Academics perception of public areas video surveillance in smart cities

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Abstract: The growing trend of the urban population looks for the formation of the concept of Smart Cities, based on the principles of sustainable development, which will meet the needs of people who live in them. The city must develop its public service infrastructure to provide all the requirements for the population. One of the requirements, people living in cities is the security of public areas managed by the city. The system of video surveillance, public areas should contribute to the personal safety of citizens, children and traffic, reducing the rate of crime and more efficient operation of public services. This research aims to examine academics' opinions (perceptions) about the impact of security cameras on increasing security within the concept of Smart Cities. The research had conducted on the territory of Serbia through an online survey. The obtained data were processed statistically by Chi-square and T-test,

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ANOVA method, multiple regression and correlation using SPSS application. The research indicates that academics much more believe in the contribution of video surveillance, reducing the crime rate, than studies of the effectiveness of the use of video surveillance shows. Video camera monitoring accelerates the reactions of competent services, but video camera recordings have not always been accepted as evidence in court.

Keywords: smart city concept, public safety, personal security, video surveillance.

1. Introduction

With the development of transport and new I.T., globalisation has influenced the world to connect more and more globally, in everyday activities, life and work throughout the entire human population. In this integration process, national economies are becoming increasingly dependent on each other and several other factors. Factors that provide certain economic benefits of technology development also refer to resources, ecology, human rights, political conflicts, and war actions. The consequence of global connectivity is that all disagreements, conflicts and crises of a local character spread rapidly, from one part of the hemisphere to another, creating global multiplication effects, which are difficult to predict fully.

Population growth, climate change, pollution and depletion of natural resources will increase the problems and tensions of the human population. There is a global trend of increasing the number and size of urban settlements (primarily cities) at the expense of rural, which set special conditions in their further sustainable development of human civilisation. According to (Ritchie H. 2020), in 2016, 54% of the human population lived in urban settlements. In 2018, that percentage increased to 55%. By the year 2050, more than two-thirds of people will live in urban settlements. Cities occupy about 1% of the global area. The same source states that the migration of the population from rural to urban settlements lies in the hope that people in urban settlements will be wealthier and have better living conditions.

It is necessary to define a sustainable, multi-dimensional concept of fast-growing cities to develop adequate infrastructure. The role of this concept is to create a specific flexible model that should meet the requirements of sustainable development of different cities and, following the requirements of development, help create adequate infrastructure.

2. Literature review

"Sustainable Development", according to the United Nations (U.N.), i.e. as determined according to "Bruntland Commission Report, represents "development that meets the needs of the present, without compromising the ability of future generations to meet their own needs" (United Nations, 1987, p.39; Emas, 2015, p.1; Ilić et al. 2020; Günther, 2020).

Authors Ilić et al. (2020) view the concept of Smart Cities as a "proactive concept that represents the dominant direction of urban development based on digital transformation and principles of sustainable development". According to the same authors Smart City concept, "at its core, the concept involves the digital transformation of the city towards achieving greater efficiency of the city administration, higher quality of life, reducing the exploitation of resources, but also reducing the negative impact on the environment".

Author Hall (2000) defines Smart City as "a city that integrates critical infrastructure intending to optimise resource use while preventively maintaining and monitoring security levels". According to him, the vision of "Smart City is based on monitoring and improving the quality of living standards of citizens".

The author Mohanty (2016) and authors Lacinák & Ristvej (2017, p.524) view "Safe City" as an integral component of the Smart City concept, which further integrates "technology and the natural environment in the direction of greater effectiveness in the direction of improving security, i.e. in the direction of reducing security risks from crime and terrorism."Also, the mentioned authors point out that "Safe City" actually integrates: "healthcare, smart traffic system, a smart safety system for surveillance, detection and identification".

East Tennessee State University (2020) states that" Personal safety is general recognition and avoidance of possible harmful situations or persons in your surroundings ". Author Lamplugh-Trust (2020) considers that "Personal safety is an individual's ability to go about their everyday life free from the threat or fear of psychological, emotional or physical harm from others". Authors Raiden, A. B. & Waters (2008), the broadly defined term as ... "a rudimentary conceptual framework for understanding the various facets of personal safety, which they claim encompasses two distinct elements: actual and perceived risk of intentional harm (as distinct from accidental harm). Although intentional harm may take the form of violence, aggression, intimidation, and maybe less foreseeable and less quantifiable than accidental harm".

