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MANAGER'S ATTITUDES TOWARDS THE CITY DIGITALISATION STRATEGY – CASE OF POLISH SMALL AND COUNTY CITIES¹

Summary

Purpose – The aim of the study was to find out whether and how the current digital transformation is taken into account in the city's sustainable development strategies, what actions are taken and what are the attitudes of city board managers related to the city's digitalisation plans.

Research method – An in-depth review of the literature on the issues of digital transformation in city development strategies was performed. The quantitative empirical study was based on a questionnaire interview with city board managers of randomly selected small and county cities, realized by telephone interview method (CATI) supported by the Internet interview method (CAWI).

Results – The results obtained in the study made it possible to assess the degree of inclusion of city digitisation plans in the sustainable development strategy, as well as to gain knowledge about the attitudes of city management managers towards the need to include digitization plans in the city's digital transformation strategy.

Originality/value/implications/recommendations – Indicating the existence of a relationship between the size of the city measured by the number of inhabitants and income per capita and the presence of digitalisation plans in their sustainable development strategies. Demonstrating that the presence of digitalisation plans in the sustainable development strategies of the studied cities depends on the attitudes of city managers towards digitalisation.

Keywords: digital transformation, Sustainable Smart City, digital city strategies

JEL classification: O18, Q56

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1. Introduction

Migration of people from rural areas to cities is a phenomenon occurring over many centuries of the development of human civilization. This trend intensified in the second half of the 20th century and is forecast to continue into the 21st century. Currently, more than half (55%) of the world's population lives in cities and it is estimated that the number will increase to up to 68% in 2050 [United Nations, 2018; Yong, 2020; Eurostat, 2020]. This poses difficult challenges for cities, related not only to the need to provide housing, technical infrastructure, energy, water, and consumer goods, but also to the need to ensure public, social, health, and economic security for their inhabitants [European Union, 2011]. Cities have always been the engines of economic growth, prosperity, and social progress throughout history and will be essential to the future competitiveness of nations and regions [European Union, 2011]. Their ability to absorb digital technologies may prove to be one of the most important determinants of sustainable urban development [Deakin, 2014]. Access to and use of Information and Communication Technologies (ICT) should therefore be a priority in the city's development strategies. Currently, cities face increased pressures for continuous and sustainable development that require continual adaptation to a rapidly changing world [Hämäläinen, 2020]. "Cities today are facing new economic, political and technological responsibilities which they must satisfy to deliver sustainable prosperity to their citizens. It's time to leverage from technology and establish smarter systems that can optimize the use of limited resources. Many cities have already started" [Sujata et al., 2016, p. 908].

The transformation of a city into a smart city requires the involvement of all its stakeholders, including residents, companies, universities and scientific institutions, and local government authorities [Hatuka, Zur, 2020]. Cities, even the leading ones from developed countries, are still at the initial stage of implementing the idea of a smart and sustainable city, hence there is a widespread opportunity for the implementation of digital technologies [Hanna, 2016]. There is still a research gap in the field of digital transformation of cities. The need for further research in the field of smart city strategies is indicated by Schaffer, Komninos, Pallot: "There is a need for research into effective city strategies to make them smarter, taking into account the specific socio-economic context and urban development objectives and approaches to mobilize participation and intelligence of citizens, businesses and social organizations" [Schaffer, Komninos, Pallot, 2012, p. 6]. With the above in mind, research was undertaken to understand how the digital transformation is progressing in Polish small and county cities in the context of

the city digitalisation strategy and what is the attitude of city managers and their expectations towards the digitalisation strategy in the context of sustainable city development. The subject of the research was the search for answers to the question about the attitudes of city managers in relation to the opportunities offered by digital transformation.

2. Digital transformation of the city

When considering cities, it can be assumed that the digital transformation of the city is a long-term, integrated process of implementing digital technology to all areas of the city's functioning – administrative, economic, and social – to ensure the sustainable development of the city and the well-being of its inhabitants [Hatuka, Zur, 2020]. The digital transformation of cities is a great challenge and requires a structured approach as cities are made up of different actors with different expectations and opportunities to use digital technologies to achieve their goals [Bokolo, 2020].

