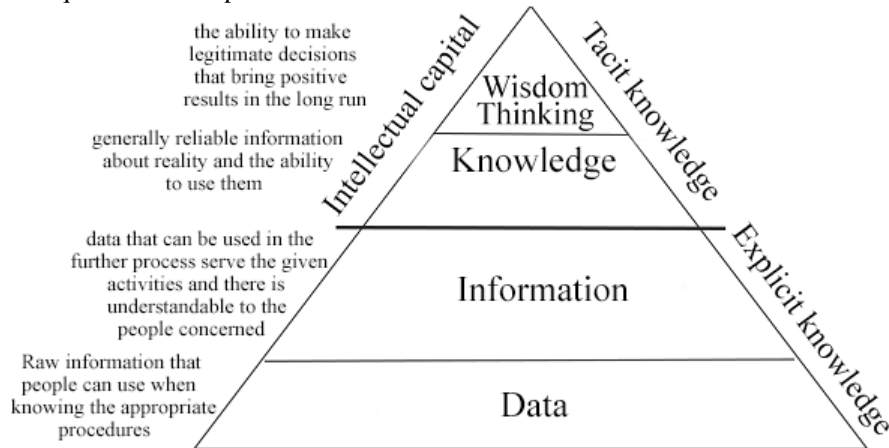
Fig. 3. Division into tacit and explicit knowledge. Own source

Wisdom thinking and knowledge can be defined as intellectual capital. This is an extraordinary positive value [30] for the city. Human and intellectual capital translates directly into the civilization level of the area [31]. People and their understanding of the processes taking place in the world, as well as their skills are the most important instrument in general development.

In December 2018, the author conducted a survey among the inhabitants of the Polish city of Wroclaw. He asked what they associate with the concept of Smart City. The survey was conducted among 200 residents on paper. The gender, age and profession diversity was taken into account.
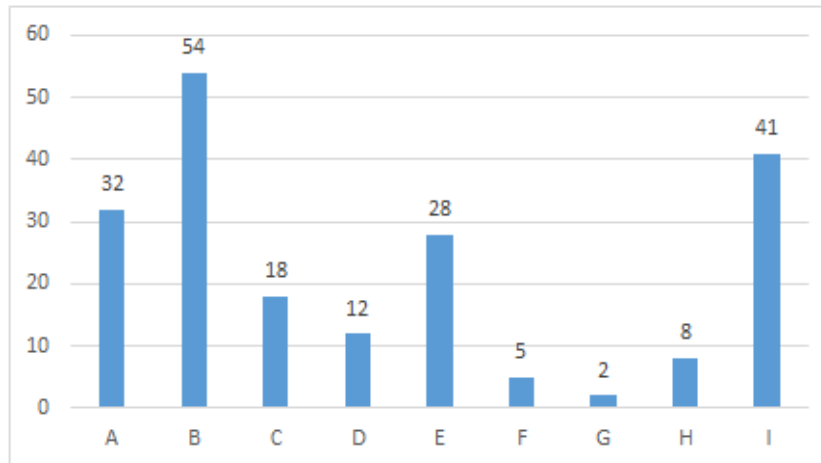
Fig. 4. Associations regarding Smart City. Own source

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

The survey results show that only 3.5% of respondents associate the idea of Smart City with the creation of a human community and exchange of knowledge between residents. This is a very small result, especially since the Smart City concept aims to change the mentality of residents into action, and not just participation in the passive form. As many as 27% of respondents associate Smart City with modern ICT systems. Respondents pointed to an increase in mobility and easier access to e-mail and e-services, as well as an increase in the number of access points with free Internet access in the city, as well as a fast Internet connection. Over half of the respondents identify Smart City with modern technologies and technical issues related to improving the quality of life. Low awareness of active participation in society as a creator / co-creator of society results in a lack of knowledge sharing processes in society. In turn, the government administration does not receive signals from residents about the need to create knowledge banks, tools supporting the exchange of knowledge and information between residents of a given metropolitan area, which causes the lack of implementation of such solutions.

During this study, the author asked the open question what residents expect in the exchange of knowledge. Answers are shown below.
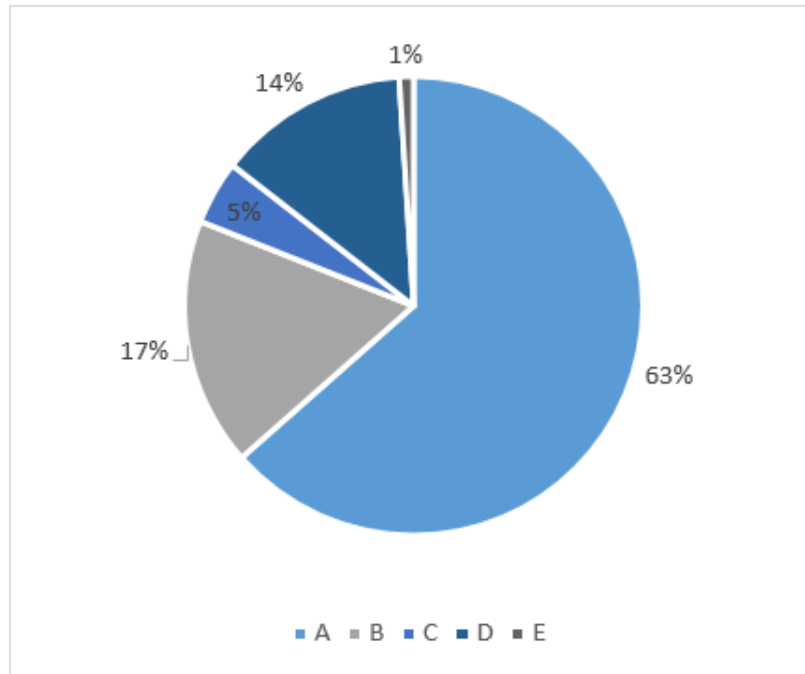
Fig. 5. Expectations of residents in the field of Knowledge Management in the urban area.