Authors Fuentes & Velastin (2004 p.356); Ryberg, J. (2007); Rouse (2012); Agarwal et al. 2018, pp.483-492), video surveillance system, that is, CCTV (closed-circuit television - CCTV), is generally observed and determined "as a monitoring system in which signals are not publicly distributed but are monitored, primarily for surveillance and security purposes".

Authors Stojanović & Mijatović (2016) stated, "the limits of CCTV system application are not dictated primarily by technology development, but ethics, civil liberties and supporting legislation." Authors Stojanović & Mijatović (2016) also point out that CCTV is among the most common security solutions in public use and that the scope of its application is constantly increasing. Everything is monitored today, from state institutions, through banks and other institutions, which due to the nature of work, are a potential target for criminals, to airports and train stations that have been endangered by security due to terrorist attacks.

Let us look at the basic principles of video surveillance system design. It is clear that when analysing CCTV systems, it is essential to emphasise that they are heterogeneous systems, often intended for different tasks, which in addition to technology and operations, are not interconnected.

There are various reports on the efficiency of the video surveillance system regarding reducing crime rates, terrorism, and traffic safety.

According to a report for 2018, entitled: "Smart Cities: Digital Solutions for a more liveable future", published by McKinsey & Company, or McKinsey Global Institute, it is stated that "Smart City uses data and technology to make better decisions, which result by improving several aspects of quality of life, with even the crime rate being reduced by 30-40%, 20-35% is faster emergency response times, as well as 30 to 300 human lives being saved annually in a city of around 5 million inhabitants ".

The authors of Welsh & Farrington (2004 state the following "where video surveillance systems (CCTV) are introduced, they cause a desirable effect in the form of crime rate reduction, as they contribute to an overall crime reduction of up to 21% compared to those parts of the city and public infrastructure where a video surveillance system does not cover public areas ". The mentioned authors also point out that video surveillance systems are the most effective in preventing criminal activities in parking lots. Author Firman (2009) stated that the application of CCTV in crime reduction has potential, as well as a positive effect in the field in terms of reducing the crime rate, but that he is not sure, in the assessment, that a reduced rate of 20% is possible due video surveillance;

According to Scottish government analysts, the effectiveness of CCTV is questionable. According to their findings based on field research, there is no significant decline and reduction in crime rates before and after the introduction of CCTV solutions. Namely, according to the mentioned research, observed in a particular environment, the crime rate, before the installation of CCTV, was 28.5% and 26.4% after the installation of CCTV (Justice Analytical Services.

In the study on the effectiveness of the use of CCTV in the direction of reducing the crime rate, author Alexandrie (2017) states that the total crime fund has decreased by an average of 24 to 28% with the introduction of cameras that monitor activities on city streets, subways, squares and other public spaces. This author also points out the positive contribution of the cameras to reducing the "savagery of organised fan groups at football stadiums";

Namely, a large number of preschool and school institutions in the world have adopted, as a security standard, technical protection measures that include CCTV, metal detectors, access and authentication using biometric data (fingerprint), face recognition on video and other scanners at points of entry within preschool, especially in school premises (Taylor, 2013). Also, in the publication of Piza et al. (2019), the results of research conducted by Lim, Kim, Eck, & Kim (2016, pp.241-255) an analysis of the results of CCTV implementation yielded the following results: the "supervised (experimental) area had a crime rate of 66.30 (184-62) while the unsupervised (control) area recorded a crime rate from 55.25 (1200-537)", noting that OR = 1.33; Diffusion of benefits occurred (higher of severe crimes than disorder crimes)".

Authors Conche& Tight (2006) analysed the possibility of applying CCTV in the direction of improving the level of traffic safety and found that the videos created by the video surveillance system in case of accidents provide the opportunity to obtain qualitatively and quantitatively better information on traffic behaviour, and based on this it is possible to design safer roads. The same

authors state that traffic incidents dropped from 5 to 0.7 per million vehicle miles (MVM) (Conche& Tight, 2006). Also, according to them, if the price of the video surveillance system on the roads, the number and amount of average damage to vehicles are taken into account, in this scenario of using CCTV, cameras pay off very quickly either by reducing damages or by collecting fines for unadjusted driving and other traffic violations (Conche& Tight, 2006).