The digital transformation of the city means a radical increase in the use of digital technologies to improve its organizational efficiency and the level and quality of life of its inhabitants. Digital technologies such as artificial intelligence and the Internet of Things are already being integrated into the infrastructure of many cities to optimize a wide range of public services [Jararweh, Otoum, Ridhawi, 2020]. As shown by the examples of many European cities, the ongoing digital transformation requires efforts aimed at building the city's capacity to integrate and implement such technological solutions [Caragliu, Del Bo, Nijkamp, 2009; Giffinger, 2007].

One of the essential goals of the city's digital transformation is to support its long-term development for the benefit of its inhabitants and the entire region [Estevez, Lopes, Janowski, 2016]. The city development strategy is one of the basic instruments of city management. It is a long-term action plan containing a set of goals and objectives related to resources and decision-making processes aimed at its implementation [DWIH-Sao Paulo, 2020]. A desire to improve the quality of life for their residents is an important reason why cities choose to undergo the digital transformation that will allow them to implement their sustainable development strategies. Another essential motive for the digital transformation of cities is the expectations of city residents interested in using modern digital technologies, for whom living in an intelligent city is a source of pride and social prestige [European Union, 2019].

3. From Digital to Sustainable Smart City

Over the past 30 years, many research teams and practitioners from around the world have conducted research related to the growing impact of technology on urban development, which has resulted in several different definitions of “Smart City” ranging from relatively brief to broadly describing this concept [Hatzelhoff et al., 2012]. Examples of Smart Cities definitions from the literature can be found in publications by Appio, Lima, Paroutis [2019], classified by their primary focus in terms of the three components: physical infrastructure, quality of life, and innovation ecosystems. The MIT Smart Cities Group defines Smart City as follows: “The new intelligence of cities resides in the increasingly effective combination of digital communication networks (nerves), ubiquitously embedded intelligence (the brains), sensors and tags (sensory organs), and software (knowledge and cognitive competence). This does not exist in isolation from other urban systems or connected to them only through human intermediaries.” [Mitchell, 2007, p. 5]. The importance of the human factor in the development of smart cities was also emphasized in the study made by Schaffer et al.: “The smart city is about people and how people are empowered, through using technology, for contributing to urban change and realizing their ambitions” [Schaffer, Komninos, Pallot, 2012]. According to Nicos Komninos “... ‘intelligent city’ and ‘smart city’ correspond to the same planning concept, a form of strategic planning based on the use of smart systems and new services (e-services) to support collaborative innovation processes and citizens’ engagement in addressing the city challenges of urbanization, sustainable growth, and globalization” [Komninos, 2015, p. 23].

Sustainable city development requires a holistic approach that goes beyond the technological dimension to also consider social and environmental aspects, emphasizing proper city management and development strategies based on the digital transformation of the city [Sarkar, 2015]. A city becomes smart when the transformation involves technological, environmental, social, and human aspects [Mendhurwar, Mishra, 2019]. The most important role of technology in smart cities should be to enable sustainable urban development, not just to implement new technology just for it [Bifulco et al., 2016; Ahvenniemi et al., 2017]. As many authors suggest, if sustainable development is an integral part of a Smart City, then such a city should be called Smart Sustainable City [Ahvenniemi et al., 2017].

4. Digital strategy for sustainable city development

The growing number of urban residents and its potential negative impact on the environment and social life makes the sustainable development of cities not only a challenge, but also a necessity [Hatzelhoff, 2012]. This is also the case in Central and Eastern European cities, which have recently been on the path of market economy development and face many barriers to sustainable development [Serbanica, Daniela-Luminita, 2017; Hadjitchoneva, 2020]. There is a debate in the literature on whether cities can become smart without being sustainable [Yigitcanlar et al., 2019]. According to W.D. Eggers and J. Skowron, sustainable development is one of the most important goals in the process of implementing the Sustainable Smart City concept [Eggers, Skowron, 2018]. City's sustainability requires a holistic approach to the planning process combining many different areas of the city for the optimisation of urban networks and ecosystems [Łobejko, Stankowska, Zabielski, 2015].

