The Security of the Local Community and Tourists Resulting from the Implementation of ICT in Cities: The Case of Poland

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Wioletta Wereda[1], Justyna Stochaj[2]

Abstract:

Purpose: *The aim of this article is to indicate ways of ensuring security for local communities in the context of ubiquitous and frequently used ICT technologies.*

Design/Methodology/Approach: *Both quantitative and qualitative research methods were used. The data for analysis were obtained using the diagnostic survey method using the questionnaire technique. More specifically, the CATI method was used to obtain the data, which made it possible to find out the opinions of the respondents via a telephone conversation. The respondents underwent statistical processing using the Statistica application. A Microsoft Excel spreadsheet was also used for the calculations. Correlations were calculated based on Pearson's chi square test. In addition, the study also used theoretical research methods, such as the analytical-synthetic method, abstraction was used to select the necessary elements for the analysis.*

Findings: *The changes taking place in the environment have had a great impact on the functioning of cities and their inhabitants. Cities, due to the excessive number of inhabitants and the resulting urbanization problems, must take steps to modernize and streamline their processes. It is possible thanks to the use of intelligent solutions.*

Practical Implications: *Contemporary cities struggle with many problems. Therefore, they must take steps to modernize and improve their processes. This is possible thanks to the use of the intelligent solutions presented in this article. One of them is basing the city safety assessment on many indicators. Examples include basing the assessment on KPIs (Key Performance Indicators) connected with the social well-being.*

Originality/value: *There are many articles about using ICT in cities but there is a lack of a publication fully devoted to the issue of ensuring the security of the local community in the context of implementing ICT in cities.*

Keywords: *Security of the population, local community, tourists, smart city, ICT technologies.*

JEL classification: *H7, H12, H56, L38.*

Paper Type: *Research study.*

[1]*PhD., Institute of Organization and Management, Faculty of Security, Logistics and Management/Military University of Technology, Warsaw, Poland,*
e-mail: *weredawioletta@tlen.pl;*
[2]*PhD., Institute of Security and Defense; Faculty of Security, Logistics and Management/Military University of Technology, Warsaw, Poland,*
e-mail: *justyna.stochaj@wat.edu.pl;*

1. Introduction

Guaranteeing the safety of the local community and tourists in expanding cities is a growing challenge. Especially since many cities are struggling with problems related to urbanization, such as population concentration problems and the over-consumption of energy (Neirotti, De Marco, Cagliano, Mangano, and Scorrano, 2014). Moreover, it is now expected that smart and sustainable cities (which are defined as integrating multiple technological solutions to improve their inhabitants' quality of life) will solve the problems that cities have today and are likely to have in the future. These include problems related to the safety of citizens and tourists, infrastructure protection, real estate vacancies, and road traffic, e.g. traffic jams and accidents (Komninos, 2002; 2017).

Today, more than half of the world's population lives in cities. It is predicted that by 2050 almost 70% (6.3 billion) of the world's population will live in cities (Czamanski and Broitman, 2017). There are great doubts as to whether it will be possible to place such a large population in cities (Fuller, Romer, 2014). Overcrowded cities can become dangerous places. Therefore, it is necessary to take appropriate steps to improve the safety of the communities inhabiting them. This is will be partially possible due to the use of ICT technologies. Modern information and communication technologies have improved the quality of communication. They allowed and still allow communication over distances and have contributed to the exponential increase in the volume of information exchange (Hilbert, 2012). They will also be used and developed in the future.

Thanks to the development of ICT, how people function in cities is changing. Many of them work from home and increasingly have flexible working hours (Alizadeh, 2012). This significantly influences the change of routes to work (Zhu, 2013) and the shape of cities. Information and communication technologies make life significantly easier, but their use may entail certain threats for the population. It should be emphasized that increasing numbers of countries and regions are using smart city solutions. It is an important element of city management's strategy and innovative concepts. The use of intelligent solutions contributes to solving the problem of rapid urbanization (Guo, Tang, and Guo, 2020).

The contemporary world is characterized by the fact that all achievements, evolutions, and advances in knowledge are closely related to the use of information and communication technologies and digital tools (Del Giudice, Caputo, Evangelista, 2016). Smart city movements are developing all over the world. They have also been created to solve many problems arising from urbanization (Mahesa, Yudoko, and Anggoro, 2019). Modern cities absorb almost three-quarters of the world's natural resources and generate three-quarters of its pollution and waste. As a result, they need to become smarter using innovative solutions to meet the challenges of large-scale urbanization. Consequently, ways of creating resident-

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friendly, competitive, and self-sufficient cities must be found (Hayat, 2016). It is estimated that there are around 240 smart cities with a population of over 100,000 in Europe alone (How many smart cities are there in Europe, 2020). Their number is growing not only in Europe, but also in the world, and will most likely continue to grow. The aim of this article is to indicate ways of ensuring security for local communities in the context of ubiquitous and frequently used ICT technologies.

2. Literature Review and Applied Research Methodology

2.1 Contemporary Concepts Related to Smart Cities and Intelligent Tourism

The concept of smart cities is very widely used. Currently, in the literature, there are many definitions of what smart cities are. These definitions are not always consistent and uniform. As a result, the differences between them are clearly visible. Selected definitions are presented in Table 1.