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

As in the previous study, the sample was 200 people. Most, because 127 respondents replied that they would like to create an Internet portal that will support knowledge among residents. The current trend of transferring all activities to the network and a high degree of mobility are conducive to the development of such initiatives. 63% of respondents would like to contribute to the exchange of knowledge on the network, putting their own neighbourhood and city as a community. Then 17% of residents would like to create events and meetings for thematic groups. Another place was to create a knowledge base that would aggregate data and procedures and benefit future generations. Answers were also received: stationary places for acquiring general knowledge, interdisciplinary and exchange of knowledge with other unconventional media, such as local newspapers and radio. All these activities can lead to the exchange of knowledge in the city, increase public awareness of the smart concept and increase the development of the region.

4 Crowdsourcing as a tool for acquiring knowledge

The subject of crowdsourcing is a fairly new and undiscovered research area. When analyzing literature, there are only a few books on the market that are commercially used for crowdsourcing. There is a research gap in the use of crowdsourcing at the urban community level. The literature on the subject focuses mainly on scientific articles, the intensification of which can be attributed to 2018 and 2019.

Crowdsourcing is a process in which an organization (a company, public institution, non-profit organization) commissions tasks traditionally performed by employees of an unidentified, usually very wide group of people in the form of an open connection [33]. It is worth noting that the latest definitions are beginning to open to other entities and areas, not only those related to organizations and business. The potential of crowdsourcing in public aspects has been recognized, addressing a wider society.

The main advantages of crowdsourcing over the urban community may include [34]:
1. Saves time and money (the crowd generates ideas much faster, and preparing a website is definitely cheaper than paying for a narrow, specialized team) [35].
2. Variety of submitted projects and their originality (many perspectives and points of view).
3. Obtaining information about the needs and expectations of residents.
4. Creating an engaged community.
5. Marketing and promotional benefits.

The most important research questions that focus on learning factors:
1. What factors determine the involvement of stakeholders in acquiring knowledge?
2. What tools are used to acquire knowledge from stakeholders?
3. To what extent and scope can the acquired knowledge be used in Smart City projects?

Below the author presents a general scheme of knowledge distribution in the area of Smart City, including Crowdsourcing of tasks.
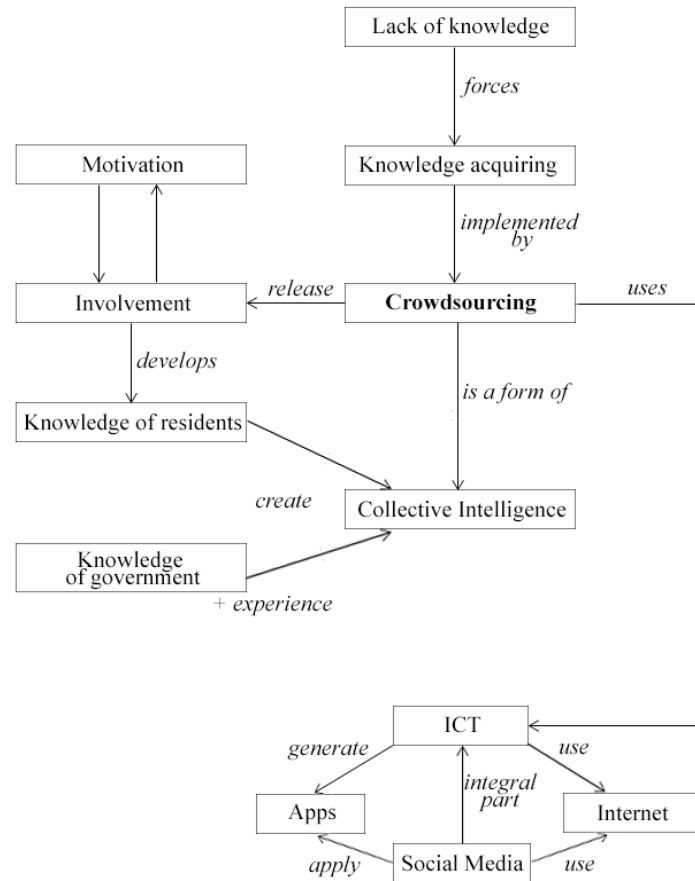
Fig. 6. Semantic network presenting crowdsourcing contexts as methods of acquiring knowledge.

The author has created a diagram illustrating the distribution of knowledge and information in the area of Smart City. Crowdsourcing is the answer to the lack of knowledge. Enforces commitment directly related to motivation. It is extremely important to observe the factors affecting the willingness to share knowledge of residents and to answer the question of what elements contribute to increasing the motivation of participants.

5 Conclusion

The article focuses on the role of the Smart City idea in current time, as well as the use of tools such as Crowdsourcing to optimize information exchange processes and knowledge management in metropolitan areas. The author carried out a study showing that there is a very high demand for electronic services that will support communication between residents, decision makers and stakeholders, as well as services

supporting digital management of all areas of the city. The article cites the benefits of implementing knowledge management processes in the Smart City area from various perspectives, including business, education, resident and government. The article cites the benefits of implementing knowledge management processes in the Smart City area from various perspectives, including business, education, resident and government. Resident portal tools available on-line for all urban groups can connect all Smart City zones, mediate communication that can be used for Crowdsourcing and manage information processes in urban agglomerations.

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