The implementation of a Sustainable Smart City which takes full advantage of the opportunities offered by digital technologies is a long-term task that requires an appropriate strategy for the development and planning of the city. "The current urbanization requires strong strategies and innovative planning to modernize urban life. Many cities are enhancing the quality and performance of urban services by being digitalized, intelligent, and smarter." [Kumar et al., 2020]. This requires the right digital strategy. The definition of digital strategy emphasizes that its scope goes beyond IT technology strategies. This approach is presented by Mark P. McDonald and Andy Rowsell-Jones in their book *The Digital Edge*. In their opinion "A digital strategy does not treat technology in isolation as a separate component of the business operations; it isn't just IT strategy or a marketing strategy. Rather, it considers how the digital technology can completely reshape the company's relationships – with customers, with the market as a whole." [McDonald, Rowsell-Jones, 2012]. The fact that strategy, not technology, is the driving force of digital transformation is confirmed by the research report entitled "Strategy Not Technology, Drives Digital Transformation" [Kane et al., 2015]. Digitalisation is whole-company transformation that needs corporate digital strategy [Gobble, 2018]. This approach also applies to the digitalisation of cities. The city's digital transformation strategy can be a common element and, at the same time, a foundation for a modern sustainable development strategy [Hanna, 2016]. Today, the digital transformation strategy is the main force facilitating and accelerating the full implementation of a sustainable development strategy that aims to transform the city into a Smart Sustainable City – Chart 1.

CHART 1

Digital transformation strategy as an important part of sustainable city development strategy



Source: own elaboration based on a literature review and the results of the study.

Sustainable development provides the city with economic stability and a systematic improvement in the quality of life of its inhabitants. Decisions related to the development of the city are made by city authorities who have different levels of knowledge of the possibilities that modern digital technologies offer for the digital transformation of the city, thus requiring a clear vision and strategy for comprehensive digitalisation [Silva, Khan, Han, 2018]. The experiences of many cities around the world (Singapore, Dubai, Oslo, Copenhagen, and many others) shows that the Smart City idea can be realized in ways that bring measurable economic, social, and environmental benefits [Mora, Deakin, Reid, 2019; Estevez, Lopes, Janowski 2016; Giffinger, 2007]. In many cases, the development of an appropriate city digitalisation strategy and its comprehensive implementation may facilitate and accelerate the achievement of sustainable development far more than the accidental implementation of different, not always compatible digital technologies.

5. Methodology

The aim of this section is to explain the methodology that guided the conduct of research underpinning this report. The methodology comprises the main activities described as follows:

1. Research Literature Review to identify and document the most significant research literature that shapes the Digital Transformation, Sustainable City Development, and Smart Sustainable City domains.
2. Defining the research problem and formulating research theses. Two research problems were formulated in the form of research questions: 1) Do city size and per capita income differentiate the attitudes of city managers towards the need to take into account digitalisation plans in sustainable development strategies? 2) What are the main expectations of city managers in relation to the city's digitalisation strategy?
3. Preparation of a research tool based on research questions for an interview questionnaire provided to 83 randomly selected Polish city board managers.
4. Completion of a quantitative empirical study, the aim of which was to learn about formal knowledge by formulating questions and measuring the levels of the phenomenon, so that from them the relationship between variables in a causal relationship can be found.
5. Verification of the correctness of the collected data and creation of a data set containing the respondents' answers.
6. Statistical analysis of collected data as well as tabular and graphical presentation.
7. Synthesis of findings in order to create a set of recommendations both for members of city boards undertaking Smart Sustainable City initiatives, as well as for people and organizations involved in the implementation of this idea.