Another way in which CCTV contributes to increased security, but also easier city operations, is to reduce the time since the first report of the incident, through its verification (which is most often done in large cities today through public video surveillance) by the time it is necessary to do an investigation and clear the road and put it into uninterrupted work. As shown in the case of New York, and according to the U.S. Department of Transportation Federal Highway Administration, this reduction in operating times can be up to 66%, or from 31 to 19 minutes.

Economic analysis of the effectiveness of CCTV-based security solutions in cities, although video surveillance is widespread, is not enough in the scientific and professional public, primarily because the costs of implementation and operation of video surveillance systems are often declared as secret, which significantly prevents conducting this type of analysis. However, despite these limiting factors, it is still possible to conduct a cost /benefit analysis (CBA) of security solutions based on video surveillance in cities, as for other technical systems.

In large cities, which represent a geographically highly diversified video surveillance system, research published by Gill and Spriggs (2005) found that the cost-benefit ratio was meagre, with some cases below the number 1. In this context, the results of a survey conducted in several suburbs of different sizes (Outskirts) are presented, where the ratio is 1.24 while for the video surveillance project in Hawkeye (Fayette County, Iowa, United States), it was 0, 67 (Brandon & Welsh, 2015).In other words, this shows that from the point of view of efficient spending, the city budget, as envisaged by the Smart City concept model, video surveillance systems should not be financed from the city budget, but should be financed by creating various forms of public-private partnership.

One of the alternatives to the broader application of video surveillance is public lighting. Namely, the improvement of public lighting, as an alternative method of deterring potential attackers, achieves a far better benefit-price ratio than the ratio achieved by the implementation of CCTV. Authors Brandon & Welsh (2015), in addition to previous research results, presented data according to which, in just one year, for the ratio obtained by cost/benefit analysis of the improvement of the public lighting system, the ratio climbs to 5.4 (for the city of Trent) and 6.2 for the city of Dudley). As public lighting systems are depreciated in the period up to 20 years, it was concluded that the ratio of costs and benefits of investing in lighting systems concerning other solutions is much higher. The investment is many times more profitable than other types. Similar results in favour of public lighting, in their research, came to the authors of Piza et al. (2016), Piza et al. (2019), as well as Ratcliffe & Groff (2019).

Research goal

This research aims to examine the opinions of academics on the impact of security cameras on increasing security within the concept of Smart Cities. The perception academics the use of security cameras is considered a guarantee of security and the possibility of developing security with some sociodemographic variables.

Research hypotheses

Hypothesis H1: There is a statistically significant difference in the attitude of respondents on the justification of the use of security cameras to increase security in Smart Cities, from the point of view of increasing personal security of citizens, personal safety of children and higher levels of traffic safety.

Hypothesis H2: There is a statistically significant difference between respondents of different sexes regarding attitudes towards the application of video surveillance systems in the system of public and traffic safety within Smart Cities.

Hypothesis H3: There is a statistically significant difference between the respondent answers to various socio-economic factors, which affect the respondent's perception, in terms of improving security, by applying a video surveillance system.

Hypothesis H4: Respondents opinion on the application of video surveillance in security can be predicted as a linear function of the respondent's age.

Hypothesis H5: There is an interrelation between categorical and ordinal dependent variables, which examine the respondents' opinion on the application of video surveillance to increase the safety of citizens, children, and traffic safety.

3. Materials and methods

Sample

The research was conducted on academics on the territory of the Republic of Serbia in the period March - April 2021. Academics must be well informed about a particular issue and influence the rest of the population's views. The research was conducted within several educational institutions. A total of 117 respondents participated in the survey, of which 57 respondents (48.7%) were male, and 60 respondents (51.3%) were female. Observed by age groups, respondents were divided into five groups: 15.8% of respondents were aged between 18 and 30 years, then 22.8% of respondents belonged to the age category between 31 and 40 years, in the category between 41 and 50 years of age were included 37.6% of respondents, then in the group from 51 to 65 years 19.8% of respondents, while 4% of respondents were over 65 years. When surveyed by employment status, the sample consisted of 80.3% employees, 0.9% were students from employment, 12.8% of the unemployed, and 2.6% were students. Regarding the acquired education, 11.1% of respondents completed high school, and 10.3% of respondents completed college or university in this sample. In comparison, 27.4% of respondents have completed college, 18.8% have a master's or master's degree, and 32.5% have a PhD. Also, respondents were divided into categories according to the amount of personal monthly income, as follows: income from 100 to 300 EUR is realised by 8.5% of respondents, 19.7% of respondents stated that their income is between 300 and 500 EUR, personal income from 500 to 1000 EUR realises 35%, while income over 1000 EUR realises 17.9%. In addition to personal income, respondents answered related to the household's monthly income and based on that. They are divided into several groups: 15.4% of respondents live in a household whose total income is between 300 and 500 EUR, 29.9% have an average income between 500 and 1000 EUR, 32.5% of them live in a household with an income between 1000 and 2000 EUR, while 11.1% of respondents have an average family income above 2000 EUR.

