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Review paper

POSSIBILITIES OF APPLYING IOT IN THE MUNICIPALITY OF GRAČANICA

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Abstract

The purpose of the research of this work is to investigate the possibilities of applying modern technologies in solving current problems in rapidly growing environments such as the municipality of Gračanica. Based on a studious analysis of the relevant literature, the concrete contribution to the understanding of the role and importance of IoT will be investigated and thus increase its use for the needs of so-called smart cities, i.e. municipalities, and at the same time answer the question of whether we can define IoT as one of the key elements of smart cities, municipalities or cities that use digital and information-communication technologies (hereinafter ICT) for more efficient operation of traditional networks, services and systems for the benefit of residents and the economy are called smart cities or communities. Smart cities and municipalities are a growing paradigm that has emerged from the convergence of many technologies such as the Internet of Things, big data and real-time systems. The purpose of smart cities and municipalities is to better coordinate resources and processes for quick response and efficient work. One of the most important priorities of the neighbouring countries is the digital transformation of public administration and society in general. It is about combining the innovative use of digital technologies, activities and processes. The digital transformation of municipalities and cities is the most pervasive step and includes broad changes, the result of which is the use of new business models through the implementation of smart services with the aim of creating and achieving greater added value. The result of the digital transformation of cities and communities are smart cities and municipalities. Many areas in a city or municipality can become "smarter" with the help of IoT, that is, they offer opportunities for automatic real-time monitoring to obtain data and turn it into meaningful and useful information. Research results indicate that this could significantly improve the effective control and management of vital functions in cities, for example property, education, traffic and smart parking management, water management, public health, environmental monitoring, energy efficiency, waste management

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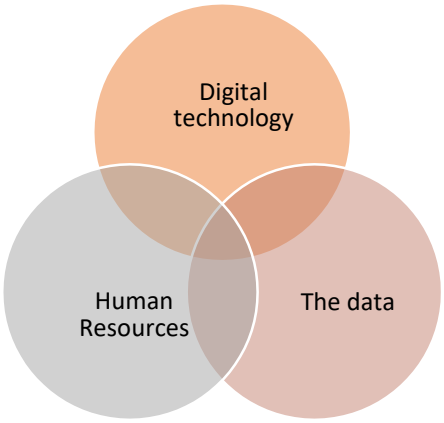
and utility services in order to make more efficient use of resources. and improving the lives of citizens of the municipal administration of Gračanica.

Keywords: *IoT, smart cities, digitization*

THEORETICAL BACKGROUND

The position of the municipality is determined by the constitution or legislation of each country. The role and position of the municipality therefore depends on the normative regulation in a particular country. This determines the relationship that local self-government has with the state and vice versa. A clear demarcation of tasks between the state and municipalities is particularly important here. The autonomy of the local self-government, that is, the municipality, is manifested in the independent regulation and resolution of certain local issues of public importance. The amount of data produced globally is increasing rapidly: it was 33 zettabytes in 2018 and is expected to grow to 175 zettabytes by 2025 (European Commission, 2018). Each new wave of EU data brings significant opportunities for it to become a world leader in this field. The way data is stored and processed is expected to change significantly in the near future. In 2018, 80% of data processing and analysis takes place in data centers and centralized computing facilities, and 20% in smartly connected objects such as cars, home appliances or manufacturing robots and in computing facilities close to the user ("edge computing").In the future, the relationship is likely to be reversed. In addition to economic and sustainable benefits, this development also brings additional opportunities for companies and the public sector to develop tools that would give data producers more control over their data (European Commission, 2018).
Figure 1 shows the main components of digital transformation in smart cities and municipalities.

Figure 1: Components of digital transformation in smart cities and municipalities



Source: Anthony Jnr (2021).

2.1 Municipality of Gracanica

The municipality of Gračanica is rich in ancient and medieval treasures and natural beauties. A modern environment with a developed economy and infrastructure.
The multi-ethnic population of this municipality, made up of Serbs, Albanians, Roma, Ashkali and Egyptians, reaches the number of 25,000 inhabitants, of which 35-40% are youth who contribute to the improvement and development of their local self-government in the direction of digitalization, transforming their municipality into a smart municipality .