Table 1. Selected definitions of smart city

Author	Definition
(Smart Cities Study. International Study on the Situation of ITC, Innovation & Knowledge in Cities, 2020)	city that uses information and communications technology to make both its critical infrastructure, its components and utilities more interactive, efficient, making citizens more aware of them
(Caragliu, Nijkamp, 2009)	city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance
(Schaffers, Komninos, Palloot, Trousse, Nilsson, Oliveira, 2011)	a city may be called 'Smart' 'when investments in human and social capital and traditional and modern communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance
(MIT. Smart Cities Group, 2013)	systems of systems, and that there are emerging opportunities to introduce digital nervous systems, intelligent responsiveness, and optimization at every level of system integration
(Manville, Cochrane, Cave, Millard, Pederson, Thaarup, Liebe, Wissne, Massink, Kotterink, 2014)	city seeking to address public issues via ICT-based solutions on the basis of a multi-stakeholder, municipally based partnership
(Smart Cities Council. Smart Cities Readiness Guide, 2015)	a smart city uses information and communications technology to enhance its livability, workability, and sustainability
(Smart Cities and Communities. Key Messages for the High-Level Group from the Smart Cities Stakeholder Platform Roadmap Group, 2013)	Smart Cities combine diverse technologies to reduce their environmental impact and offer citizens better lives. This is not, however, simply a technical challenge. Organisational change in governments – and indeed society at large – is just as essential. Making a city smart is therefore a very multi-disciplinary challenge, bringing together city officials, innovative suppliers, national and EU policymakers, academics and civil society.

Source: Own work.

The definition of intelligent tourism has similar variety. The term has also had many different definitions. As a result, there are differences between the various definitions. Selected definitions of smart tourism are presented in Table 2.

Table 2. *Selected definitions of smart tourism*

Author	Definition
Phillips, SG.	can be understood as adopting a holistic, long-term and sustainable approach to the planning, development, service and marketing of tourism products and businesses
UN World Tourism Organization's (UNWTO) Tourism Resilience Committee	is clean, ecological, ethical and offering high-quality services
The Organisation for Smart Tourism in the U.K.	is the use and application of technology in the tourism sector
Molz, J.G.	represents a wider effort to imagine tourism as a form of deep civic engagement, not just a simple form of consumption
Ma, Y.; Liu, J.	is oriented towards human, ecology, science and technological innovation
Zhang, L.; Li, N.; Liu, M.	is based on a new generation of information and communication technology, aimed at meeting the needs of individual tourists for high-quality, satisfactory services that enable sharing and efficient use of tourism resources while promoting the integration of social resources
Shi, Y.	is a next-generation communication technology that combines cloud computing, networks and the Internet with personal mobile terminals and artificial intelligence

Source: *Elaboration based on Li, Hu, Huang, and Duan, 2017.*

In the field of smart tourism, research was conducted on the strategic use of information technologies in the tourism industry (Buhalis, 1998), providing information to the tourism market (Michopoulou and Buhalis, 2013), progress in tourism management (Law, Qi, and Buhalis, 2010), as well as competitive marketing of the future (Buhalis, 2000). In addition to the definition of smart tourism, the definition of a smart destination has been revised. Selected concepts are presented in Table 3.

Table 3. *Selected definitions of smart tourist destination*

Author	Definition
López de Ávila, A.	An innovative tourist destination, built on the basis of the most modern infrastructure, technology that guarantees the sustainable development of tourist areas to which everyone has access, which facilitates the interaction of the guest and integration with the environment, increases the quality of experience at the destination, and improves the quality of life of residents
Lamsfus, C., Martin, D., Alzua-Sorzabal, A., Torres-Manzanera, E.	can strengthen the position of organizations managing destinations, local institutions and tourism companies to make decisions and actions based on the obtained data at the destination, which is collected, managed and processed using ICT technologies using infrastructure including intelligent systems, cloud computing, related data , social

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	networks, internet of things and mobile applications
Lamsfus, C., Xiang, Z., Alzua-Sorzabal, A., Martin, D.	should be considered in the context of mobile systems
Gretzel, U., Werthner, H., Koo, C., Lamsfus, C.	part of the broader idea of a smart tourism ecosystem

Source: *Elaboration based on: (Vargas-Sánchez, 2016).*

In the field of security in the context of the functioning of smart cities and the use of ICT technologies in them, research was conducted on the protection of processed data in smart cities (Popescul and Radu, 2016), cybersecurity (Efthymiopoulos, 2016; Elmaghraby and Losavio, 2014), crowd detection (Fernandes, Silva, Analide, and Neves, 2018), security and privacy of applications used in smart cities (Zhang, Ni, Yang, Liang, Ren, and Shen, 2017), as well as challenges related to ensuring security in cities (Braun, Fung, Iqbal, and Shah, 2018).

Smart cities are based on a new city management model and management concepts. First and foremost, smart cities make full use of information and communication technologies to detect, analyze, and integrate the underlying systems of urban operations, as well as to intelligently respond to activities related to environmental protection, public safety, and urban services. These cities create better living conditions for the urban community (Appio, Lima, and Paroutis, 2019) and significantly improve their quality.