Method

The conducted research is of quantitative type and was realised through an online questionnaire. The enumerated statements examined the respondents' opinions on applying security cameras in improving security in Smart Cities. For data analysis, the following were applied: descriptive analysis (percentages, arithmetic mean), Chi-square test, t-test, one-factor analysis of variance, multiple linear regression and Pearson's correlation coefficients. The level of statistical significance was set at $p < 0.05$, and all obtained data were processed in the SPSS program, version 23.

Independent variables

Independent variables (predictors) in this study are sociodemographic variables: gender, age, level of education of respondents, monthly personal income of respondents, monthly household income.

Dependent variables

Dependent variables examined the respondents' opinion on the use of security cameras to increase the security of citizens within Smart Cities, over eight statements where respondents, according to a five-point Likert-type scale, assessed the extent to which they agreed with them.

As a particular type of generic dependent variable, we used a perception score based on the sum of positive attitudes of the respondents, which increased the number of dependent variables by three. The dependent variable ScorePozPerception represents scores obtained so that each statement on the Likert scale where all the answers given to this group of questions are added to the score. If the respondent has not answered any of these questions, he is assigned a score of 0. The dependent variable CategoryScorePositive represents the score of positive attitudes of the respondents, which was obtained as the sum of all positive attitudes expressed in response to categorically asked questions from the questionnaire. This variable is created by assigning a value of 1 for each affirmative, positive answer to the question.

Table 1: Questions for experts (scale of 1-5)	
No.	Dependent variables
1.	How would you assess the impact of the application of the Smart Cities concept on the improvement of your security?
2.	How would you assess the level of citizens trust in the institutions in charge of your security?
3.	How would you assess the impact of the application of the Smart Cities concept on improving the level of child safety?
4.	How would you assess the application of video surveillance on increasing the level of safety of citizens?
5.	How would you assess the impact that the application of video surveillance has on improving the level of safety of children?
6.	How would you assess the degree of un-justification of usurping your right to privacy by applying video surveillance in public areas?
7.	How would you assess the impact of video surveillance in traffic infrastructure on reducing the overall crime rate?
8.	How would you assess the impact of video surveillance in traffic infrastructure on reducing the number of traffic violations?

Source: authors

In contrast, a value of 0 is assigned to that answer for a negative answer (or if the respondent did not answer the same), and then all answers are added to obtain a score of positive attitudes. The dependent variable TotalPositiveScore represents the sum of the arithmetic values of the ScorePozPerception and CategoryScorePositive scores. It represents the overall positive attitude of the respondents towards the application of the video surveillance system.

The perception of personal and collective security within the concept of Smart Cities is one of the most important KPIs (key performance indicators), which measure the success of security mechanisms, institutions and tools. The test yielded the results shown in the following table.

4. Research results

No.	Dependent variables	Frequency distribution (%)					
		1	2	3	4	5	n
1.	How would you assess the impact of the application of the Smart Cities concept on the improvement of your security?	9.1	6,1	31.8	33,3	19,7	66
2.	How would you assess the level of citizens trust in the institutions in charge of your security?	7,8	44	38,8	6	3,4	116
3.	How would you assess the impact of the application of the Smart Cities concept on improving the level of child safety?	4,3	7,2	20,3	37.7	30,4	69
4.	How would you assess the application of video surveillance on increasing the level of safety of citizens?	3,8	7,5	39,6	27,4	21,7	106
5.	How would you assess the impact that the application of video surveillance has on improving the level of safety of children?	2,8	4,7	24,5	36,8	31,1	106
6.	How would you assess the degree of un-justification of usurping your right to privacy by applying video surveillance in public areas?	21,3	18,8	37,5	8,8	13,8	80
7.	How would you assess the impact of video surveillance in traffic infrastructure on reducing the overall crime rate?	4,7	7,5	25,2	35,5	27,1	107
8.	How would you assess the impact of video surveillance in traffic infrastructure on reducing the number of traffic violations?	5,3	8	25,7	32,7	28,3	113