The research questionnaire contained four questions (one closed and three multiple choice) addressed to the managers of Polish cities:

1. Does your city's development strategy include plans to digitise the city?
Answers: Yes, No, I don't know.
2. What digitalisation plans are included in your city's development strategy?
 - a) Implementation of intelligent urban traffic control solutions to improve street traffic.
 - b) Implementation of intelligent public transport control solutions to increase its efficiency and increase the comfort of travellers.
 - c) Implementation of smart grid solutions, i.e. intelligent measurement systems in urban networks, e.g. for water reading.
 - d) Implementation of intelligent solutions to improve urban monitoring in order to increase safety.
 - e) Transferring IT services to cloud computing.
3. Have you undertaken, are currently working or intend to attempt to develop a strategy for the digital transformation of the city?

- f) We haven't done anything in this regard yet.
 - g) We want to do it in the near future.
 - h) We are currently working on the assumptions for such a strategy.
 - i) We have already developed a strategy for the city's digital transformation, but we have not implemented it yet.
 - j) We have already developed a digital transformation strategy and will start implementing it soon.
 - k) We have already developed a digital transformation strategy and have already started implementing it.
4. What do you expect from the implementation of the city digitalisation strategy?
- l) Improving the quality of life of residents thanks to universal access to broadband networks and Wi-Fi enabling easy and fast access to the Internet.
 - m) Improving the ecological condition of the city (lower dust, CO₂ and other pollution).
 - n) Facilitating keeping the city clean by using sensors signalling when garbage bins are full.
 - o) Optimisation of public transport due to transport efficiency, transport costs, reducing crowds during peak hours and increasing the comfort of traveling by means of transport.
 - p) Improving street traffic in the city thanks to applications informing drivers about traffic jams and traffic intensity on the streets.
 - q) Improving traffic flow through intelligent traffic control, parking space management and store delivery logistics.
 - r) Collecting tolls and parking fees at different amounts, depending on the time of day and traffic intensity.
 - s) Improving the safety of residents through intelligent monitoring with cameras activated by motion sensors instead of continuous operation.
 - t) Better quality of administrative services for citizens (e-office).
 - u) Improving the quality of medical services and health care (e-health).
 - v) Easier access to out-of-school education (e-education).
 - w) Improving safety in public places.
 - x) Activating residents to participate in social life.
 - y) Activation of companies to take action for the benefit of the local community.

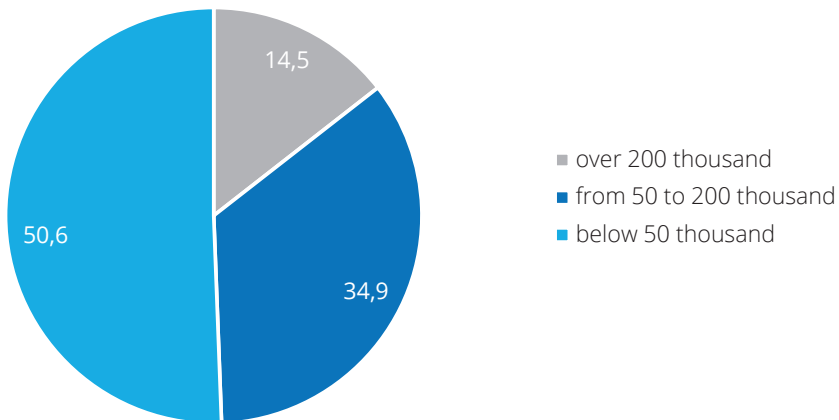
The survey was conducted in November-December 2019 by representatives of the city board of county cities and small towns. The method of telephone interviews (CATI) supported by the method of Internet interviews (CAWI) was

used. The study covered all county cities (48) and 41 small cities randomly (simple random sampling method) selected from a representative sample of 117 cities, in accordance with the structure of the entire surveyed population in terms of two criteria: city size and income per capita. As a result, 83 correctly completed questionnaires were received. The structure of cities in the sample by the number of inhabitants was as follows: large cities (200 thousand and more) inhabitants – 14.5%, medium-sized cities (from 50 to 200 thousand) inhabitants – 34.9%, and small cities (less than 50 thousand) inhabitants – 50.6%, which corresponds to the structure of cities in Poland (Chart 2).