Nowadays, smart cities are expected to reduce costs, increase efficiency, and automate services with the help of the Internet and IT services. Moreover, it is assumed that the use of intelligent solutions will create an active channel for forging connecting with citizens in a more effective and pragmatic way (Cai, Haung, Lin, Nie, and Tan, 2009). The socio-economic changes taking place in the information age have a huge impact on societies, as well as on lifestyle, the environment, and urban amenities (Lee, Yigitcanlar, Han, and Leem, 2008). Population changes dynamically in cities. As they grow, cities face the problem of increasing numbers of cars, and this, in the absence of infrastructure modernization and the implementation of intelligent solutions, causes road congestion and longer commutes. This significantly contributes to the increase in exhaust emissions and the deterioration of the urban environment (Hymel, 2009). Consequently, the city's inhabitants' health has deteriorated.

In addition, many cities are struggling with the problem of population density growth. This is conducive to increasing the number and the intensity of threats due to anonymity and weaker interpersonal ties between the inhabitants of a large urban agglomeration (Wieteska-Rosiak, 2015). In many cities, a program has been implemented to prevent crime through appropriate environmental design. The essence of this program is based on the assumption that appropriate design and development of the environment contributes to a reduction in crime levels, an

increase in the sense of security, and an improvement the inhabitants' quality of life (Łojek, 2004).

Megacities with problems related to the environment, crime prevention, and disaster prevention have dynamically developed intelligent solutions aimed at solving identified problems (Lee, Hancock, and Hu, 2014). Contemporary cities offer many opportunities, but it should be emphasized that they also encounter numerous problems. As a result of the globalization of the urban economy, cities increasingly must directly compete with global and regional economies for international investment that can generate new jobs as well as increase income and funds for development. There are also cities that cannot compete with the larger ones due to low productivity, economic instability, and poverty, as well as inequality and social conflicts. They have no way of gaining access to investments and sources of income for development. This has an impact on their citizens' productivity and quality of life (Basiri, Azim, and Farrokhi, 2017), as well as on their safety.

To address the problems identified in cities, some authors propose a multi-index approach to ranking and prioritizing urban safety issues, such as crime number, population-based crime rates, risk-based crime rates, crime density, and location factors (di Bella, Corsi, and Leporatti, 2015).

However, some authors believe that the assessment of the city is the most important element, for which the so-called key performance indicators are based on the Social Wellbeing Index (Hara, Nagao, Hannoe, and Nakamura, 2016). One of the key achievements in building a smart community is the creation of a community learning center in information and communication technologies (Sari, 2019). Many of today's technologies are not intuitive to use. This necessitates training in the scope of their application.

Another type of solution that improves safety in the city is an intelligent crime prevention service. This solution can be applied to the four functional areas of the intelligent system, such as intelligent video surveillance, surveillance of suspicious vehicles, hazard warnings, and unusual noise sources. This crime prevention service may be used, inter alia, in the prevention of sudden threats, violence, kidnappings, and the use of suspicious vehicles, explosions, collisions, and sudden events (Park and Lee, 2020). City security architecture is often considered in terms of situational crime prevention and defense space. Some researchers argue that the emergence of smart cities and intelligent technologies forces a broader conceptualization of security design. Above all, they recommend that security architecture be rethought in terms of pastoral authority in the context of Foucault's concept of governing individuals and populations through care and protection (Schuilenburg and Peeters, 2018).

A good solution to improve safety in cities is video surveillance, which is an integral

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part of the modern world. Its use increases the sense of the population's security, but it should be remembered that it also generates specific threats (Socha and Kogut, 2020). Sometimes, the use of monitoring causes criminals to move to other places. As a result, only selected elements of city are safe element.

Another way to improve the population's security is to properly secure smart cities against cyber-attacks (Elmaghraby and Locavio, 2014). In these cities, it is natural to use devices that enable payment for various services, e.g. entertainment. Many of these devices' security features contain vulnerabilities that could reveal private user data and be used to spy on or distribute malicious code. Another example is the use of smart radars, which are also not well secured. As a result, it is likely that malicious users will easily gain access to the installed cameras and manipulate the data collected (Shekhar, 2016). In the light of ubiquitous and cheaper technologies, the key importance in interpersonal communication, which uses various devices, is securing the transmitted information. In this context, it is important to create security boundaries by establishing information security and, more specifically, by creating an environment that enables information security in interpersonal communication. Modern communication tools are vulnerable to attacks aimed at data theft. It is therefore important to ensure that personal communication protects the user's information content (Breda and Varga, 2019).

Some researchers have attempted to provide guidelines, suggestions, and comments on possible ways to meet the challenges of the digital age (Leeflang, Verhoef, Dahlström, and Freundt, 2014; Eshet, 2012). Others have paid particular attention to possible ways to use new technologies to solve new and old problems (Bijker, Hughes, Pinch, and Douglas, 2012). As time goes on and technology is modernized, it is becoming increasingly better at solving recurring problems.