Table 2. Results of the respondents' opinions (scale of 1-5)

Source: authors

Table 2 shows the results, respondents' opinions on the use of security cameras to increase the safety of citizens within the security services in Smart Cities. Analysis of the obtained data has shown that 84.8% of respondents believe that the implementation of video surveillance systems in Smart Cities significantly contributes to the safety of citizens. Comparative results showed that most (53%) agree that video surveillance systems increase security in Smart Cities, where respondents live and work. Distrust in the justification and expediency of the video surveillance system when it comes to women amounts to (33.3%), while for men, this percentage is significantly higher (66.7%).

With the institutional use of cameras in the video surveillance system, citizens' trust in institutions in charge of security is growing, and above-average trust in institutions shows 48.2% of respondents. 88.5% of respondents believe that the video surveillance system significantly contributes to the safety of children. In comparison, 88.7% believe that the improvement of the video surveillance system has contributed to increasing the personal safety of citizens. Therefore, 92.4% of respondents positively characterise the impact of video surveillance on children's safety.

The importance of research on the protection of personal data and biometric data in video surveillance for surveillance and control of public areas is noticed by 60.1% of respondents. At the same time, 82.4% of respondents positively assess the impact of video surveillance in traffic infrastructure to reduce the overall crime rate. In comparison, 86.7% positively assess the impact of video surveillance in reducing the number of traffic violations and increasing traffic safety.

5. Discussion

Chi-square test

The test showed a statistically significant relationship between the use of video surveillance systems, the perception of security in the cities where respondents live and work, and the gender of respondents, $x^2(2, 115) = 2,300$, p=0.141.

Kramer's indicator V was calculated to determine the magnitude of the impact, considering the number of degrees of freedom. To determine the criterion to be applied, 1 (R-1) is subtracted from the number of categories in the ordinal variable. Then 1 (K-1) is subtracted from the number of categories in the column variable. Of these two obtained numbers, a smaller number is retained. Accordingly, the following rules apply to determine the magnitude of the impact:

- For R-1 or K-1 equal to 1 (two categories): weak/small impact = 0.01, medium impact = 0.03, strong/large impact = 0.05
- For R-1 or K-1 equal to 2 (three categories): weak/small impact = 0.07, medium impact = 0.21, strong/large impact = 0.35
- For R-1 or K-1 equal to 3 (four categories): weak/small impact = 0.06, medium impact = 0.17, strong/large impact = 0.29

Based on the above rules, it was found that the answers of respondents of different sexes differ in terms of perception, in terms of justification of video surveillance, as a method for raising environmental security and safety of citizens in Smart Cities and that there is a tremendous influence between the observed categories variables because Kramer's exponent V (R-1 = 2, K-1 = 1) has a value 0.141.

The chi-square test was done to investigate the relationship between categorical variables. The results showed that at a significance of 0.05, there is a statistically significant difference in the perception of respondents, the justification for the use of security cameras to increase security within security services and mobility services (traffic, transport, communications) in Smart Cities, concerning the following predictors: gender of respondents, their education, monthly personal income. The results of the respondents with individual questions that tested the perception of security of citizens showed that most agree that video surveillance systems used to raise security in Smart Cities, where respondents live and work, with confidence in the justification and purposefulness of the video system supervision, when it comes to women amounts (33.3%), while for men this percentage is significantly higher (66.7%). The research also showed a relatively high homogeneity of responses. One of the possible reasons for the high homogeneity of the answers obtained by the questionnaire could be that the research was conducted within higher education institutions where knowledge, beliefs and perceptions about a phenomenon are grouped and homogenised depending on the authority that presents them. If the trustor at least the perception of trust in the expertise, reliability and integrity of the authority is such that it exceeds a certain threshold of trust, then often the views and beliefs of a given authority spill over to the whole group not critically, i.e. without prior detailed verification of allegations and views. The existence of an apparent difference between "official" and "every day (real)" security was studied at the University of Exeter (Daniel P. Stevens 2020). CEUSS (Siedschlag 2020)studied the influence of culture on the perception of security. The sample showed that in this way, by homogenising and standardising attitudes about the reliability and efficiency of security technologies and the threats they face, a homogenised public opinion was created, which dominates the perception of an individual in matters of security for that individual. In the case of our observed phenomenon, this could explain why the perception does not change significantly and shows uniformity regardless of the change of other investigated independent variables. In other words, an individual's perception is not conditioned by his / her attitude but by an accepted paradigm that is not questioned. In that case, the relationships