CHART 2

The structure of the cities studied by the number of inhabitants in 2019

Structure of the examined cities by size (%), N=83



Source: own calculations.

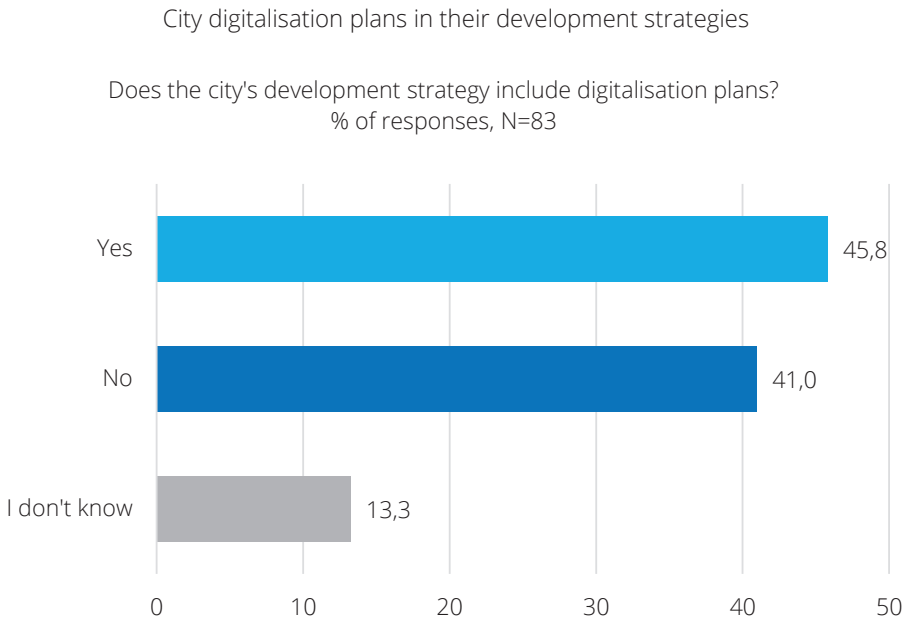
6. Research results

Statistical analysis including response rates, crosstabs and correlation analysis based on Pearson's correlation coefficient was performed.

Representatives of the city board managers answered the survey questions. The answers to the first research question, whether the city's development strategy takes into account the city's digitalisation plans, shows that the issue of digital transformation of the city is unimportant for the managers of 41% of the cities

surveyed. Only in 45.8% of the examined cities does the city development strategy include a digitalisation plan (Chart 3).

CHART 3



Source: own calculations.

Respondents answering the second question indicated the types of digitisation plans included in the city's development strategy. Most often, the digitalisation plans included in the strategies are focused on issues related to the implementation of intelligent public transport control solutions (70.3%), intelligent urban traffic control solutions to improve road traffic (70.3%), and intelligent solutions improving city monitoring to increase security (64.9%). This indicates a very narrow approach to the issue of digitalisation, although very pragmatic because it is focused on the problems that affect contemporary cities the most.

The answers to the third research question about the level of advancement or intentions to attempt to develop a city's digital transformation strategy show that relatively many cities (28.9%) intend to start work on the digitalisation strategy in the near future, 7.2% are currently working on such a strategy, and only 1.2% have a strategy developed and have started to implement it.

The surveyed city board representatives were also asked about their expectations regarding the digital strategy – fourth question in the survey. Most respond-

ents (65.3%) indicated improvement in the quality of administrative services for citizens (e-office), followed by improvement in the quality of life of the residents (63.9%) thanks to universal access to broadband networks and Wi-Fi connectivity enabling easy and quick access to the Internet. Improvement of safety in public places was indicated in third place (61.1%), improvement of the ecological condition of the city (lower pollution of dust, CO₂, etc.) in fourth (54.2%), and in fifth place (45.8%) was optimisation of public transport due to the efficiency of transport, transport costs, reduction of congestion during peak hours, and increased comfort of travelling by means of transport.