Despite the different pathways adopted to overcome emerging problems, sustainable urban development is of key importance for the population's security. Research is being conducted into smart city approaches and tools for sustainable development (Angelidou *et al.,* 2018). Smart and sustainable cities will have to face the following challenges to solve at least some of the problems in cities:

- Defining the methods, practices, and strategic assessments of a smart city.
- Introducing mitigation measures for the over-consumption of resources.
- Finding the right combination of interventions to achieve goals.
- Ensuring the local government's advanced strategic competence in order to precisely define the city's needs.
- Managing and coordinating stakeholders in smart, sustainable cities (Höjer and Wangel, 2015).

To sum up, the literature review did not find any publication entirely devoted to the analyzed topic. However, publications were found that partially refer to the issue

under study. The authors will mention the most useful publications for topic.

2.2 Methodology of the Research

Taking into account the review of the literature on the subject and the lack of a publication fully devoted to the issue of ensuring the security of the local community in the context of implementing ICT in cities on the example of Poland, it was decided to solve the following research problem: What are the ways of ensuring the safety of the population in cities in the context of using ICT? The following working hypothesis was formulated for the main research problem: It is assumed that many complicated problems arise because of the implementation of ICT in cities. Therefore, it is necessary to implement modern and intelligent solutions that will contribute to their solution. These solutions particularly include monitoring. The following specific problems were formulated for the identified main research problem: 1) What is the relationship between smart cities and the ICT technologies used in them? 2) What are the benefits to the city and its inhabitants as a result of the implementation of ICT and what aspects are centered on security? 3) What is the impact of the use of ICT in the city on its various areas' functions?

Both quantitative and qualitative research methods were used. The data for analysis were obtained using the diagnostic survey method using the questionnaire technique. More specifically, the CATI method was used to obtain the data, which made it possible to find out the opinions of the respondents via a telephone conversation. The data was obtained in July 2019. Correlations were calculated based on Pearson's chi square test. In addition to the empirical method, the study also used theoretical research methods, such as the analytical-synthetic method, which was used to perform the critical analysis of the literature on the subject. Moreover, abstraction was used to select the necessary elements for the analysis. The data obtained from the survey questionnaire was compared with the recommendations in the field of city safety. Generalization and inference were used to formulate conclusions.

According to data from the Central Statistical Office (June 2019), there were 223 medium-sized and large cities in Poland. This includes 184 medium-sized cities (136 class IV cities with 20 to 50 thousand inhabitants and 48 class V cities with 50 to 100 thousand inhabitants) and 39 large cities (22 class VI cities with 100 to 200 thousand inhabitants and 17 class VII with over 200 thousand inhabitants) (Statistica – Przewodnik, 2008). 80 administrative entities agreed to participate in the study out of all the medium and large cities.

2.3 Characteristics of the Respondents

80 representatives from medium and large cities participated in the study. Medium-sized cities dominated (63). Moreover, older cities with a history of over 500 years formed the largest portion of the study. The list of cities participating in the study is

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presented in Table 4.

Table 4. *General characteristics of the respondents*

City features		Cluster		Total
		Medium cities	Large cities	
Size of population	20–50 th	42	0	42
	50–100 th	21	0	21
	100–200 th	0	11	11
	Over 200 th	0	6	6
Total		63	17	80
Age	Up to 100 y.o.	13	2	15
	101–300 y.o.	6	2	8
	301–500 y.o.	5	0	5
	501–700 y.o.	18	5	23
	701–900 y.o.	16	8	24
	Over 900 y.o.	3	2	5
Total		61	19	80
City name	Kołobrzeg, Koszalin, Białogard, Stargard, Mrągowo, Olsztyn, Augustów, Giżycko, Zambrów, Zamość, Biała Podlaska, Puławy, Kraśnik, Kędzierzyn Koźle, Strzelce Opolskie, Głogów, Legnica, Dzierżoniów, Wrocław, Jelenia Góra, Piła, Gostyń, Gostyń, Turek, Konin, Krotoszyn, Dopiewo, Luboń, Lublin, Gniezno, Słupsk, Wejherowo, Gdańsk, Brodnica, Malbork, Kwidzyn, Tuchola, Żyrardów, Opoczno, Bełchatów, Piotrków Trybunalski, Radomsko, Aleksandrów Łódzki, Skarżysko-Kamienna, Częstochowa, Lubliniec, Libiąż, Olkusz, Jastrzębie-Zdrój, Rybnik, Żory, Tarnowskie Góry, Mikołów, Łaziska Górne, Sosnowiec, Dąbrowa Górnicza, Bytom, Ruda Śląska, Gliwice, Ostrów Mazowiecka, Łuków, Mińsk Mazowiecki, Kutno, Płońsk, Płock, Wołomin, Ożarów Mazowiecki, Zakopane, Rzeszów, Przemyśl, Stalowa Wola, Tarnów, Dębica, Dębica, Jasło, Krosno, Myślenice, Kraków (poviat), Kraków, Skawina.			
Gender of the president / mayor of the city	Woman	6	2	8
	Man	57	15	72
In total		63	17	80
Voivodship	Dolnośląskie	3	2	5
	Kujawko-Pomorskie	2	0	2
	Lubelskie	5	1	6
	Lubuskie	0	0	0
	Łódzkie	6	0	6
	Mazowieckie	7	0	7
	Opolskie	2	0	2
	Podkarpackie	6	1	7
	Podlaskie	2	1	3
	Pomorskie	4	0	4
	Świętokrzyskie	1	0	1
	Warmińsko-mazurskie	2	1	3
	Wielkopolskie	9	0	9
	Zachodniopomorskie	3	1	4
	Małopolskie	5	3	8
	Śląskie	6	7	13
Total		63	17	80
City function - dominant type of	Industrial	14	1	15
	Commercial	2	0	2