of dependent and independent variables are predetermined and do not change with changes in independent parameters within the group (The above applies to all independent variables except the gender variable; therefore, the gender variable can be said to satisfy the conditions set by hypothesis H1.

Based on the obtained results of the Chi-square test of **hypothesis H1**: There is a statistically significant difference, in terms of respondents, on the justification of the use of security cameras, to increase security in Smart Cities, from the standpoint of increasing personal safety of citizens, personal safety of children and higher levels of traffic safety, so this claim is accepted.

T-test

The T-test further examined whether there were differences between respondents of different sexes in responses to dependent variables expressed through the Likert scale and derived generic dependent variables (ScorePozPerception, CategoryScorePositive), which arose as a score of positive attitudes of respondents towards justification and purposefulness of the video surveillance system.

No.	Dependent variables	Mean		t	df	Sig. (2-tailed)
		M	F			
1	How would you assess the impact of the application of the Smart Cities concept on the improvement of your security?	3,48 3,35	3,63	-0,957	64	0,342
2	How would you assess the level of citizens trust in the institutions in charge of your security?	2,53 2,47	2,59	-0,748	114	0,506
3	How would you assess the impact of the application of the Smart Cities concept on improving the level of child safety?	3,83 3,70	3,97	-1,017	67	0,313
4	How would you assess the application of video surveillance on increasing the level of safety of citizens?	2,53 2,47	2,59	-0,748	114	0,456
5	How would you assess the impact that the application of video surveillance has on improving the level of safety of children?	3,56 3,42	3,70	-1,416	104	0,160
6	How would you assess the degree of un-justification of usurping your right to privacy by applying video surveillance in public areas?	3,89 3,81	3,96	-0,799	104	0,426
7	How would you assess the impact of video surveillance in traffic infrastructure on reducing the overall crime rate?	3,73 3,79	3,67	0,549	105	0,584
8	How would you assess the impact of video surveillance in traffic infrastructure on reducing the number of traffic violations?	3,71 3,61	3,81	-0,945	111	0,347

Table 3: Statistical characteristics of dependent variables (scale of 1-5)

Source: Authors

The T-test showed (Table 3) that the respondents did not differ, by gender, in terms of quantitative assessments of their attitude, according to the application of video surveillance to increase safety, because p> 0.01 for all dependent variables, which we tested individually. The same results are presented in all questions in which respondents were asked to assess the level of agreement with a given affirmative statement.

Based on the obtained results **hypothesis H2**: There is a statistically significant difference between respondents of different sexes, regarding the attitude towards the application of video surveillance systems in the system of public and traffic safety, within Smart Cities, which is rejected.

ANOVA

A one-factor analysis of ANOVA variance examined the influence of demographic factors on specific claims. Results of ANOVA analysed the examined claims with the predictors' age, employment status, education, personal income of respondents and household income.

One-factor analysis of variance (ANOVA) investigated the influence of age on respondents' opinions on improving safety using video surveillance. Subjects were divided into five groups according to age (younger than 30 years, 31 to 40 years, 41 to 50 years, 51 to 65 years and over 65

years. The results showed no significant differences between the respondents agreeing with the above eight statements expressed through the offered consents given through the five-point Likert scale. Other claims were investigated using the same method, and the obtained results clearly showed no significant differences between respondents of different age groups in terms of attitudes towards the application of video surveillance.

The research shows that the respondents at the end of their working life have a very positive attitude towards introducing and using video surveillance systems to increase security. Also, the positivity of the attitude towards the application of video surveillance varies with age. As we enter each new age, this dependent variable increases and decreases as the respondent approach older. This value decreases just before the end of the business century, only to rise again when entering retirement days and constantly to grow.

Based on the obtained research results of **hypotheses H3**: There is a statistically significant difference between respondents' responses of different age groups that affect respondents' perception of improving security by applying a video surveillance system, it is rejected.