The correlation analysis of the responses in terms of the size and status of the studied city, carried out as part of the study, allowed for the detection of the existing dependencies and answers to the research questions. There is a relatively high, positive correlation between having city digitalisation plans in relation to the city size measured by the number of inhabitants (Pearson's R = 0.530, Spearman's ρ = 0.554). The larger the city, the more advanced it is in digitalisation planning (Table 1).

TABLE 1
Correlation between occurrence of digitalisation plans in the city's strategy and the city's size (number of inhabitants)

Analysis of the correlation between occurrence of a digitalisation plan in the city's development strategy and its size measured by the number of inhabitants: small city < 50 thousand inhabitants, medium-sized city 50–200 thousand inhabitants and large city > 200 thousand inhabitants.

Correlation	Value	Asymptotic standard error*	Approximate T**	Approximate significance
Pearson's R	0.530	0.079	5.621	0.000***
Spearman's ρ	0.554	0.080	5.993	0.000***
N observations	83	–	–	–

* without assuming the null hypothesis

** an asymptotic standard error was used, assuming the null hypothesis

*** based on an approximation of the normal distribution

Source: own calculations.

The study shows a relatively high, negative correlation between having city digitalisation plans in relation to the city affluence measured by total income per capita (Pearson's R = -0.481, Spearman's ρ = -0.562) (Table 2).

TABLE 2

Correlation between occurrence of digitalisation plans in city's strategy
in relation to city total income per capita

Analysis of the correlation between the presence of the digitalisation plan in the city's development strategy and the city total income per capita in three city categories: income per capita (in PLN) below 5,000.00, from 5,000.0–6,999.00 and 7,000.00 and more.

Correlation	Value	Asymptotic standard error*	Approximate T**	Approximate significance
Pearson's R	-0.481	0.065	-4.932	0.000***
Spearman's ρ	-0.562	0.073	-6.120	0.000***
N observations	83	–	–	–

* without assuming the null hypothesis

** an asymptotic standard error was used, assuming the null hypothesis

*** based on an approximation of the normal distribution

Source: own calculations.

A very low positive correlation (Pearson's $R = 0.031$, Spearman's $\rho = 0.148$) occurred between taking actions for the implementation of the city digitalisation strategy in relation to the total income per capita (Table 3).

TABLE 3

Correlation between activities undertaken for the implementation of the city's
digital strategy in relation to city's total income per capita

Analysis of the correlation between activities undertaken for the implementation of the city's digital strategy and the city's total income per capita in three city categories: income per capita (in PLN) below 5,000.00, from 5,000.0–6,999.00 and 7,000.00 and more.

Correlation	Value	Asymptotic standard error*	Approximate T**	Approximate significance
Pearson's R	0.031	0.121	0.275	0.784c***
Spearman's ρ	0.148	0.117	1.347	0.182***
N observations	83	–	–	–

* without assuming the null hypothesis

** an asymptotic standard error was used, assuming the null hypothesis

*** based on an approximation of the normal distribution

Source: own calculations.