The result of the digital transformation of cities and municipalities is smart cities and municipalities (CB Insights, 2021). The digital transformation of cities and municipalities has gone through several phases over time (Figure 2):

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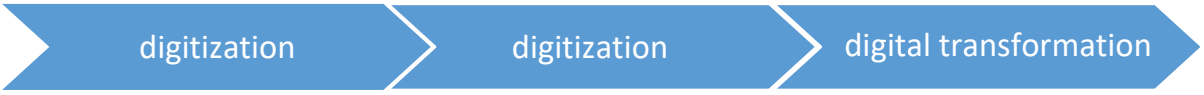
 digitization, which is defined as the process of converting analog contents or tasks into digital ones. Digitization is generally the process of converting information from analog to digital form. In other words, digitalization takes an analog process and turns it into a digital form without any other changes in the process itself (Gartner, 2021);
 digitization implies the use of digital technologies to change the business model and income and new opportunities to increase value. According to Gartner, the process of transitioning to digital business. In the digitization of municipalities, the emphasis is on optimizing existing processes in the municipality with the aim of developing smart city services. Changes affect urban processes such as transport, health, education, governance, energy, waste management, etc. (Anthony Jnr (2021)., 2021). Digitization enables better coordination between smart services and creates additional security for residents by improving their services. Digitization is not only focused on costs, but also on the development of services that improve the user experience of residents;
 the digital transformation of municipalities and cities is the most pervasive step and includes broad changes, the result of which is the use of new business models through the implementation of smart services with the aim of creating and achieving value. Digital transformation affects the entire city (residents and other stakeholders) and goes beyond digitization that changes processes and tasks. The entire business logic of a city or municipality changes by reorganizing the value creation process (Anthony Jnr (2021)., 2021).

Figure 2: Stages of digital transformation in smart cities and municipalities



Source: *Anthony Jnr (2021).*

An example of digital transformation is participatory budgeting, which is an almost completely digitally transformed concept of municipal budget implementation. Citizens submit budget proposals through a digital platform, vote for them and monitor their implementation through an online or mobile application.
Based on the set goals and measures, the goal is to ensure greater transparency and efficiency in the management of the municipality's budget funds. At the same time, the introduction of a unique information solution would significantly contribute to greater transparency of the municipality. The implementation is part of the municipality's long-term digitization strategy, which will facilitate the municipality's adaptation to market fluctuations, globalization processes, social changes, technological progress and similar processes. By implementing the solution, the municipality will ensure the creation of a solid and stable institutional environment for successful social development, which will reduce lagging behind the private sector based on the use of innovative digital tools, approaches, principles and technologies.

2.2 From e-administration to digital administration

According to the digital government maturity model, establishing an e-government model is only the first step towards public administration becoming a mature organization for digital services. The first thing to understand is that while e-government is measured by the number of services available to citizens, digital government will be measured by reducing the number of services in favor of a comprehensive experience (Di Maio, 2016).

Another point is that digital government is not an end goal, but a means to achieve affordable and sustainable government services. It's a situation that Di Maio, executive vice president of Gartner, described as smart government (governance). Gartner's Digital Government Maturity Model describes five key stages on the road to smart government (Di Maio, 2016):

 Today there are many offices on the first level and this corresponds to a more traditional model of e-government. Here, the main focus is on the digitization of existing services, such as vehicle registration and taxation or applications for state benefits. Success is measured in terms of increasing the number of online services to increase efficiency and save costs. To move forward, CIOs need to move from simply digitizing services to collecting and using data generated during service delivery.