City features		Cluster		Total
		Medium cities	Large cities	
activity	Service	8	2	10
	Recreation and tourism	8	1	9
	Industrial and service	25	12	37
	Religious object	1	0	1
	Other	5	1	6
Total		63	17	80

Source: *Own study based on a diagnostic survey method using the questionnaire study technique.*

Most of the cities had presidents or mayors who were men (72). Men as representatives of the cities dominated both in the group of medium-sized cities (57) and large cities (15_ (see Table 4). Representatives of cities from almost all of the voivodships participated in the study. The exception was the Lubuskie Province. Of the remaining ones, at least one city was tested, and in some it was possible to test more of them, e.g. in the Śląskie Province, 13 were tested (see Table 4).

The dominant type of urban activity of the cities participating in the study was industrial and service activities (37). Industrial activity (15) and service activity (9) also deserve attention (see Table 4). Other respondents also indicated towns with a spa, service, and tourist character; settlement, trade, and service character; and agricultural and service character.

3. Results

3.1 Smart Cities and ICT Technologies

There is no universal definition of a smart city (O'Grady and O'Hare, 2012). Moreover, there is a conceptual ambiguity in the meaning of the term, smart city. The authors disagree as to the methods that a city should use to become intelligent (Glasmeier and Nebiolo, 2016; Vanolo, 2014; Lombardi, Giordano, and Farouh, 2012). Smart cities are developing through elements such as the Internet of Things, cloud computing, big data, mobile Internet, and other next-generation technologies enabling information exchange and communication. In a smart city, data resources from various fields are integrated and applied in practice (Wu, Sun, and Wu, 2020). The functioning of smart cities is primarily based on the development and application of information and communication technologies, which are related to various disciplines and areas of social life (Wu and Chen, 2019).

In smart cities, information and communication technologies are used in real-time calculations and processing of data on inhabitants and city facilities (Makoza, 2019). Digital information technology enables the implementation of a tool for efficient and effective management and planning of urban space. It can be used in the fields of transport, environment, public facilities, and the provision of advanced services to

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citizens. Contemporary possibilities of information and communication technologies are increasing. It seems that digital technology is crucial to the smart city planning strategy (Kourtit, Nijkamp, and Steenbruggen, 2017). Today, it is desirable for ICT to largely create successful smart and sustainable cities (Graham and Marvin, 1996). Information and communication technologies are therefore closely related to smart cities, and they form their key element.

Information and communication technologies may play a key role in the evolution of sustainable urban development in the future. This is because these technologies have features that will contribute to a less material-consuming economy and, consequently, reduce the environmental impact of economic growth. In most cases, smart yet sustainable cities focus on whether and how smart city tools, applications, and platforms contribute to its sustainable development (Hilty, Lohmann, and Huang, 2011). At the same time, it should be noted that sustainable development allows the city to develop with the lowest environmental losses.

Information and communication technologies, as well as sustainable development, are considered to enable the development of smart cities and smart urban planning, as well as smart growth (Bifulco, Tregua, Amitrano, and D'Auria, 2016). The Integrated Approach to Smart City focuses on creating an enabling environment where people's capabilities are developed using fast and real-time technology and information. The creation of such an environment favors the appearance of advanced forms of urban intelligence (Datta, 2015).

3.2 Benefits as a Result of the Implementation of ICT Technologies

The respondents were asked to indicate the benefits for the city resulting from the use of selected ICT technologies. The respondents could choose up to 6 of the proposed answers. Almost 79% of respondents indicated that the main benefit is the improvement of administrative processes and security in the office. The following improvements indicated by more than half of the respondents included the improvement of communication in the office (69%), the increase of innovative solutions in the city (68%), the improvement of communication between the office and external entities, e.g. investors (55%), the improvement of communication between the office and clients (54%), and improving the processes of contacts with regulating and governmental institutions (51%).

Statistical dependencies between all the answers to the question about the benefits for the city because of the use of ICT were examined. Statistically significant relationships were found; the strength of which was defined as weak between the following:

- The increase in the number of investors in the city, and the respondents' major: management, economics (p = 0.04991, Fi = 0.2192143).