Observing the answers, we noticed that respondents from both ends of the property spectrum believe less on average in the benefits of using video surveillance to increase security. Respondents with average incomes are more likely to believe in video surveillance as a security tool and security policy measures. It can be explained by the fact that all campaigns, which try to justify the use of video surveillance in the field of security, both traffic and personal, within the concept of Smart Cities, have targeted this population group for several reasons. In developed countries, decision-makers come from it, producing gross national income and wealth. Convincing citizens of the benefits of video surveillance in terms of increasing personal and traffic safety was focused on this social group, which proved to be the analysis of the results of the collected answers to the questionnaire on the perception of citizens on the application of video surveillance systems to increase the safety of citizens, children and traffic.

Multiple regression

Multiple regression was used to examine how independent variables (gender, age, work status, level of education, monthly personal income) were related, as a linear combination of predictors with a group of dependent variables.

The results of multiple regression showed that a model could not be established for these predictors, which would have the required reliability, given by conditions of testing significance. The P-value significantly exceeds the level of trust (Sig. = 0.617) when the generic variable TotalPositiveScore is assumed as a criterion variable, and gender, age, employment status, level of education and monthly personal income as predictors of the independent variable. It can be said that it is not possible, based on the above categories, to predict the opinion of the respondents, but that it mainly depends on the external security paradigm, which is presented to the respondent by a reliable authority, which coincides with testing the statistical significance of variables as shown earlier.

Based on the above **hypothesis H4**: Respondents' opinion on the application of video surveillance in security can be predicted as a linear function of the respondent's age, is rejected.

Correlation

Using the Pearson linear correlation coefficient, the interrelationship between several dependent variables (created as a score used to assess the respondents' opinion on the influence of various categorical and qualitative factors relevant to safety) was examined. By applying scores, the positivity of the attitude of the respondents towards the use of video surveillance was assessed. The obtained degree of correlation (with a confidence interval that implies an error of less than 1%) was such that the attitude of the respondents could be predicted. The Total Positive Score expresses it. In other words, respondents who had a high positive score of categorical variables, as a rule, give high marks of agreement on the qualitative assessment of the positivity of the application of video surveillance to raise personal safety, child safety and traffic safety.

Obtained results of the correlation matrix show that the highest level of dependency was found between the current category and qualitative statements about the positivity of attitudes. However, there is a high correlation between specific issues with the approval rating given to Liquor scale and the TotalPositiveSkore of the respondents (r=+0.683, p < 0.01), which means that the respondents who believe that the use of video surveillance in the security system is justified do not express this attitude only categorically but evaluate it quantitatively and qualitatively by the stated categorical statements. In other words, the categorically positive attitude regarding the justification and efficiency of the use of video surveillance, as an element to increase security, indeed entails that

the respondent will highly quantify specific claims that fit into the basic security paradigm, which reaffirms that the perception of security is which largely determines the security stance. However, if both dependent and independent variables have correlation coefficients less than 0.700, such coefficients indicate no multicollinearity (Sekaran & Bougie, 2010).

Based on the results of ANOVA analysis **hypothesis H5**: There is an interrelation between categorical and ordinal dependent variables, which examine the opinion of the respondents on the application of video surveillance to increase the safety of citizens, children and traffic, is not accepted.

6. Conclusion

The long-term trend of increasing human population and their migration to urban settlements, combined with the growing lack of resources and climate change, leads to increased tensions among people need for urban settlements to develop following the concept of sustainable development has led to the need to develop the concept of Smart Cities. As an increasing part of the human population lives in big cities, the adequate application of the concept of smart cities is one of the conditions for the survival of human civilisation as we know it today.

To survive and develop, Smart Cities must build infrastructure following their needs to ensure that people's needs in densely populated areas are met. One of the needs of the people is undoubtedly public and personal security, which is solved through several institutions, from the police, the judiciary to technological solutions that should provide support to these institutions. A video surveillance system is a strategic approach to improving security within Smart Cities by raising personal safety, child safety and traffic safety. Video surveillance is one of the types of technical support that is increasingly used in the practice of modern cities. The public sector uses video surveillance to monitor the functioning of public areas, including roads. The role of video surveillance is to record possible threats, speed up interventions necessary for human security and provide evidence for faster criminal prosecution. The aim is to increase human security by reducing the crime rate and making the justice system work more efficiently. Systematic data collection on human activities in public areas carries the possible misuse of data that may jeopardise people's privacy rights.