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 Open data. Many government organizations have open data programs in place and have established an open data platform that is heavily focused on the use of open public government data by citizens and businesses through the development of mobile applications and dashboards. To move forward with digital transformation, CIOs should transform their agencies from mere suppliers of data to consumers of open data coming from other government and non-governmental organizations. In addition, they should plan how to expand the open data initiative beyond public data.
 Focus on data. This level represents a real turning point in the transformation of digital government. Data becomes a key focus. Treating all data as open (which does not necessarily mean that it is public, but accessible through a single interface) opens up countless opportunities for innovation. New ways of aggregating and analyzing data within and across agency boundaries will lead to new services and new service delivery models, likely to involve non-governmental entities as intermediaries.
 Completely digital. At this level, the organization has fully recognized the importance of a data-centric approach to transformation and regularly seeks opportunities for innovation based on open data principles. Data is more often used outside of the office, leading to easier interactions based on understanding the context and situation of the participants. Privacy will remain a primary concern and will determine the extent to which data can be used to transform the service. New value-added services are created using data. This could include tax advice from agencies that have real-time insight into a taxpayer's situation or childcare services based on contextual information about applicants' foster families. Traditional and new services will be available through various channels, including non-governmental ones, and data will be shared not only between agencies, but also with external partners such as banks, employers, merchants, where possible and in full compliance with privacy laws.
 Digital transformation is now the norm, and the innovation process is predictable and repeatable. The CIO is taking on a larger and renewed role as an information and data steward, charged with prioritizing and managing the portfolio of transformational opportunities presented. Challenges will remain, however, including maintaining a sustainable digital transformation and preparing for the arrival of smart machines in key business processes.

2.3 Smart municipalities

The world population is constantly increasing and by 2050 there will be 9.7 billion people on Earth (United Nations, 2019). Resource consumption per capita is expected to grow further due to the shift from the lower class to the middle class. There are many challenges in all areas. One of the solutions to the upcoming challenges is a smart community (Figure 6), such as a municipality or city, which is capable of coordinating resources and processes for quick response and efficient operation (IBM, 2009).

The Digital Slovenia 2030 strategy states that smart communities become the starting point for the digital transformation of the entire society. A smart community is able to effectively manage resources to meet social, economic and environmental needs for well-being

Citizens. Dealing with these areas ensures the sustainable viability of municipalities. People are at the center of digital transformation. Digitization of cities and communities leads through a demanding transformation, which includes social, economic, urban, mobile, educational, technological and cultural changes (Government of RS, 2023a).

Smart cities and municipalities are defined by three elements that enable sustainable development (IBM, 2009):

 data analytics for better decisions,
 the ability to anticipate problems, proactively solve them and minimize the consequences,
 coordinating resources and processes for quick response and efficient work.

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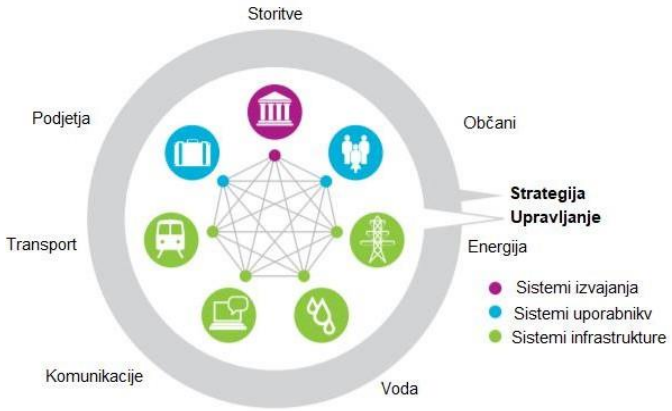
Figure 6: Smart communities strategy



Izvor IBM Vision of smarter cities (2009).

Smart cities and municipalities must be able to effectively manage resources to meet social, economic and environmental needs for the benefit of citizens, which is far from an easy task, as municipalities are often organized in separate areas and rarely managed as integrated entities, usually however , decision makers also do not have insight into what is happening in the municipality in real time, nor quality aggregated data on the basis of which they could make decisions.

LITERATURE

[1] Anthony Jnr, B. (2021). Managing digital transformation of smart cities through enterprise architecture–a review and research agenda. *Enterprise Information Systems*, *15*(3), 299-331.

[2] Di Maio, A., (2016). Gartner. *Five stages define a CIOs journey from e-government to digital government. Pristup 12.01.2024 godine na* https://www.gartner.com/smarterwithgartner/ when-less-becomes-more-the-journey- to-digital-government

[3] European Commission. (2018). European data strategy. Accessed on 12.01.2024 at https://ec.europa.eu/digital-single-market/en/european-strategy-data?etrans=sl

[4] Gartner. (2021). *Digitization.* Accessed on 12.01.2024 at https://www.gartner.com/en/ information-technology/glossary/digitization

[5] IBM. (2009). *A vision of smarter cities.* New York: IBM Global Business Services.

ISBN: 978-86-6461-074-2