- The improvement of administrative and security processes in the office, and the field of public administration completed by the respondents (p = 0.04070, Fi = 0.2288171).
- The improvement of administrative and security processes in the office, and the gender of the respondents (p = 0.04968, Fi = 0.2194370).
- The improvement of administrative and security processes in the office, and the improvement of the respondents' knowledge area related to obtaining European funds (p = 0.03170, Fi = -0.240170).
- The improvement of the contact processes with supervisory and government institutions, and those remaining outside the indicated areas of improving the respondents' knowledge (p = 0.02430, Fi = 0.2518226).
- The increase in innovative solutions in the city, and the improvement of the respondents' knowledge in terms of regulations and laws (p = 0.01582, Fi = -0.269795).
- The growth of innovative solutions in the city and the improvement of the respondents' knowledge area in the field of human resources management (p = 0.02558, Fi = -0.249611).
- The improvement of communication in the office and the field of study of public administration completed by the respondents (p = 0.04524, Fi = 0.2238750).
- The improvement of communication in the office and the improvement of the respondents' knowledge of the problems related to the city's functioning (p = 0.03278, Fi = 0.2386703).
- The improvement of communication in the office and the improvement of the respondents' knowledge area in the field of quick and accurate decision-making (p = 0.03934, Fi = 0.230382).
- The improvement of communication in the office and the improvement of the respondents' knowledge area in terms of the possibility of implementing smart solutions in the city (p = 0.04217, Fi = 0.2271680).
- The improvement of communication with external entities (investors, business partners, etc.), and the improvement of the respondents' area of knowledge in the field of marketing (p = 0.03671, Fi = 0.2335497).
- The improvement of communication with external entities (investors, business partners, etc.), and the improvement of the respondents' knowledge area in the field of ICT (p = 0.03141, Fi = -0.240583).
- The increase in employee involvement and the respondents' level of education (p = 0.02741, Fi = 0.2998682).
- The increase in employee involvement and the improvement of the respondents' knowledge of foreign languages (p = 0.01965, Fi = 0.2608313).
- The increase in employee involvement and the improvement of the respondents' knowledge area in the field of human resources management (p = 0.02896, Fi = 0.2441784).
- Increasing the effectiveness of the processes that create work efficiency and

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improving the respondents' area of knowledge in the field of economy (p = 0.02892, Fi = 0.2442475).

- The faster implementation of the city development strategy and improving the respondents' knowledge of the problems of the city's functioning (p = 0.01547, Fi = -0.270699).

Moreover, statistically significant relationships were found the strength of which was defined as the average between the following associated benefits:

- The increase in the number of investors in the city and the improvement of the respondents' knowledge of provisions and laws (p = 0.00290, Fi = 0.3329569).
- The growth of innovative solutions in the city, and the improvement of the respondents' knowledge of the field of marketing (p = 0.00206, Fi = -0.344541).
- The increase in innovative solutions in the city and the improvement of the respondents' knowledge of foreign languages (p = 0.00550, Fi = -0.310367).
- The increase in innovative solutions in the city and the improvement of the respondents' knowledge of interpersonal skills (p = 0.00423, Fi = -0.319823).
- The growth of innovative solutions in the city, and the improvement of the respondents' knowledge of quick and accurate decision-making skills (p = 0.00250, Fi = -0.337963).
- The improvement of communication in the office and the improvement of the respondents' knowledge of interpersonal skills (p = 0.00712, Fi = 0.3008663).
- The improvement of communication in the office and the improvement of the respondents' ability to delegate tasks to subordinates (p = 0.00313, Fi = 0.3302891).
- Increasing the effectiveness of the office work efficiency processes, and the gender of the person holding the position of the mayor or city president (p = 0.00019, Fi = -0.417899).
- The faster implementation of the city's development strategy and the city's function (p = 0.01481, Fi = 0.4445407).

In addition, a statistically significant relationship was found the strength of which was defined as high between the benefit associated with the increase in employee involvement and the voivodship of respondents (p = 0.02202, Fi = 0.5760811). This benefit was indicated by the respondents from the following voivodships: Dolnośląskie (18%), Lubelskie (18%), Małopolskie (18%), Pomorskie (27%), Warmińsko-Mazurskie (9%), and Wielkopolskie (9%).

The analysis particularly focused on relationship between the answer indicating the

increase in public safety in the city as a benefit resulting from the use of ICT in cities, and the characteristics of the respondents (the answers to the questions included in the specification). As a result, a statistically significant correlation was found between the improvement of public safety in the city and the position taken by the person filling the questionnaire, p = 0.03342. This relationship was assessed as weak: Fi = 0.2914915. Functional managers or chiefs (83%) more often than executive bodies (mayor, president, and their deputies; 17%) indicated a benefit related to improved safety. No secretary pointed out this advantage.

The increase in public safety in the city was most often indicated by people who lived in medium-sized cities (20–50 thousand, 67%; 50–100 thousand, 25%). In the case of large cities (over 200,000) it was 8%. The respondents living in cities from 100,000 to 200,000 residents did not indicate this benefit.

The cities whose representatives indicated a security benefit include Dopiewo, Wejherowo, Bełchatów, Libiąż, Tarnowskie Góry, Ostrów Mazowiecka, Mińsk Mazowiecki, Płońsk, Ożarów Mazowiecki, Stalowa Wola, Dębica, and Kraków.

In the case of cities where the benefit related to increasing public safety in the city was indicated, the majority of persons holding the office of president or mayor were men (92%). In the case of cities where this function was performed by women, the improvement of safety in the city was indicated by 8% of the respondents.