7. Discussion

The empirical results confirmed that the size of the city is an indicator of the degree of involvement in the development of a strategy based on the digital transformation of the city. The results of the study show that for managers of the boards of the surveyed cities the issue of digital transformation is relatively unimportant. Only 45.8% of the surveyed cities have a digitalisation plan in their city development strategy. As many as 41% of cities did not take any action related to the development of a digitalisation plan. 28.9% of cities want to start working on a digitalisation strategy in the near future. Only 7.2% are currently working on such a strategy and 1.2% have already developed such a strategy and started implementing it. This last indicator is very low. Most often, digitalisation plans included in city development strategies are focused on issues related to the implementation of intelligent public transport control solutions (70.3%), implementation of intelligent urban traffic control solutions to improve street traffic (70.3%), implementation of intelligent solutions to improve urban monitoring to increase safety (64.9%). This indicates a very narrow approach to the issue of digitalisation, although very pragmatic because it is focused on the problems that most currently affect modern cities. The surveyed city management representatives were also asked about their expectations regarding the digital strategy. The greatest number of respondents, as many as 65.3%, indicated improving the quality of administrative services for citizens (e-office); in the second place (63.9% of responses) they indicated improving the quality of life of their residents thanks to universal access to broadband networks and Wi-Fi connections enabling easy and fast Internet access, in the third place (61.1% of responses) improving safety in public places, in the fourth place (54.2% of responses) improving the ecological condition of the city (lower dust, CO₂ and other pollution) and in the fifth place (45.8% of responses) optimization of public transport due to transport efficiency, transport costs, reducing crowds during peak hours and increasing the comfort of travelling by means of transport. As part of the correlation analysis of the responses obtained in relation to the size of the city and income per capita, the following relationships were demonstrated:

1. There is a relatively high positive correlation between having city digitisation plans in relation to the city's size measured by the number of inhabitants (Pearson's R 0.530). The larger a city is in terms of the number of inhabitants, the more advanced it is in digitalisation planning.
2. The study shows a relatively high negative correlation between having city digitisation plans and the level of total income per capita (Pearson's R -0.481).

The obtained result indicates that cities with lower income per capita have plans to digitise the city. From this we can draw the conclusion that the amount of total income per capita is not a factor determining whether a city has a digitalisation plan in its development strategy. It seems that this relationship should be confirmed on a larger research sample of cities.

3. A very low positive correlation occurred between taking actions to implement the city's digitisation strategy and the total income per capita. Hence the conclusion that taking actions to promote digitalisation does not depend on the level of income per capita in a given city. This is an encouraging conclusion indicating that taking actions related to the digitalisation plan in the city's development strategy depends more on the attitudes of city management managers than on the income per capita.

8. General remarks

Modern cities, by their nature, face serious challenges in terms of sustainable development; population concentration causes cities to consume large amounts of natural resources and produce large amounts of waste. One of the key factors positively influencing the sustainable development of cities is the use of digital technologies enabling the digital transformation of the city. To fully exploit the opportunities offered by digital technologies, cities should have a sustainable development strategy based on digital transformation.

Today, the smart city concept is still not very popular in Polish cities. Moreover, in many cities, this idea is reduced to the implementation of individual technological solutions, such as free Wi-Fi networks or traffic light control systems. Quite often, the actions intending to lead to the transformation into a smart city are ill-considered and inconsistent, and there is no action plan setting out the individual stages of transformation [Szymańska, Lewandowska, Korolko, 2019; Korenik, 2019]

The smart city formula is simplified to the implementation of modern technologies without simultaneously taking care of the sustainable development of the city which can be achieved through the digital transformation of the city. As Nicos Kominos rightly emphasized, any smart city can be digital, but digital cities are not necessarily smart.

Therefore, actions are needed to make people aware of the great opportunities for sustainable city development offered by modern digital technologies, if they are implemented comprehensively in all areas of the functioning of urban centers, including people, economy, environment, governance, living, and mobility. It is

particularly important to realize that the smart city idea is much more than just the implementation of ICT [Holland, 2008].

The presented research results make a cognitive contribution to science, indicating the possibility of identifying correlations between occurrence a digitisation plan in the city development strategy and the size of the city measured by the number of inhabitants and income per capita.

The research results are also of practical nature. It can be assumed that the survey results will increase the awareness of city managers about the possibilities of accelerating digital transformation to the benefit of the life and work of city residents. By developing and implementing digitalisation plans, cities will be able to realize the idea of sustainable development faster and achieve the goal of a smart, sustainable city. Increased awareness of city board managers about the need to include a digitalisation plan in their development strategy will have a positive impact and encourage them to take actions related to digital transformation.

Further research on larger samples of cities is needed to demonstrate the relationship between the presence of a digitalisation plan in city development strategies and the awareness and attitudes of city board managers depending on their position in the city management and their knowledge in the field of digital technologies.

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