The main goal of the video surveillance system is to ensure the level of the constant presence of law enforcement agencies in all places and deter potential criminal acts. The subjective feeling of academics, thus, that thanks to the application of video surveillance technologies, crime rates and traffic and other violations are significantly reduced, thus raising the level of safety of citizens, children, or traffic within Smart Cities.

The application of the video surveillance system implies a faster and more adequate response to actual security threats in real-time and the possibility of subsequent fact-finding, which further contributes to raising confidence in the safety of citizens, children, and traffic. The system creates the necessary preconditions for the perpetrators of any incident to be brought to justice and punished. It ensures trust in the security forces and the legal order and raises the overall perception of security in the long run.

The literature analysis on the effects of video surveillance in public areas speaks of the somewhat controversial efficiency of this system, despite the significant investment. Some research indicates improvements in reducing the crime rate and relocating crime to areas not covered by cameras.

This research aims to examine the opinions of academics on the impact of security cameras on increasing security within the concept of Smart Cities. There are many academically educated respondents (about 90%) in the sample, distorting the obtained data. It is expected that respondents who have an academic background are more familiar with Smart City's concept than those with lower levels of education in the population, which is significantly higher. The primary deficiency of this research is that it only covers research into the attitudes of the academically educated part of the population.

The results showed that, except in the case of the relationship between safety perception and gender of academics, there is no statistically significant difference with age and income level of respondents, for all other pairs of variables Hi-square test never reached the appropriate level of reliability.

It was examined whether there is a difference between academics of different sexes in the answers, which is noticeable on the dependent variables, within which the respondents' opinion was assessed, on the influence of different independent variables on the perception of safety. Due to the low level of reliability obtained by testing on t-test, it was shown that there is no statistically significant difference between academics in terms of safety perception.

ANOVA analysis examined claims with age, employment status, education, and personal income of academics according to different types of security. This analysis showed no statistically significant difference between the respondents 'answers regarding the above factors, which affect the respondents' attitude towards the efficiency and justification of using video surveillance systems to raise security.

Multiple regression was used to examine how the independent variables were related. The aim was to examine whether the opinion of academics according to the categories of independent variables could be predicted. The results of linear regression analysis show that this combination of predictors did not prove to be statistically significant for prediction because the coefficient of determination (R^2) in all cases is below 0.5. Accordingly, it can be concluded that the opinion of academics cannot be predicted based on independent variables.

Finally, Pearson's linear correlation coefficient examined the relationship between the security paradigm and generic variables that examined the overall opinion of academics on the impact of various factors on security improvement using video surveillance systems as a method to raise security levels. The correlation analysis results showed some statements concerning the generic scores of positive opinion defined above them on video surveillance.

Proposal of measures for the implementation of this study

– Educating the general population about the possibilities and limitations of video surveillance.
– Improving public lighting as a system requires less investment and offers significant benefits.
– More comprehensive legal regulation of the application of cameras in public areas. Legal regulations for use (procedures and use in court practice) and control over video surveillance data.
– Motivating companies in the public sector and taxi associations to install video cameras on their vehicles.
– Raising citizens' awareness and encouraging them to use the Crowdsourcing mechanism to gather evidence and inform law enforcement agencies in the event of a security breach, during and after a crime or other criminal activity they witness. In many countries, such recordings are used as evidence in court proceedings.

The proposal for further research includes additional factors affecting the perception of security from the point of view of video surveillance and excludes the influence of the authority's opinion that is easily imposed when it comes to security or its perception. It means that during the future field survey, respondents are previously presented with independent studies, which support the views that go in the direction of acceptance, but also those that call into question the justification of video surveillance as a method to raise the safety of citizens, children and traffic in Smart Cities. Further research could refer to the case law of using video surveillance recordings as evidence in court proceedings to see the consequences of the effects of video surveillance and their correspondence with the growth of security.

Funding

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Citation information

Reference

Agarwal, P., Singh Kahlon, S., Bisht, N., Dash, P., Ahuja, S., & Goyal, A. (2018). Abandoned object detection and tracking using cctv camera. In book: *Information and Communication Technology for Sustainable Development*, pp.483-492; https://doi.org/10.1007/978-981-10-3920-1_49

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