Increasing public safety in the city as a benefit resulting from the use of ICT was indicated by respondents from the following voivodships: Łódzkie (8%), Małopolskie (17%), Mazowieckie (33%), Podkarpackie (17%), Pomorskie (8%), Śląskie (8%), and Wielkopolskie (8%). The benefit related to the improvement of safety was noted by respondents who came from cities where the key functions of the city were defined as industrial (17%), service (17%), recreation and tourism (8%), industrial and services (33%), and others (25%).

People with higher education more often indicated the benefit related to improving safety in the city (92%). This benefit was also marked by people with higher education and a title (8%). In turn, among all people with higher education, this benefit was indicated by 17%, and among people with higher education, it was only 7%. The answers given by the respondents in this regard are puzzling, as it was assumed that people with higher education should be aware of the benefits of using ICT in the city for its security. However, taking the field of study completed by the respondents into account, hardly anyone had graduated from the field of security; therefore, these answers should not come as a surprise.

Among the people who graduated from the field of public administration, 31% of respondents indicated this benefit. Among the people who graduated in management, only 13% noticed this benefit. Among the other fields of study, this

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benefit was indicated by people who graduated from political science, history and management, international project management, environmental engineering, and technical faculties. Of the people who indicated a benefit related to improving safety in the city, 33% were women and 67% men. Moreover, among the people who opted for this benefit, the majority were aged up to 45 (58%). The next largest group were people aged 56–65 (25%) and people aged 46–55 (17%).

3.3 The Impact of ICT on City's Functions

In the study, respondents were asked to assess the strength of the impact of ICT on individual elements related to the city's functions. No impact was indicated in any of the items proposed to respondents. The respondents assessed that each of the proposed elements was influenced by ICT. A large proportion of respondents assessed that ICT has a very large impact on the following: disseminating information about the city, 47%; sharing data, promoting the city, and creating its image, 44%; information and knowledge about interested parties (e-administration), 39%; and speed and effectiveness of customer service processes in the office, 36%.

The selected elements which, in the opinion of the respondents, were influenced to a large extent were as follows: the overall efficiency of city hall's work, 58%; the dissemination of data, information, and knowledge among employees, 52%; the standard of living and the well-being of the inhabitants, 49%; creating office safety procedures and standards, 46%; effectiveness of monitoring, forecasting, and planning city activities, 42%; promotional activities for the city and creating its image, 42%; speed and efficiency of customer service processes in the office, 42%; disseminating information about the city, 41%; building a repository for data, information, and knowledge, and data security, 36%; innovative processes implemented in the city, 36%; sharing data, information, and knowledge with clients (e-administration), 35%; reducing bureaucracy and increasing the security of information flow, 34%; and obtaining data about investors, 32%.

The following responses from respondents deserve special attention, as they indicate a large or very large impact from ICT: disseminating information about the city, 88%; sharing data, promoting the city, and creating its image, 86%; speed and efficiency of customer service processes in the office, 79%; and information and knowledge shared with interested parties (e-administration), 74%.

A large group of respondents assessed the impact of ICT at an average level in the following areas: city infrastructure development, 38%; acquiring data about investors, 32%; population growth, 31%; and innovative processes implemented in the city, 31%. The area where respondents felt that technology has little influence was an increase in the population, 33% (see Table 5).

Table 5. *The impact of ICT in the city on individual elements related to its functions as assessed by respondents (data in%)*

	0	1	2	3	4	5
Acquiring data about investors	0	5	13	32	32	12
Development of the city's infrastructure	0	1	7	38	26	22
Disseminating information about the city	0	1	1	4	41	47
The standard of living and the well-being of the inhabitants	0	5	6	18	49	16
Population growth	0	33	20	31	9	1
Creating procedures and safety standards for the city's offices	0	1	7	19	46	21
Building a data, information, and knowledge repository and data security	0	8	4	25	36	21
Disseminating data, information, and knowledge among employees	0	0	2	19	52	21
Sharing data, information, and knowledge with interested parties (e-administration)	0	0	4	16	35	39
Effectiveness of monitoring, forecasting, and planning city activities	0	0	1	26	42	25
The city's promotional activity and creating its image	0	0	1	7	42	44
Speed and efficiency of customer service processes in the office	0	0	1	14	42	36
Overall effectiveness of city hall's work	0	0	2	19	58	15
The financial liquidity of the city	0	14	12	28	25	15
Innovative processes implemented in the city	0	1	7	31	36	19
Reducing bureaucracy and increasing the security of information flow	0	8	14	24	34	13

Note: *Values from 0 to 5: 0 means no influence; 1, very little; 2, little influence; 3, medium influence; 4, big influence; and 5, a very big influence.*
Source: *Own study based on a diagnostic survey method using the questionnaire study technique.*

The statistical relationships between all the answers to the question about the impact of ICT on the various elements of the city's functions were examined. Statistically significant relationships were found; the strength of which was defined as weak between the influence of technology on the dissemination of information about the city and the gender of the person holding the office of the city president or mayor (p = 0.04391, Fi = 0.3500283).

Moreover, statistically significant relationships were found; the strength of which was defined as the average between the influence of technology on the following:

- Obtaining data about investors and improving the knowledge area of respondents in the field of foreign language skills (p = 0.03747, Fi = 0.3567628).
- Obtaining data about investors and improving the area of respondents' knowledge in terms of indicating answers as other (p = 0.00727, Fi =

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0.4184628).
- Population growth and the field of study completed by the respondents: management, economics (p = 0.00670, Fi = 0.4212233).
- Building a repository of data, information, knowledge, and data security, and improving the respondents' knowledge area in terms of the ability to make accurate and quick decisions (p = 0.03257, Fi = 0.3625713).
- Building a repository of data, information, knowledge, and data security, and improving the respondents' knowledge area in terms of the ability to delegate tasks to subordinates (p = 0.00926, Fi = 0.4100733).
- Effectiveness of monitoring, forecasting, and planning city activities, and the gender of respondents (p = 0.00511, Fi = 0.3998843).
- Effectiveness of monitoring, forecasting, and planning city activities, and improving the area of respondents' knowledge in terms of indicating answers as other (p = 0.00107, Fi = 0.4489312).
- Promotional activities for the city and creating its image and improving the area of respondents' knowledge in terms of indicating the answers as other (p = 0.00091, Fi = 0.4536141).
- Overall work efficiency of the city hall and the position held by the respondent (p = 0.02185, Fi = 0.4301436).
- The city's financial liquidity and the age of the respondents (p = 0.03507, Fi = 0.4549296).
- The city's financial liquidity, and the improvement of the respondents' knowledge area in the field of ICT (p = 0.00063, Fi = 0.4934621).
- Innovative processes implemented in the city, and the age of the respondents (p = 0.02101, Fi = 0.4747277).

Taking into account the considerations in the literature on the impact of ICT on individual elements related to the functioning of cities, it can be concluded that their impact is large or very large. For example, the elements related to the improvement of the safety of the population, the development of the city and its infrastructure, and the innovative processes implemented in the city. As a result of the conducted study, the considerations conducted by other researchers were largely not confirmed. Only a smaller proportion (not exceeding 50% of the respondents) assessed that ICT technologies used in cities have a large impact on issues related to the security of the city hall, data security and information flow security. In addition, they assessed that ICT has an average impact on the development of the city's infrastructure and a medium and high impact on innovative processes implemented in the city.

3.4 Limitations of the Study

Several major limitations were identified in this study. The conducted study has not provided in-depth information on the benefits for population security as a result of the implementation of ICT in cities. The respondents only referred to the proposed

answers, and rarely presented their proposed answers. It should be emphasized that, in the case of any doubts, it was possible to ask the respondent for additional explanation about the answers they had provided. Moreover, in opinion polls there is always a risk of making false judgments or expressing something in an exaggerated manner. In addition, efforts were made to conduct the survey in all provinces in the country, although this was not achieved.

4. Conclusions

As a result of the conducted research, the main research problem was solved: What are the ways of ensuring the populations' safety in cities in the context of the use of ICT? The working hypothesis assumed for this research problem was positively verified, but in the opinion of the authors it requires supplementing. It was confirmed that the changes taking place in the environment exerted a great influence on the functioning of cities and their inhabitants. Due to the excessive number of inhabitants and the resulting urbanization problems, cities should take steps to modernize and streamline their processes. This is possible thanks to the use of intelligent solutions, such as basing the city's safety assessment on many indicators.

Examples include focusing the assessment on KPIs based on social well-being. Another is to create a place where the community can learn to use newer types of technology. Another solution is to introduce an intelligent crime prevention service in the city. This solution is related to the four functional areas of the intelligent system: intelligent video surveillance, surveillance of suspicious vehicles, hazard warnings, and unusual noise sources. The use of modern solutions based on computer systems requires appropriate security. It is necessary to ensure their protection against the malicious actions of third parties, as well as to properly secure the data sent by the city's population, particularly regarding personal data. In the case of tourists, it is particularly important to guarantee safety in the areas of car transport and rest by the water (Szczęsny, 2014; Woźniak and Wereda, 2018).

As a result of the conducted research, the formulated detailed research problems were also solved. First, the relationship between smart cities and the ICT technologies used was indicated. It turns out that the functioning of smart cities is primarily based on the development and use of information and communication technologies. Therefore, these technologies are both an element and the foundation of smart cities. Secondly, it was determined what benefits the city and its inhabitants achieve because of the implementation of ICT technologies, including the question of security. It should be stated that the smart city in the initial period of the development is referred to the usage of modern technologies, primarily in the area of communication, information and security in the space of high density, which is the city (Korneć and Wereda, 2018). The vast majority of respondents indicated that the main benefits include the improvement of administrative processes and security in the office, the improvement of communication in the office, the improvement of

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communication between the office and external entities (e.g. investors), the improvement of communication between the office and clients, and the improvement in the contact processes with supervisory and supervisory governmental institutions. Interestingly, an increase in public safety in the city was also noticed by the respondents, but only by a small group. Third, the research checked the impact of the use of ICT in individual areas of the city's functions. The following responses from respondents deserved particular attention, as they indicated a large or very large ICT impact on the city: disseminating information about the city, sharing data, promoting the city and creating its image, speed and efficiency of customer service processes in the office, and providing information and knowledge to interested parties (e-administration).

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